Exploring Impact of Self-selected Student Teams and Academic Potential on Satisfaction

Vic Matta
matta@ohio.edu

Thom Luce
luce@ohio.edu

Gina Ciavarro
Gina.Ciavarro.1@ohio.edu

MIS Department,
College of Business, Ohio University
Athens, OH 45701, USA

Abstract

Creation of teams in professional and student contexts has been well researched and written about. The research landscape can be divided into instructor selected and student selected teams, both of which have advantages and disadvantages. The purpose of this paper is to combine the two techniques for creating teams in an effort to maximize the advantages and minimize the disadvantages, all while achieving high student satisfaction. The paper explores a technique for creating student teams to maximize student satisfaction in a high pressure project using two antecedents: (i) prior academic performance in the same major and (ii) compliance with student's preferences for their peers. Student satisfaction is measured by a survey developed and used for a similar project (Mahenthiran & Rouse, 2000). Results confirm that academic performance is a clear predictor of student satisfaction; however the act of students selecting their teammates has a very small impact in their level of satisfaction in the team. The causes of this outcome are discussed along with a few limitations of the study and implications.

Keywords: Creating teams, team formation, student satisfaction, student-selected teams, academic heterogeneity

1. INTRODUCTION

Undergraduate and graduate classes frequently use group projects in their courses, which are worked on by students in teams. Student team selection has long been an issue, and much has been written about the various methods used to create student teams. The current landscape of research on student team selection can be broken down into two main groups: instructor selected teams and student selected teams. A common way to construct teams is through instructor selection, because instructors often feel the need to create groups. Instructors create teams either by predetermined criteria or at random. However, they need to make teams without having the opportunity to get to know students. Occasionally, students are permitted to select their own teams, especially when students are already familiar with each other and therefore have pre-formed relationships. In the following literature review, we discuss the advantages as well as disadvantages of each of these methods and make the case for a hybrid approach that combines student preference with a degree of instructor control. In order to confirm the validity of this approach, data for (i) preferences of teammates (student selection) and (ii) prior academic performance is collected and used as antecedents, or independent variables. At the end of the course, students are asked to complete a survey to assess their level of satisfaction with their experience as a team. This value is then examined for its predictability by the antecedents.

2. LITERATURE REVIEW

Techniques that instructors use for team formation can largely be divided into three segments: at random, based on personality assessment, and based on academic heterogeneity (Scott, Bisland, Tichenor, & Cross, 1994). For the current research, the term random refers to an ad-hoc approach used by instructors that excludes students' choices. Some instructors justify "random" selection of teams, because they believe it will help them learn to work with colleagues they will not be able choose to work with in the workplace (Grundy, 1996). Teams based on Personality Assessment are less common because, they are not always easy to make and often require specific circumstances and complicated assessments (Scott et al., 1994). Teams are often based on academic heterogeneity because it allows students with a variety of skill sets an opportunity to work together which they may not have had in the other team selection scenarios (Maznevski, 1994). The Academic heterogeneity method builds student teams based on ranking of past academic performance and then places students in teams with differing academic performance histories. Building diverse teams is both important to the success of the teams, as well as the simulation of "real world" problems that students may encounter outside of the classroom. It has been suggested that diversity in membership of the group is desirable for increasing the quantity of solutions offered and the quantity of alternatives offered (Maznevski, 1994). While we believe that academic heterogeneity would be desirable to have, there are challenges to accomplishing it. The greatest challenge is that there needs to be an even mix of students in all grade categories present in the class (Reilly, Lynn, & Aronson, 2002). The criteria of grade mix in the classroom cannot always be met. This research follows the underlying principles of academic heterogeneity – that each team should have a good mix of academic achievers, and no team should have students who are academically homogenous in being high or low achievers. Therefore, a well-balanced class would have academically homogeneous teams comprised of academically heterogeneous students.

In trying to create the most harmonious and successful teams for a group project, at times professors often allow students to select their own groups. Studies show that the selection of group members by students can allow them to form more harmonious groups (Richards, 2009; Scott et al., 1994; Owens, Mannix, & Neale, 1998). Richards attributes successful group projects to group harmony and satisfaction, and asserts that for short term group projects, allowing students to self-select groups is best. A "successful" outcome associated with teamwork may include not only grades, but also outcomes such as satisfaction with the team as well as attitudes toward their team in general (Potosky & Duck, 2007). Another study showed that, "students who choose their own team members were more satisfied with the overall performance of the group" (Connerly & Mael, 2001). Not only does this facilitate the happiness of students, but self-selection of work groups is also becoming an increasingly popular form of management by U.S. businesses (Owens et al., 1998). For instance, self-selection has been cited as a positive factor in creating successful teams at companies such as, Burlington Northern and Garden State Brickface (Katzenbach & Smith, 1993). Good team dynamics are a major contributing factor to the success of any team (Scott et al., 1994).

Self-selection of teammates has many benefits, but there is also a downside. The most detrimental negative effect is that students often choose partners or teammates who are similar to themselves in gender, ethnicity, knowledge and academic ability. These similarities are known to cause teams difficulty in problem solving and conflict resolution (Rutherford, 2001). Of the above-mentioned dimensions, while creating teams (Cohen, 1994) academic ability has been found to significantly impact student satisfaction and has frequently been a dimension that instructors control for (Connerly & Mael, 2001).

By balancing team membership based on grades, performance in prerequisite courses and overall grade point averages, instructors can have a positive effect on the performance of each team (Scott et al., 1994). Therefore a practical technique would involve self-selection without sacrificing balance of academic performance teams across the class. As long as it is feasible, the other factors such as gender, ethnicity, or backgrounds should be considered as well.

Instructors, who look to develop teams based on self-selection and control for academic performance, must look to the multitude of student evaluation instruments that are available, or create their own to capture the appropriate information. Developing a student evaluation instrument, that balances teams according to achievement in prerequisite courses, differing psychological profiles and project specific hardware/software skills takes extra time but is often time well spent (Scott et al., 1994). Aggregating student grades from previous courses in the major for each student, and normalizing them across teams in the class provides a way to achieve academic heterogeneity to some degree. Team preferences (self-selection) and academic potential (the control for academic heterogeneity) is collected to assist team formation. Since student teams that have a high level of satisfaction, are more successful (Liang, Moreland, & Argote, 1995), the purpose of the current research therefore is to evaluate whether this premise of creating teams - self-selection and academic performance makes satisfied student teams. As stated earlier, student satisfaction is considered in terms of their team experience. The research statements can be hypothesized as:

H_1: A higher level of self-selection (SPI) of student teammates will result in a higher level of student satisfaction (SSI).

H_2: Students with higher academic performance (API) in previous courses will achieve a higher level of satisfaction (SSI).

This research also tests for the interaction of the two independent variables (academic performance & student preference) on overall satisfaction. The hypothesis can be stated as:

*H_3: When better performing students are teamed with their preferred teammates (SSI*API), the increase in satisfaction (SSI) is greater than the case when worse performing students are teamed with their preferred teammates.*

Below is a discussion of the research surveys and the methodology that were utilized to build teams and conduct this study.

3. METHODOLOGY

The method by which we create teams begins with collecting (i) student's preferences for their teammates, and (ii) their academic performance in three courses that are prerequisite to the current course. This is done by way of an online form (see Appendix A). Students are asked to list desirable and as well as undesirable students. Since these students are seniors, they have a good history of grades in prior MIS courses, and their potential for good academic performance in the course is used as an extrapolation of their grades in prior courses. Additionally the survey also collects information that could be used to support team formation decisions, if found relevant. These include: personal background, the roles they see themselves playing in their teams and their self-elected strengths. This survey is deployed after the first week of class to account for students who may drop or add the class in the first week. Students are informed of the purpose of the survey, and are encouraged to complete it honestly and entirely. They are informed that in the attempt to most fairly distribute the measure for academic potential, and the number of choices complied with across teams, it may not be possible for everyone's choices to be honored. It has been proven, in our experience and that of others (Felder & Brent, 1994), that this is an effective method of controlling student reactions.

Data collected by the online questionnaire is then exported into an Excel workbook for ease of calculations and organization. Student team size is then calculated depending on the project and class size. Student team size has been heavily debated; however, we use teams of the suggested optimum of four or five students (Denton, 1996). While keeping student team size requirements in mind, the first step is to place students into groups based on who they self-selected to work with, as well as who they self-selected *not* to work with.

To evaluate the satisfaction of particular students, as well as the team as a whole we have implemented a quantitative measure called "Student Preference Index" (SPI). If one individual shows a preference for another and is being placed on the same team, that person is assigned an SPI score of 1 unit or point. For students who have a preference to not be with someone, the same system is used as above, except negative points are used and the weights are doubled to reflect the fact that a dislike is proven to be a great detriment to team member satisfaction and task accomplishment (Porter & Lilly, 1996). SPI points are aggregated for each team. Since SPI is simply a measure of how well a student's choices of a teammate have been satisfied, the goal is to achieve aggregate SPI scores that are similar for each team in the class.

The next step in the team building process is to ensure that the teams have approximately similar levels of academic potential and are well balanced teams (by gender, ethnicity or background). Since our students are typically homogenous in terms of ethnicity or background, and easily balanced by gender, we focus on distributing the measure on academic potential. Grades in prior MIS courses (i.e. responses to Items 7, 8 & 9 of the team formation survey in Appendix A) are simply aggregated into a single number much like a grade point average, and then averaged for each team to form the measure called Academic Performance Index (API), for the purpose of our research. Building teams with similar API scores will ensure that each team has equal or nearly equal potential for success. Once the teams are created with equal or near equal API scores, an instructor can then look to check for heterogeneity in other factors such as gender, ethnicity, or background, and ensure good distribution of the same.

Balancing of SPI and API scores across a class size of 30 to 40 students is made easier by the fact that some students do not have a preference about who they would or would not like to work with. The students without preferences are then assigned teams based on their normalizing impact on API and SPI. If there is a great disparity in either, further adjustments must be made using the above steps until the teams are approximately even.

The next phase of our research is to assess the dependent variable: student satisfaction. This is done by way of a survey tool for self and peer assessments, which are linked to Student satisfaction and learning outcomes (Clark, Davies, & Skeers, 2004) that are desired in the class. The student satisfaction instrument that we have chosen to use in our research was taken from a study on the impact of group selection on student performance and satisfaction (Mahenthiran & Rouse, 2000). In addition to collecting information on satisfaction, the survey tool also attempts to measure a few related dimensions such as: task variety, autonomy, and project predilection, which are not relevant to the current research. Task variety is inapplicable because the given project highly encourages the definition of roles, and it was found that students kept to their roles well. Autonomy is not relevant because we are trying to measure how the group functioned as a whole. Finally, it is clear through course evaluations that students are not fond of the project due to its intensity and the nature of work involved (i.e. heavily code based). Moreover, we are interested in assessing whether they like the group, not necessarily if they like the project. Therefore the survey by this research is a subset of the one used by Mahenthiran and Rouse, and includes five items, measured on a five point scale. (See Appendix B).

Students of three sections of this course were asked to complete the peer assessment survey instrument. Please note, that over the course of these quarters, the team-based project deliverable, as well as the technique used to create teams, remained the same. Out of 92 students, 65 responded, which yielded a response rate of 71%. Of these, three responses contained missing data and had to be removed. Compliance of the student's preference for another student was calculated as described above and entered as SPI. Academic Performance was used as API. Multiple Regression was used, with API & SSI entered in the first block and the interaction of the two in the second block, using stepwise entry.

4. ANALYSIS

The purpose of the research is to examine the ability of two antecedents: student's preferences (SPI) and prior academic performance (API), to predict student satisfaction (SSI).

Descriptives

The student satisfaction index (SSI, or in other words, overall student satisfaction) was an aggregate of a five item, five point Likert scale, with 1 indicating Strong disagreement and 5 indicating Strong Agreement. It had a mean of 20.66. On a five point scale this reflected an average of over four – i.e. an overall high level of satisfaction. SPI, (student preference index) an indicator of student preference, had a mean of 1.02, which indicated that on an average, every student was granted one request for a student they may have selected. API (Academic Potential index), an indicator of academic performance, had a mean of 10, which indicated a mean grade of B+ (with 12 representing an A). See Table 1 below for more details.

Finally, correlations amongst the variables were examined. None of the variables suffered from high correlation values, with the highest being .286 between API & SSI. However, item #6 was seen not to correlate (less than or equal to .1) with any of the other items. The Cronbach Alpha for the instrument was seen to increase by .04 (to .68) with this item removed. A quick (Exploratory) Factor Analysis revealed that this item was not a part of the same Eigen Vector at all! While this item may have attempted to assess a somewhat relevant measure (one's groups influence on one's effort), it seemed to lose its impact, perhaps due to its wordiness and complexity (Converse & Presser, 1986). This item was therefore excluded from further analysis.

The Output, Assumptions and the Model

The proposed equation can be written as:

$Y' = B_1*(SPI) + B_2*(API) + B_3*(API* SPI) + A$

Where:

- Y' = predicted value of Student Satisfaction Index (SSI)
- B_1 = coefficient of Student Preference Index (SPI)
- B_2 = coefficient of Academic Performance Index (API)
- B_3 = coefficient of Academic Performance Index (API)
- A = difference between the actual and predicted values

The purpose of the research was to investigate whether a relationship existed between the antecedents (SPI & API) and dependent variable (SSI). The following discussion describes the outputs of the analysis.

Table 2 displays the model summary. There are a few points of note:

1. Hypothesis H_1 was accepted. In other words, a higher level of self-selection was shown to lead to greater satisfaction in team experience (B=.84).
2. Hypothesis H_2 was accepted. In other words, a higher level of academic performance in prior courses was shown to lead to greater satisfaction in team experience (B=.598).
3. Hypothesis H_3 was rejected. In other words, when academic potential and student's preferences were high, no significant increase in student satisfaction was observed. Therefore this component was dropped from the regression equation.
4. The effect size is R-square is .142, which implies that API & SPI explain only about 14% of variability in SSI.
5. Adjusted R-square reduces the R-square by about 3%, implying there is good cross-validity of the model (Field, 2009).
6. The Durbin-Watson statistic is 1.96 and well between the values of 1 and 3, indicating that the errors are independent (Field, 2009).
7. The F-ratio of 5.14 (df=2) is significant (p=.009), which implies that the model is significantly better at predicting SSI than using the mean as a best guess.
8. Both SPI (p=.039) and API (p=.032) are significant predictors of SSI
9. There is no violation of the collinearity assumption because values of VIF are not substantially greater than 1 and tolerance is not lower than 0.2 (Field, 2009).
10. The assumption of normality of residuals was met.
11. Homoscedasticity was examined by looking at the plot of standardized residuals against standardized predicted value. The data was evenly scattered, therefore meeting this assumption.

The resulting equation for the model can therefore can be written as:

$SSI' = .598 * (API) + .840 * (SPI) + 13.701$

5. DISCUSSION

The method of creating of teams by using the hybrid approach of students' preferences and prior academic performance was shown to be successful in increasing satisfaction in their team experience. Complying with students' preferences was seen to be slightly stronger predictor of their satisfaction than prior academic performance, which is widely supported (Richards, 2009; Scott, Bisland, Tichenor, & Cross, 1994; Owens, Mannix, & Neale, 1998). Regression coefficients, or B-values, are a measure of satisfaction impacted by each predictor, while keeping the values of the other predictor constant. B value for API is .60, while that for SPI is .84. In other words, as API increases by one unit, the satisfaction index increases by .60 units. Similarly, as SPI increases by one unit, satisfaction index increases by .84 units.

This is consistent with Mahenthiran and Rouse's research, in which group satisfaction was enhanced when teams were formed from student's preferences rather than at random. (Mahethiran and Rouse, 2004). However, together they were only able to account for about 14% of the variation in their satisfaction. The reason for low impact of the antecedents is not clear, however, it could be theorized that: (i) knowing someone socially and working with them are different, and, (ii) people tend to have higher expectations with their friends, and when these higher expectations are not met, they are more disappointed than they would have been had their teams been made at random, thus weakening the case for SPI. This may be truer for the current course, since it is a senior level course in Business Systems Integration and has an extraordinarily challenging group project.

Prior academic performance happens to be a significant predictor of satisfaction in teams, but explains a small variation in satisfaction. The lack of a strong correlation is not unusual, since academic performance is being handled as a collective measure of grades in three prior courses. Students could be strong in one and not so strong in another. However, these details are not captured in the experiment. It is possible that some performance in some courses impact satisfaction in team experience more than others.

Additionally, the satisfaction survey is also handled as a collective measure of several items. The authors believe that a full-scale exploratory factor analysis would better tease out the relationships between specific prior courses and specific items on the survey.

6. LIMITATIONS AND FUTURE RESEARCH

There are a few limitations of this research that restrict the generalizability of this research. Overall:

1. Student preferences and academic potential only explain a small amount of variability in student satisfaction. It is clear that other factors are at work that could be related to course content and instruction style.
2. The survey items were unidirectional. This was done to avoid negative wording of items which have been shown to be reduce internal consistency reliability as measured by Cronbach Alpha (Barnette, 2000). For the current research the Cronbach Alpha of 0.68 (for five items) was deemed sufficient (Field, 2009).
3. There were only five usable items on the survey to construct student satisfaction as a latent dependent variable. This survey could be enriched by additional items such as whether
   - they liked the meeting times
   - they liked the roles they played in their groups
   - the work was fairly divided within the group
   - they were able to identify a leader/slacker
   - and how much they liked/disliked the leader/slacker
4. The current research does not examine the impact of individual items to tease out factors and the relationships between them.

7. CONCLUSION

It is found that allowing students to select their own teammates has a small but significant impact on student satisfaction in team projects. The implication for educators is that students are more likely to be happier and more satisfied when combined with others they have selected themselves. These results were therefore consistent with the similar study by Mahethiran and Rouse (2004) from which the satisfaction instrument was used. It should be noted that the original study only paired students based on self-selection, after which teams were created by randomly combining pairs. In contrast the current research studied the impact of fully self-selected and academic potential, on student satisfaction.

Prior academic performance is equivalent to academic heterogeneity and therefore its success in predicting student satisfaction is consistent with existing literature. The authors believe that by using this technique which incorporates self-selection of students with a balance for academic performance has the benefit of making teams with a strong reduction of issues that otherwise surround randomly created teams or those that only use one of the two.

This research explores team formation, using a unique approach of combining students' self-selection and prior academic performance. It finds that this technique successfully improves satisfaction in a course that uses team-based project work. This paper also identifies areas of future research to further refine team formation techniques.

8. REFERENCES

Barnette, J. J. (2000). Effects of Stem and Likert Response Option Reversals on Survey Internal Consistency: If You Feel the Need, There is a Better Alternative to Using those Negatively Worded Stems. Educational and Psychological Measurement , 60 (3), 361-370.

Clark, N., Davies, P., & Skeers, R. (2004). Self and Peer Assessment in Software Engineering Projects. ACM International Conference Proceeding Series (pp. 91-99). Newcastle, New South Wales, Australia: Australian Computer Society, Inc. Darlinghurst, Australia, Australia.

Cohen, E. (1994). Restructuring the Classroom: Conditions for Productive Small Groups. Review of Educational Research , 1-35.

Connerly, M. L., & Mael, F. A. (2001). The Importance and Invasiveness of Student Team Selection Criteria. Journal of Management Education , 25 (5), 471-494.

Converse, J. M., & Presser, S. (1986). Survey Qusetions: Handcrafting the Standardized Questionnaire. Thousand Oaks, CA: Sage.

Denton, H. G. (1996). Developing design team working capability: some planning factors emerging from a survey of engineering design courses. Loughborough's Institutional Repository , 1-7.

Felder, R., & Brent, R. (1994). Cooperative Learning in Technical Courses: Procedures, Pitfallsm and Payoffs. ERIC Document Reproduction Service Report ED .

Field, A. (2009). Discovering Statistics using SPSS. Sage Publications.

Grundy, J. (1996). Experiences with Facilitating Student Learning in a Group Information Systems Project Course. International Conference on Software Engineering: Education and Practice , 12-20.

Katzenbach, J., & Smith, D. (1993). The Wisdom of Teams: Creating the High-Performance Organization. Boston: Harvard Business School Press.

Liang, D. W., Moreland, R., & Argote, L. (1995). Group versus individual training and group performance: The mediating factor of transactive memory. Personality and Social Psychology Bulletin, 21 (4), 384-393.

Mahenthiran, S., & Rouse, P. J. (2000). The impact of group selection on student performance and satisfaction. The International Journal of Education Management , 255-264.

Maznevski, M. (1994). Understanding Our Differences: Performance in Decision-Making Groups with Diverse Members. Human Relations , 531-552.

Owens, D. A., Mannix, E. A., & Neale, M. A. (1998). Strategic Formation of Groups: Issues In Task Performance And Team Member Selection. JAI Chapter , 1-37.

Porter, T., & Lilly, B. (1996). The effects of conflict, trust, and task commitment on project team performance. The International Journal of Conflict Management , 361-376.

Potosky, D., & Duck, J. (2007). Forming Teams For Classroom Projects. Developments in Business Simulation and Experiential Learning , 144-148.

Reilly, R. R., Lynn, G. S., & Aronson, Z. H. (2002). The role of personality in new product development team performance. Journal of Engineering and Technology Management , 39-58.

Richards, D. (2009). Designing projects and Assessments on Group Format Based Courses. ACM Transactions on Computing Education , 1-40.

Rutherford, R. (2001). Using Personality Inventories to Help Form Teams for Software Engineering Class Projects. ACM SIGCSE Bulletin, Proceedings of the 6th

Annual Conference on Innovation and Technology in Computer Science Education, (pp. 73-76).

Scott, T. J., Bisland, R. B., Tichenor, L. H., & Cross, J. H. (1994). Team Dynamics in Student Programming Projects. ACM , 111-115.

Appendix A: Project Formation Questionnaire

Project Formation Survey

1. What is your full name?
2. When are your best meeting times?
3. How many credit hours are you taking?
4. When did you complete application design?
5. When did you complete database design and analysis/ project lifecycle management?
6. Do you have a second or third major? If yes, please list.
7. What grade did you achieve in application design?
8. What grade did you achieve in project lifecycle management?
9. What grade did you achieve in database design and analysis?
10. Please list who you would **like** to work with
11. Please list who you would **not like** to work with
12. Please list any other information you feel would be helpful in pairing you up

General Project Skills

13. Please rate your skills based on the following scale

    1-No Skill 2-Low Skill 3-Some Skill 4-Lots of Skill 5-Excellet Skill

    a. General Project Skills
    b. SQL
    c. Database Design
    d. Web Design
    e. Graphics and Screen Design
    f. Project Presentation
    g. System Testing
    h. Documentation and Writing
    i. Programming
    j. Other Skills, use the space below to specify and assess

Appendix B: Altered Satisfaction Survey Questionnaire

This survey was created in the hopes that we would be able to determine student satisfaction with the MIS400 group project, as well as the project teams. Please fill this eight question survey out honestly and completely to the best of your ability. Thank You!

1. Name (Last, First)

Please answer the questions below based on the following scale
1-Very Little 2-Little 3-Neutral 4-Some 5-A lot

2. How much of your work on the project depended on your ability to work with others in your group?
3. Did the project provide you an opportunity to develop friendships?
4. How much control did you have over the pace of the group?
5. How fair was the team selection process?
6. How much influence did the group that you were assigned to have on the amount of effort you put forth?
7. How much did you learn as a result of this project?

Appendix C: Output of Statistical Analysis

Table 1: Descriptive Statistics

	Mean	Std. Deviation	N
Satisfaction (SSI)	20.66	2.981	65
Student Prefs.(SPI)	1.023	.8858	65
Academic Perf.(API)	10.20	1.291	65

Table 2: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
Dimension 0 1	.377[a]	.142	.115	2.805	1.960

a. Predictors: (Constant), SPI, API
b. Dependent Variable: SSI

Table 3: Coefficients

Model		Unstd. Coefficients		Std Coeff	Sig.	95.0% Conf Interval for B		Collinearity Statistics	
		B	Std. Error	Beta		Lower Bound	Upper Bound	Tolerance	VIF
2	(Constant)	13.701	2.795		.000	13.744	27.842		
	SPI	.840	.398	.250	.069	-.074	1.933	.990	1.010
	API	.598	.273	.259	.030	.074	1.451	.990	1.010

a. Dependent Variable: Satisfaction