A Comparison of Team Effectiveness and Perception of Team Success in Academic and
Athletic Teams

by
Jaime Law

A THESIS

submitted to

Oregon State University

Honors College

in partial fulfillment of
the requirements for the
degree of

Honors Baccalaureate of Science in Design and Innovation Management and Interior Design
(Honors Scholar)

Presented May 19th, 2020
Commencement June, 2020

AN ABSTRACT OF THE THESIS OF

Jaime Law for the degree of <u>Honors Baccalaureate of in Design and Innovation Management and Interior Design</u> presented on May 19, 2020. Title: <u>A Comparison of Team Effectiveness and Perception of Team Success in Academic and Athletic Teams</u>.

Abstract approved:_____

Belinda Batten

The goal of this research was to compare team effectiveness with objective team success as seen through individual team members' perceptions in academic and athletic teams. We hypothesized that successful teams are most often strong in team effectiveness, that individual perceptions of team effectiveness can differ among teammates, and that athletic and academic teams share a similar correlation between team effectiveness and objective team success. This study used the Team Effectiveness Questionnaire developed by the London Leadership Academy, which allowed us to quantify team effectiveness. Eligible participants included Oregon State engineering students who completed ME 382 Introduction to Design and student-athletes from the 2019/2020 OSU gymnastics team. For the engineering students, success was measured by rankings in the end of term competition. For the gymnasts, success was measured by NCAA team rankings and team scores from three different competitions throughout the 2020 season. Our results show that teams with strong team effectiveness are sometimes objectively successful, but not always. In several instances, engineering teams were strong in team effectiveness but performed poorly. In contrast, the OSU gymnastics team was consistently strong in team effectiveness and objectively successful throughout their competition season.

Key Words: teamwork, effectiveness, performance, academics, athletics

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APPROVED:

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Robert Paasch, Committee Member, representing the School of Mechanical, Industrial, and Manufacturing Engineering

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Bryony DuPont, Committee Member, representing the School of Mechanical, Industrial, and Manufacturing Engineering

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Toni Doolen, Dean, Oregon State University Honors College

I understand that my project will become part of the permanent collection of Oregon State University, Honors College. My signature below authorizes release of my project to any reader upon request.

_____
Jaime Law, Author

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INTRODUCTION

Teamwork is relevant in nearly all disciplines, whether it be an athletic, academic, design, or corporate context. Effective teamwork matters for both individual team members and the team as a whole. Many diverse, visible, and invisible roles exist within teams. The study of team dynamics and team member's individual experiences is valuable for understanding the relationships between these roles and their effects on team experiences, organizational behavior, commitment, productivity, management, and profitability.

Group work involves the collaboration of individuals towards a common goal. These individuals may vary in skill sets, roles, and responsibilities, but they come together and hold each other accountable for the team's performance. Groups may be self-managed or have an appointed group leader. Interdependence, accountability, support, and communication are all important for effective work teams. Over the last century, group work and work teams have become increasingly common in the workforce. One study showed that eighty percent of organizations with over 100 employees report that half of their employees are a member of at least one team (Cantu 1). There is a lot of literature on group work and the different ways of analyzing teams. For this study, we will be considering team performance in this context of group work.

The goal of this research is to analyze and compare objective team success with team effectiveness as seen through individual team members' perceptions, with the broader goal of better understanding successful team cultures and exceptional team dynamics. The ME 382 course and the sport of gymnastics are uniquely suited for these goals. With both populations, success and failure can be analyzed objectively. Rankings and earned points can be analyzed as

metrics of success. However, it's important to keep in mind the factors of subjective success that can impact a team's perceived success such as effort levels, team camaraderie, and lessons learned. When it comes to teamwork, both the mechanical engineering students and the gymnasts must work together with their teams in order to achieve their goals and perform well.

Team effectiveness and perceptions of success are integral to NCAA collegiate gymnastics. Collegiate gymnasts are able to lead and learn in a variety of different roles whether it be a team captain, a one event specialist, a community service coordinator, or an all arounder. Whether team members are on the floor competing each weekend or moving mats on the sidelines, each individual gymnast plays an integral part of the team. In addition, as seen by the gymnasts' expressions in Figure 1, the success of one individual is celebrated as the success of the entire team.

Much like the athletic teams in NCAA gymnastics, team effectiveness is integral to academic teams like the engineering teams in the ME 382 course. The objective of ME 382, Introduction to Design, is to provide a team project-based, hands-on discovery experience of developing prototype products through a well-organized engineering design process including planning, problem definition, concept design, product design/realization, and testing. Design processes and methods are introduced through the lectures, and the processes and methods are applied in a design project. Each team of four students demonstrates their application of the theory through designing, building, and testing a remote-controlled vehicle in a competitive obstacle course. The students are given the CAD drawings and design specifications of the obstacle course ahead of time in order to help them prepare their prototype. As seen in Figure 2, each team is given two opportunities to complete as many of the obstacles as possible. As the

course progresses, the obstacles increase in difficulty. At the end of the competition, students are

given a ranking based on how many obstacles they completed.

FIGURE 2
ME 382 Design Competition Stage in Milam Hall
Photo by Jaime Law taken December 5th, 2019

In the next section, we will present a literature review of relevant work on the topic of

teams through group work. That will be followed by a chapter on methodology and approach,

after which the results of the survey and conclusions are presented. Finally, we will discuss

suggestions and improvements for further research on this topic.

LITERATURE REVIEW

HISTORY AND GROWTH OF RESEARCH IN GROUP WORK

In the 1920s and 1930s, studies of group work and motivation took off after the ground-breaking Hawthorne studies. These studies analyzed the factors which impact productivity in the workplace and coined the term the "Hawthorne effect". The "Hawthorne effect" describes the idea that being observed increases active compliance (Wickström 463). Since the Hawthorne studies and the increased number of formal work groups and work teams, much research has been done on the many benefits and unique challenges of group work versus individual work.

By optimizing team effectiveness and group work, organizations can improve productivity, organizational behavior, and individual wellbeing. Research shows that team-based work can improve performance, efficiency, quality, and employee relations (Guzzo). Wellbeing involves one's happiness, subjective well being, flourishing, and objective measurements such as sufficient resources to meet needs (Butler 1,2). There is much evidence to support that perceptions of interpersonal and social interactions play an important role in well-being (Butler, 1; Hupper, 6). Research also shows that team effectiveness is positively correlated with servant leadership, affective team commitment, and organizational citizenship behavior (Mahembe). Team effectiveness, relationships, social interactions, and wellbeing are important to consider when analyzing team dynamics and team success.

Psychologist Martin Seligman studied the relationships between well-being, leadership, and positive psychology. His PERMA theory describes the five core elements of wellbeing: positive emotion, engagement, relationships, meaning, and accomplishment. Evidence indicates

that positive constructs such as life satisfaction, well being, and optimism lead to greater occupational success and improved physical health (Butler).

Each of the five elements of Seligman's PERMA theory are insightful in understanding the key components of optimal teamwork and organizational behavior. First, positive emotion involves the ability to create a sense of optimism of the past, present and future. This optimism can create a constructive team environment and help improve relationships and performance (Pascha). Next, engagement involves acknowledging, enjoying, and being present in the moment. It encourages flow theory which can increase productivity, efficiency, and meaningfulness of work (Souders). Next are relationships and social connections to other people, places, and things, which are critical for meaningful lives. Strong relationships provide support in times of difficulty and promote love, intimacy, and a strong emotional and physical connection with those around us. Next is meaning which is key in finding motivation and purpose. Understanding the impact of one's work can increase job satisfaction. Finally, accomplishment involves making and attaining goals and ambitions. Accomplishment is important to push the limits and create a sense of pride and fulfillment (Pascha). These concepts outlined in Seligman's PERMA theory are applicable and valuable to this study, particularly in selecting a questionnaire that addresses these elements.

TOOLS FOR ANALYZING INDIVIDUALS AND TEAMS

Many different tools and assessments have been developed to understand individuals and teams. Tools like the Myers Briggs Type Indicator and Enneagram tests focus on individual psychological personality typing (MBTI® Basics; The Riso-Hudson Enneagram Type Indicator).

Others like the DISC Profiles for Sport are designed for specific types of teamwork such as athletic teams (DISC Profiles for Sport). There are many methods and tools to aid in analyzing individuals and teams. However, though many of these tools are intended to help teams perform better, many are not able to do so effectively. To do so, these tools must focus on variables or dimensions that are known to impact performance, can be manipulated or improved, and are applicable in a variety of settings (Wageman 374).

One tool that looks at the many dimensions of a successful team is the TEAM Assessment Tool. This tool proposes 12 dimensions of team effectiveness: communication, decision making, performance, customer focus, team meetings, continuous improvement, handling conflict, leadership, empowerment, trust, cohesiveness/team relationships, and recognition and rewards (Cantu).

The Team Diagnostic Survey, or TDS, was developed solely on existing research and concepts by researchers such as Richard Hackman and his colleagues on the conditions that boost team effectiveness. It has been used by many types of organizations and the psychometric properties have been found satisfactory based on 2,474 members of 321 teams (Wageman 373). Past instruments such as Hackman's model of team effectiveness fall short in identifying causal factors linked directly to successful performance. The TDS is unique in how it measures the enabling conditions for team effectiveness and assesses different dimensions of team effectiveness such as team processes, the quality of members' work relationships, and individuals' motivation and satisfaction (Wageman 375-376).

The TDS analyzes team effectiveness using the following three dimensional criterion: the productive output of the team, the social processes of the team, and the group experience. The

first dimension is not assessed by self-reporting, but by an indirect assessment. This is because self-reporting is not always a reliable and trustworthy way to collect data about the acceptability of a team's work (Wageman 376).

Based on past research, the TDS suggests the following five different enabling conditions for optimal performance and success in their criterion of team effectiveness:

1. Those responsible for the work must be on an actual team, not just a team in name only.

2. The team must have a compelling direction for its work.

3. The team's structure must facilitate interdependent and collaborative work.

4. The organization in which the team functions must provide support for their tasks.

5. The team must have access to feedback and coaching in order to optimize their performance to the fullest.

Research has shown that when these five conditions are met, the team is highly likely to succeed in the defined three criteria (Wageman 377).

The Team Effectiveness Questionnaire, or TEQ, was developed by the London Leadership Academy, an NHS London leadership development organization designed to support healthcare leaders and organizations. The TEQ examines and quantifies team effectiveness from the perspective of eight dimensions: purpose and goals, roles, team processes, team relationships, intergroup relations, problem solving, passion and commitment, and skills and learning. Each question on the questionnaire corresponds to one of these eight categories, and there are seven questions for each category. In total, there are 54 questions. The questionnaire is useful in assessing the effectiveness of a team and identifying team dimensions that need to be worked on

to increase team effectiveness (London Leadership Academy). The TEQ addresses the same three criteria as the TDS: productive output, social processes, and group experience.

Researchers in Ismailia, Egypt used the London Leadership TEQ to study interpersonal conflict, job satisfaction, and team effectiveness among nurses in a general hospital. Their TEQ results showed a negative correlation between job satisfaction and team effectiveness, and a positive correlation between job satisfaction and team effectiveness. Researchers found that the larger the team effectiveness score of the hospital staff, the greater job satisfaction and the more the team environment improved. This study supports the conclusions found in many other studies that strong team effectiveness is typically associated with higher hospital patient satisfaction, higher job satisfaction for employees, and higher workforce preservation (El-Hosany).

A study of senior design students at the University of Nebraska-Lincoln College of Engineering and Technology analyzed team effectiveness and individual Myers-briggs personality types. A unique team effectiveness survey was used for this study, but its goals and questions were very similar to the London Leadership TEQ: to seek to measure dimensions of team effectiveness that are related to performance. These researchers hoped to find whether certain preferences or strengths in their team effectiveness questionnaire predicted high performance. They were unable to confirm that there is an ideal team profile in regards to the Myers Briggs types. They found that though personality types play a role in team performance, they cannot predict the performance or effectiveness of a team (Varvel).

Productivity and success are often measured in a single level of analysis. Often, the assumption is made that increases in individual or group productivity will increase the productivity of the organization as a whole. However, there are many other factors at play in the perceived and true success of a group. One particularly vital factor is whether the productivity achieved aligns with the team or organization's goals. Performance strategies must be aligned with the task requirements in order to reach optimal performance (Wageman 376).

There are two main ways that productivity is defined. Traditionally, as labor economists would define it, productivity is the ratio of outputs to inputs. Others argue that productivity must take into account quality and effectiveness to be meaningful. When examining true productivity and success, diverse perspectives are useful in understanding these two definitions of productivity (Harris 3-8).

Contributions and efforts towards the productivity of an organization or team are often not measurable by traditional productivity measurement systems. Indirect work or inputs such as training or management may not be associated with traditional measurements of success or end outputs. The output of a team is likely not a simple summation of the output of its members. Actual group productivity must account for what social psychologists Joseph McGrath calls "process losses", which are losses incurred during the process of performing tasks. This concept, known as the productivity paradox, was typified in the research of the integration of IT into modern life and its effect on the U.S. economy, which will be summarized later on (Harris 120).

Efficiency and productivity are not necessarily interchangeable with performance. If productivity does not align with the team goals and strategies, productivity is hollow. Even if

productivity is aligned with organizational strategies and goals, counterproductive workplace

behaviors such as tardiness, negative attitudes, or time wasting may not be accounted for by a

particular productivity measurement. On the flip side, positive organizational citizenship

behaviors may not be accounted for such as exceptional customer service, sportsmanship,

altruism, or attitudes. For these reasons, it is important to make a distinction between measures

of productivity and measures of performance (Harris 126).

OTHER RESEARCH ON TEAM EFFECTIVENESS, PERCEIVED SUCCESS, AND

PERFORMANCE

As mentioned previously, the concept of the productivity paradox is exemplified in the

introduction of information technology and its effect on the U.S. economy. Integration of IT has

undoubtedly contributed to advances in medicine, availability of banking, and communication.

However, despite the accomplishments of IT and significant investments made in it, scholarly

research has failed to show that it has improved productivity of the U.S. economy or U.S. firms.

This peculiar phenomenon shows how important it is to understand what comprises success,

productivity, and performance, and what an organization or team's ultimate goals are (Harris 13).

According to Hackman and Wageman's research, any team that gives sufficient effort in

it's work, deploys a task-appropriate performance strategy, and has quality talent on the project

is highly likely to perform well with a productive output. This research posits that certain criteria

of performance processes such as social processes and group experience are linked with success

in generating satisfactory products and services (Wageman 376).

Research also shows that perceived success and a positive reputation play a significant role in shaping individual attitudes and actions. One study found that perceived social responsibility and development played a more significant role on employee work outcomes and organizational identification than perceived market and financial performance, resulting in improved outputs and overall job performance (Abraham).

RESEARCH QUESTION

As stated in the introduction, the goal of this research was to compare team effectiveness with objective team success as seen through individual team members' perceptions in academic and athletic teams, with the broader goal of better understanding successful team cultures and exceptional team dynamics.

THESIS STATEMENT

We make the following hypotheses about team effectiveness and objective success:

1. Objectively successful teams typically have strong team effectiveness.

2. Individual perceptions of team effectiveness can differ among teammates.

3. Athletic and academic teams share a similar correlation between team effectiveness and objective team success.

METHODOLOGY

APPROACH

The London Leadership Academy Team Effectiveness Questionnaire was selected for this study because it addresses multiple dimensions of team effectiveness, it was already developed by a reputable source, and other studies have cited its usefulness and effectiveness in team analysis. The questionnaire was sent electronically to prospective participants including Oregon State ME 382 students and student-athletes on the 2019/2020 OSU gymnastics team. For the engineering students, objective success was measured by the team's ranking based on their performance in the obstacle course competition. For the gymnastics student-athletes, objective success was measured by weekly NCAA rankings and team scores from three different competitions throughout the 2020 competitive season.

The ME 382 data analysis was completed by examining individual perceptions of team effectiveness and responses to the TEQ survey, as well as at the group level if multiple individual responses were received from within the same team. The OSU gymnastics data analysis was completed by looking at both individual responses to the TEQ survey and the response of the group as a whole through group averages. The OSU gymnastics team was sent the TEQ survey three separate times throughout the 2020 season. The goal of collecting data in this way was to analyze how much, if at all, the team would progress or change in team effectiveness measures and objective success throughout the season.

Because the data collection method was not identical for these academic and athletic teams, conclusive answers and evidence to support part three of the hypothesis could not be

given. However, this research was able to provide insights on team dynamics and inspire further hypotheses in comparing academic and athletic teams.

TEQ ADAPTATIONS

The only change made to the TEQ was to question #24. Originally the question was worded as follows: "As a team, we are continually working to improve cycle time, speed to market, customer responsiveness, or other key performance indicators". It was revised to the following in order to best relate to the target populations: "As a team, we are continually working to improve key performance indicators such as grades, rankings, scores, time efficiency, or other key performance indicators". All other aspects of the questionnaire including the calculation method were kept the same as the original London Leadership Toolkit questionnaire.

RESULTS AND DISCUSSION

TEQ CALCULATION EXPLAINED

TEQ scores were calculated as instructed by the London Leadership Academy as seen in Figure 3. First, responses were given a numerical value with "strongly agree" equalling 5 points, "somewhat agree" equalling 4 points, "neither agree nor disagree" equalling 3 points, "somewhat disagree" equalling 2 points, and "strongly disagree" equalling 1 point. Figures 4 and 5 show individual responses from the TEQ on this likert scale for each of the 56 questions.Then, sums were totalled for each of the eight categories, which can be seen in Figure 6. Next, each of these sums were divided by 7 to calculate point averages for each category, which can be seen in Figure 7. Finally, those averages were added together for a final point total and TEQ score, which can be seen in Figure 7.

FIGURE 3

TEQ Calculation Method

Graphic by the London Leadership Academy

2. Transfer your assessments to your personal score sheet

1. In the matrix below, *write the numeric value of your assessments* (1, 2, 3, 4 or 5) for each of the 56 statements.

2. *Total the scores*.

3. *Divide each total by 7* to calculate the average for each team effectiveness dimension.

My scoresheet   Name _____

Purpose and goals	Roles	Team processes	Team relationships
1	2	3	4
9	10	11	12
17	18	19	20
25	26	27	28
33	34	35	36
41	42	43	44
49	50	51	52
Total =	Total =	Total =	Total =
Average Divide total by 7	Average Divide total by 7	Average Divide total by 7	Average Divide total by 7

Intergroup relations	Problem solving	Passion and commitment	Skills and learning
5	6	7	8
13	14	15	16
21	22	23	24
29	30	31	32
37	38	39	40
45	46	47	48
53	54	55	56
Total =	Total =	Total =	Total =
Average = Divide total by 7	Average = Divide total by 7	Average = Divide total by 7	Average = Divide total by 7

Total of all 8 average scores =   **= Team Effectiveness Score**

Leading across London   **Leading teams**

FIGURE 4
Calculation I: TEQ Raw Data I

TEQ RAW DATA I

ID / ME 382	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28
E1	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	4	5
E2	4	4	4	3	4	4	5	5	4	4	3	4	3	5	4	3	4	3	3	4	4	4	3	4	3	3	5	4
E3	5	4	5	5	5	5	4	2	5	1	4	4	2	5	5	4	4	4	4	5	5	4	5	5	5	5	5	5
E4	4	4	3	4	4	2	3	3	3	4	5	5	2	4	5	4	3	4	3	5	3	1	5	5	4	5	5	5
E5	5	4	5	4	4	4	4	3	5	5	5	5	5	4	5	4	4	4	2	4	5	5	5	5	4	5	5	5
E6	5	4	5	5	3	5	5	4	5	2	4	4	2	2	5	2	4	4	4	5	4	5	5	5	4	5	5	5
E7	5	4	5	5	5	4	5	4	5	3	5	5	4	5	4	5	5	4	4	5	5	5	5	5	4	5	4	5
E8	3	4	5	4	4	2	4	3	2	3	4	4	4	3	2	3	4	4	3	4	4	3	3	4	3	4	3	3
E9	5	2	4	2	3	2	2	2	4	2	2	2	3	4	4	2	4	2	1	3	5	3	3	5	5	2	5	4
E10	5	4	4	4	4	2	4	5	5	3	4	2	4	4	4	2	4	4	1	3	3	2	4	4	3	4	3	3
E11	5	4	5	2	5	4	4	1	5	4	5	3	2	2	2	5	4	2	5	4	4	5	1	5	5	2	4	2
E12	4	4	5	5	5	4	4	4	5	5	5	3	3	4	5	4	2	4	4	5	5	5	5	5	5	5	4	4
GYMNASTS 1																												
G1	5	5	5	5	4	5	5	5	5	5	4	5	4	4	5	5	5	5	3	4	4	4	5	5	5	5	5	4
G2	5	4	4	5	5	4	5	5	5	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
G3	5	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5
G4	5	5	4	5	4	4	5	5	5	4	4	4	5	5	5	5	5	4	4	4	5	4	5	5	5	5	4	5
G5	5	4	2	5	2	3	4	5	5	3	1	3	3	4	5	4	3	4	3	2	3	2	5	5	5	5	4	5
G6	5	4	5	4	4	5	5	5	5	3	3	4	3	4	5	5	5	4	3	3	4	3	5	5	5	5	3	4
GYMNASTS 2																												
G1	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
G2	5	4	4	5	4	4	4	5	5	4	4	4	4	4	5	5	5	5	4	4	3	4	5	5	5	5	4	4
G3	5	5	4	4	4	4	5	5	5	4	4	5	4	4	5	5	4	4	4	4	4	5	5	5	5	5	5	5
G4	5	4	4	5	2	5	5	5	5	3	3	3	3	4	5	3	4	4	2	2	3	2	5	5	5	5	5	3
G5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
GYMNASTS 3																												
G1	5	5	5	5	5	4	5	5	5	5	4	4	5	5	5	5	5	5	5	4	4	4	5	5	5	5	5	4
G2	5	5	5	5	4	5	5	5	5	5	4	5	4	4	5	5	4	5	5	5	5	5	5	4	5	5	5	5
G3	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5
G4	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
G5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
G6	5	5	5	5	4	5	5	5	5	4	5	4	3	4	5	5	5	5	5	4	4	5	5	5	5	5	5	5
G7	5	5	5	5	4	5	5	5	5	5	5	5	4	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5
G8	5	5	4	4	4	4	5	5	5	3	3	4	4	5	5	5	5	5	4	4	5	5	5	5	5	5	4	5

Question Category Color Key:

- Purpose and Goals
- Roles
- Team Processes
- Team Relationships
- Intergroup Relations
- Problem Solving
- Passions and Commitment
- Skill and Learning

FIGURE 5
Calculation I: TEQ Raw Data II

TEQ RAW DATA II

ID	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	Q51	Q52	Q53	Q54	Q55	Q56
ME 382																												
E1	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
E2	3	5	5	5	4	4	4	4	3	4	3	4	3	5	5	4	3	3	4	4	5	5	5	5	5	4	3	4
E3	5	1	2	4	4	5	4	5	2	5	3	3	3	2	5	5	5	5	3	5	5	4	5	5	4	5	5	4
E4	3	3	2	4	4	5	5	5	1	5	3	3	4	3	5	5	3	5	4	5	4	4	5	4	1	4	5	4
E5	5	5	5	4	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5
E6	5	1	2	4	4	2	4	5	1	5	3	4	3	4	4	5	3	5	4	4	5	1	5	5	5	5	5	5
E7	5	4	5	5	4	5	5	5	3	4	3	2	5	4	5	5	5	4	3	4	5	5	5	5	5	5	4	3
E8	5	3	4	4	3	4	3	5	4	4	3	3	4	4	3	4	4	4	4	2	3	5	3	3	4	4	4	4
E9	4	4	2	2	4	4	4	4	3	4	3	2	4	2	4	4	3	1	3	3	4	5	4	4	4	2	4	4
E10	3	4	3	3	4	3	4	4	2	2	3	3	4	3	4	4	3	4	4	4	3	4	4	3	3	2	4	4
E11	4	2	4	4	1	1	5	5	5	4	3	3	3	4	5	5	4	2	4	5	4	5	5	5	5	5	2	4
E12	5	3	2	4	4	5	5	5	3	4	4	5	4	4	5	5	5	4	5	5	4	4	5	5	3	4	4	3
GYMNASTS 1																												
G1	5	4	4	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5
G2	3	4	5	5	5	4	4	5	5	5	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4
G3	5	5	5	5	5	4	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5
G4	5	4	5	4	5	5	5	5	5	5	5	5	5	4	5	4	5	5	5	5	5	5	5	5	5	4	5	5
G5	4	3	4	4	5	3	4	5	3	4	5	5	5	2	4	2	3	5	5	5	4	4	5	3	4	5	5	5
G6	4	2	3	4	5	4	4	4	3	4	5	5	5	4	4	4	3	4	5	5	4	3	5	5	4	4	5	5
GYMNASTS 2																												
G1	4	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
G2	3	3	4	4	5	4	5	5	3	4	5	5	5	4	5	5	3	5	5	5	5	4	3	4	4	3	5	5
G3	4	4	4	4	5	4	5	4	5	5	5	5	4	4	4	4	5	5	5	5	4	4	5	4	5	5	5	5
G4	3	3	4	4	4	5	4	4	3	2	5	5	5	2	5	1	3	3	5	5	3	3	5	3	3	3	3	5
G5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
GYMNASTS 3																												
G1	5	2	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5
G2	5	4	4	4	5	4	4	5	5	5	5	5	5	5	4	5	5	5	4	4	4	4	4	4	5	5	5	5
G3	5	5	5	5	4	4	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
G4	5	4	5	4	5	4	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
G5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5
G6	5	4	4	5	5	4	5	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	5	5	5
G7	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
G8	5	3	4	5	5	4	5	4	5	5	5	5	5	4	4	4	5	5	5	5	3	4	4	5	4	5	5	5

Question Category Color Key:
- Purpose and Goals
- Roles
- Team Processes
- Team Relationships
- Intergroup Relations
- Problem Solving
- Passions and Commitment
- Skill and Learning

FIGURE 6

Calculation II: Individual Category Sums

TEQ CALCULATION								
RESPONDENT ID	**INDIVIDUAL CATEGORY SUMS**							
ME 382	Purpose and Goals	Roles	Team Processes	Team Relationships	Intergroup Relations	Problem Solving	Passions and Commitment	Skill and Learning
E1	35	35	33	35	34	34	35	34
E2	27	26	29	29	26	34	26	28
E3	31	25	32	34	28	30	27	28
E4	26	29	31	33	17	24	27	28
E5	33	33	32	33	34	33	33	29
E6	30	22	31	34	23	28	29	28
E7	33	30	33	35	32	31	29	28
E8	22	28	24	27	29	23	24	23
E9	30	19	24	23	25	20	21	20
E10	28	25	24	23	22	20	26	25
E11	27	22	34	26	29	24	20	27
E12	28	31	33	32	29	28	29	30
OSU GYMNASTS								
MEET 1								
G1	35	35	32	33	31	31	34	35
G2	35	32	32	34	32	33	33	34
G3	35	32	34	35	35	34	35	35
G4	35	32	31	32	34	31	35	34
G5	33	25	22	27	21	25	33	33
G6	35	28	25	28	26	26	33	34
MEET 2								
G1	35	35	34	35	34	35	34	35
G2	35	30	29	31	24	27	33	34
G3	33	31	29	32	28	31	34	34
G4	33	26	26	23	20	22	32	32
G5	35	35	35	35	35	35	35	35
MEET 3								
G1	35	35	34	35	34	29	34	35
G2	32	33	31	34	32	33	33	33
G3	34	34	35	35	34	35	34	34
G4	35	34	35	35	34	33	35	34
G5	35	34	35	35	35	35	35	35
G6	35	33	35	34	29	30	34	35
G7	35	35	35	35	33	34	35	35
G8	35	29	28	29	33	31	34	35

FIGURE 7

Calculation III: Individual Category Averages

TEQ CALCULATION										
RESPONDENT ID	**INDIVIDUAL CATEGORY AVERAGES**								**TOTALS**	
ME 382	**Purpose and Goals**	**Roles**	**Team Processes**	**Team Relationships**	**Intergroup Relations**	**Problem Solving**	**Passions and Commitment**	**Skill and Learning**	**TEQ SCORE**	**ME 382 Team #**
E1	5.00	5.00	4.71	5.00	4.86	4.86	5.00	4.86	39.29	24
E2	3.86	3.71	4.14	4.14	3.71	4.86	3.71	4.00	32.14	23
E3	4.43	3.57	4.57	4.86	4.00	4.29	3.86	4.00	33.57	35
E4	3.71	4.14	4.43	4.71	2.43	3.43	3.86	4.00	30.71	41
E5	4.71	4.71	4.57	4.71	4.86	4.71	4.71	4.14	37.14	21
E6	4.29	3.14	4.43	4.86	3.29	4.00	4.14	4.00	32.14	25
E7	4.71	4.29	4.71	5.00	4.57	4.43	4.14	4.00	35.86	34
E8	3.14	4.00	3.43	3.86	4.14	3.29	3.43	3.29	28.57	45
E9	4.29	2.71	3.43	3.29	3.57	2.86	3.00	2.86	26.00	13
E10	4.00	3.57	3.43	3.29	3.14	2.86	3.71	3.57	27.57	36
E11	3.86	3.14	4.86	3.71	4.14	3.43	2.86	3.86	29.86	22
E12	4.00	4.43	4.71	4.57	4.14	4.00	4.14	4.29	34.29	24
OSU GYMNASTS										
MEET 1										
G1	5.00	5.00	4.57	4.71	4.43	4.43	4.86	5.00	38.00	
G2	5.00	4.57	4.57	4.86	4.57	4.71	4.71	4.86	37.86	
G3	5.00	4.57	4.86	5.00	5.00	4.86	5.00	5.00	39.29	
G4	5.00	4.57	4.43	4.57	4.86	4.43	5.00	4.86	37.71	
G5	4.71	3.57	3.14	3.86	3.00	3.57	4.71	4.71	31.29	
G6	5.00	4.00	3.57	4.00	3.71	3.71	4.71	4.86	33.57	
								TEAM AVG	**36.29**	
MEET 2										
G1	5.00	5.00	4.86	5.00	4.86	5.00	4.86	5.00	39.57	
G2	5.00	4.29	4.14	4.43	3.43	3.86	4.71	4.86	34.71	
G3	4.71	4.43	4.14	4.57	4.00	4.43	4.86	4.86	36.00	
G4	4.71	3.71	3.71	3.29	2.86	3.14	4.57	4.57	30.57	
G5	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	35.00	
								TEAM AVG	**35.17**	
MEET 3										
G1	5.00	5.00	4.86	5.00	4.86	4.14	4.86	5.00	38.71	
G2	4.57	4.71	4.43	4.86	4.57	4.71	4.71	4.71	37.29	
G3	4.86	4.86	5.00	5.00	4.86	5.00	4.86	4.86	39.29	
G4	5.00	4.86	5.00	5.00	4.86	4.71	5.00	4.86	39.29	
G5	5.00	4.86	5.00	5.00	5.00	5.00	5.00	5.00	39.86	
G6	5.00	4.71	5.00	4.86	4.14	4.29	4.86	5.00	37.86	
G7	5.00	5.00	5.00	5.00	4.71	4.86	5.00	5.00	39.57	
G8	5.00	4.14	4.00	4.14	4.71	4.43	4.86	5.00	36.29	
								TEAM AVG	**38.52**	

Before analyzing this data, it must be discussed what comprises a strong and weak TEQ score, as well as what defines objective success and failure. First we will discuss the TEQ score. If the respondent answers "strongly agree" on all questions, they would receive the strongest and highest possible TEQ score of 40 points and team effectiveness would be considered very strong. If the respondent answers "somewhat agree" on all questions, they would receive a TEQ score of 32 points and team effectiveness would be considered fairly strong. If the respondent answers "neither agree nor disagree" on all questions, they would receive a TEQ score of 24 points and

team effectiveness would be considered neutral. If the respondent answers "somewhat disagree" on all questions, they would receive a score of 16 points and team effectiveness would be considered fairly weak. Finally, if the respondent answers "strongly disagree" on all questions, they would receive a TEQ score of 8 points and team effectiveness would be considered very weak. The continuums in Figures 8, 9, and 10 illustrate these distinctions for the strength of team effectiveness and individual categories. These continuums will be used as guidelines in analyzing questionnaire responses and the strength of team effectiveness.

FIGURE 8
Strength of Team Effectiveness Continuum using TEQ Score
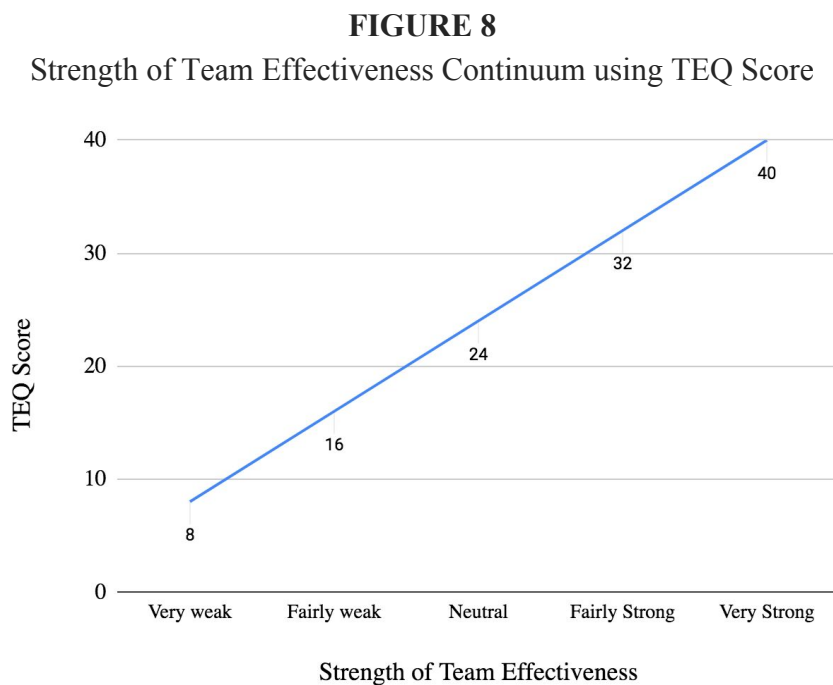
FIGURE 9

Strength of Team Effectiveness Continuum as a Percent
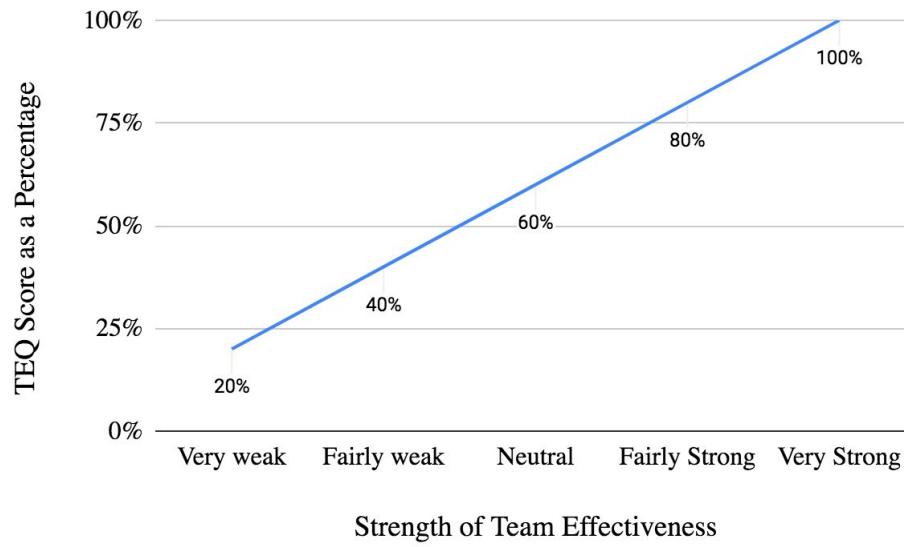
FIGURE 10

Strength of Individual Category Continuum
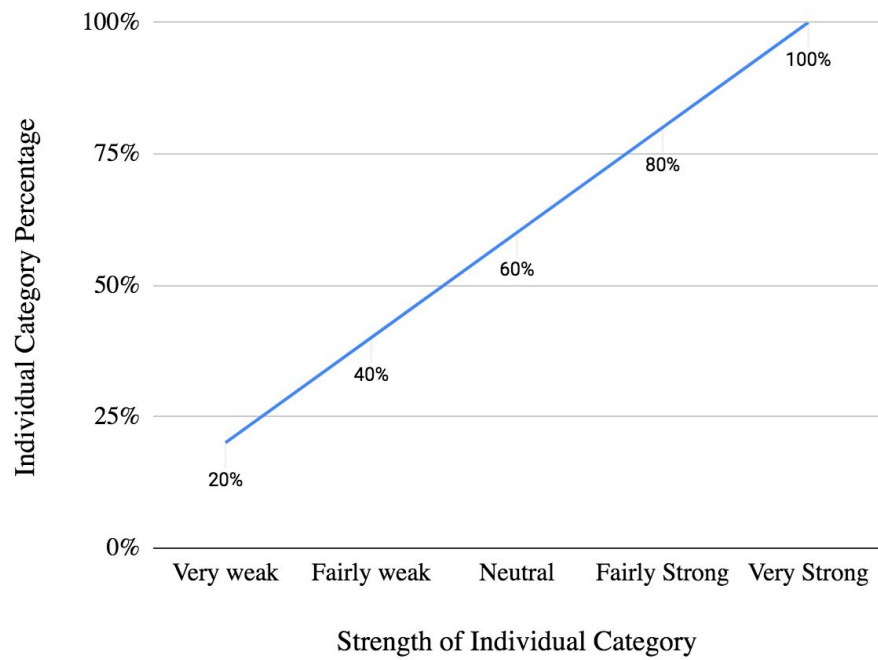
To further aid in analyzing the eight dimensions of team effectiveness, Figure 11 shows the individual categories and total TEQ scores expressed as percentages. Individual category percentages were calculated by point totals within each category divided by the points possible for that category. For example, Figure 6 shows that E12's responses resulted in a score of 28 points in the category "purpose and goals". Since there are 35 possible points in each category, respondent E12 received 80% of the total possible points in this category, as seen in Figure 11. A similar calculation was done in Figure 11 for total TEQ scores. For example, respondent E12 received a total TEQ score of 34.29 points out of a maximum of 40 points, resulting in a percentage of 85.71%.

It is important to note that TEQ overall percentages are not the same as typical letter grade percentages. For example, though a 75% may not be considered a strong letter grade, a team with an overall TEQ percentage of 75% is considered fairly strong in team effectiveness. The continuum in Figure 10 shows the strength of individual categories based on percentages.

FIGURE 11

Individual Category and TEQ Score Expressed as Percentages

TEQ CALCULATION									
RESPONDENT ID	INDIVIDUAL CATEGORY PERCENTAGES								TEQ SCORE
ME 382	Purpose and Goals	Roles	Team Processes	Team Relationships	Intergroup Relations	Problem Solving	Passions and Commitment	Skill and Learning	TOTAL TEQ SCORE
E1	100.00%	100.00%	94.00%	100.00%	97.00%	97.00%	100.00%	97.00%	98.21%
E2	77.00%	74.00%	83.00%	83.00%	74.00%	97.00%	74.00%	80.00%	80.36%
E3	89.00%	71.00%	91.00%	97.00%	80.00%	86.00%	77.00%	80.00%	83.93%
E4	74.00%	83.00%	89.00%	94.00%	49.00%	69.00%	77.00%	80.00%	76.79%
E5	94.00%	94.00%	91.00%	94.00%	97.00%	94.00%	94.00%	83.00%	92.86%
E6	86.00%	63.00%	89.00%	97.00%	66.00%	80.00%	83.00%	80.00%	80.36%
E7	94.00%	86.00%	94.00%	100.00%	91.00%	89.00%	83.00%	80.00%	89.64%
E8	63.00%	80.00%	69.00%	77.00%	83.00%	66.00%	69.00%	66.00%	71.43%
E9	86.00%	54.00%	69.00%	66.00%	71.00%	57.00%	60.00%	57.00%	65.00%
E10	80.00%	71.00%	69.00%	66.00%	63.00%	57.00%	74.00%	71.00%	68.93%
E11	77.00%	63.00%	97.00%	74.00%	83.00%	69.00%	57.00%	77.00%	74.64%
E12	80.00%	89.00%	94.00%	91.00%	83.00%	80.00%	83.00%	86.00%	85.71%
Very Strong TEQ Group Average	91.40%	88.00%	92.80%	96.40%	89.60%	89.20%	87.40%	85.20%	90.07%
Fairly Strong TEQ Group Average	76.17%	72.33%	82.67%	81.83%	69.67%	73.00%	72.33%	75.67%	75.42%
Neutral TEQ Group Average	86.00%	54.00%	69.00%	66.00%	71.00%	57.00%	60.00%	57.00%	65.00%
OSU GYMNASTS									
MEET 1									
G1	100.00%	100.00%	91.00%	94.00%	89.00%	89.00%	97.00%	100.00%	95.00%
G2	100.00%	91.00%	91.00%	97.00%	91.00%	94.00%	94.00%	97.00%	94.64%
G3	100.00%	91.00%	97.00%	100.00%	100.00%	97.00%	100.00%	100.00%	98.21%
G4	100.00%	91.00%	89.00%	91.00%	97.00%	89.00%	100.00%	97.00%	94.29%
G5	94.00%	71.00%	63.00%	77.00%	60.00%	71.00%	94.00%	94.00%	78.21%
G6	100.00%	80.00%	71.00%	80.00%	74.00%	74.00%	94.00%	97.00%	83.93%
AVERAGE	99.00%	87.33%	83.67%	89.83%	85.17%	85.67%	97.50%	97.50%	90.71%
MEET 2									
G1	100.00%	100.00%	97.00%	100.00%	97.00%	100.00%	97.00%	100.00%	98.93%
G2	100.00%	86.00%	83.00%	89.00%	69.00%	77.00%	94.00%	97.00%	86.78%
G3	94.00%	89.00%	83.00%	91.00%	80.00%	89.00%	97.00%	97.00%	90.00%
G4	94.00%	74.00%	74.00%	66.00%	57.00%	63.00%	91.00%	91.00%	76.43%
G5	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	87.50%
AVERAGE	97.60%	89.80%	87.40%	89.20%	80.60%	85.80%	95.80%	97.00%	87.93%
MEET 3									
G1	100.00%	100.00%	97.00%	100.00%	97.00%	83.00%	97.00%	100.00%	96.79%
G2	91.00%	94.00%	89.00%	97.00%	91.00%	94.00%	94.00%	94.00%	93.21%
G3	97.00%	97.00%	100.00%	100.00%	97.00%	100.00%	97.00%	97.00%	98.21%
G4	100.00%	97.00%	100.00%	100.00%	97.00%	94.00%	100.00%	97.00%	98.21%
G5	100.00%	97.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	99.64%
G6	100.00%	94.00%	100.00%	97.00%	83.00%	86.00%	97.00%	100.00%	94.64%
G7	100.00%	100.00%	100.00%	100.00%	94.00%	97.00%	100.00%	100.00%	98.93%
G8	100.00%	83.00%	80.00%	83.00%	94.00%	89.00%	97.00%	100.00%	90.71%
AVERAGE	98.50%	95.25%	95.75%	97.13%	94.13%	92.88%	97.75%	98.50%	96.29%

Strength of TEQ Score Color Key	TEQ Score Range
Strong Team Effectiveness	33.6 to 40
Fairly Strong Team Effectiveness	27.2 to 33.6
Neutral Team Effectiveness	20.8 to 27.2
Fairly Weak Team Effectiveness	14.4 to 20.8
Very Weak Team Effectiveness	8 to 14.4

Next we will discuss what comprises objective success and rankings for this study.

Because there are multiple ways to define objective success, measuring success by a singular

metric is not entirely accurate or representative. For example, the OSU gymnastics team could

have a season-high team performance, but still lose the meet and have a low national ranking. In

addition, an ME 382 student could successfully complete the majority, some, or none of the obstacles in the design competition, but still receive a strong overall grade in the class. Thus, definitive overall success cannot be generalized by mere points, grades, or places. However, for the purpose of this study, team success will be analyzed relative to past performances, rankings, and comparison with the competition. This is how objective success will be described for this study moving forward.

ME 382 SCORING AND RANKING

Based on their performance in the competition, engineering students earned a raw score, rank, and percent. The raw score is based on the number of obstacles they completed. The rank describes the ranking of the team from 1st-7th place including ties. The percentage represents the percent grade that each team received for their performance in the competition with 60% being the floor and 100% being the ceiling. These results are shown in Figures 12 and 13. Figure 14 shows the distribution of teams who responded to the TEQ and how they placed relative to the rest of the class. For the purposes of this study, ME 382 teams will be considered successful if they ranked 5th place or higher, meaning they were able to complete more than one obstacle in the competition.

FIGURE 12

ME 382 TEQ Calculations and Objective Success

ME 382 TEQ DATA	Team Effectiveness	Objective Metric		
Respondent ID	**TEQ Score**	**Rank**	**Percent** (60% floor, 100% ceiling)	**ME 382 Team #**
E1	39.3	7	60	24
E2	32.1	7	60	23
E3	33.6	5	73.33	35
E4	30.7	2	93.33	41
E5	37.1	2	93.33	21
E6	32.1	7	60	25
E7	35.9	4	80	34
E8	28.6	7	60	45
E9	26	7	60	13
E10	27.6	7	60	36
E11	29.9	7	60	22
E12	34.3	7	60	24
RE-ORDERED BY TEQ SCORE				
E9	26	7	60	13
E10	27.6	7	60	36
E8	28.6	7	60	45
E11	29.9	7	60	22
E4	30.7	2	93.33	41
E2	32.1	7	60	23
E6	32.1	7	60	25
E3	33.6	5	73.33	35
E12	34.3	7	60	24
E7	35.9	4	80	34
E5	37.1	2	93.33	21
E1	39.3	7	60	24
RE-ORDERED BY RANK				
E4	30.7	2	93.33	41
E5	37.1	2	93.33	21
E7	35.9	4	80	34
E3	33.6	5	73.33	35
E1	39.3	7	60	24
E2	32.1	7	60	23
E6	32.1	7	60	25
E8	28.6	7	60	45
E9	26	7	60	13
E10	27.6	7	60	36
E11	29.9	7	60	22
E12	34.3	7	60	24

Strength of TEQ Score Color Key	TEQ Score Range
Strong Team Effectiveness	33.6 to 40
Fairly Strong Team Effectiveness	27.2 to 33.6
Neutral Team Effectiveness	20.8 to 27.2
Fairly Weak Team Effectiveness	14.4 to 20.8
Very Weak Team Effectiveness	8 to 14.4

FIGURE 13
ME 382 Class Results

ME 382 Class Results			
ME 382 Team #	**Best Raw Score** (Based on obstacles completed)	**Rank** (Out of 7)	**Percent** (60% floor, 100% ceiling)
14	105	1	100
16	105	1	100
17	75	2	93.33
21	75	2	93.33
41	75	2	93.33
43	75	2	93.33
32	50	3	86.66
34	30	4	80
54	30	4	80
35	15	5	73.33
12	5	6	66.66
26	5	6	66.66
37	5	6	66.66
42	5	6	66.66
44	5	6	66.66
47	5	6	66.66
53	5	6	66.66
55	5	6	66.66
11	0	7	60
13	0	7	60
15	0	7	60
22	0	7	60
23	0	7	60
24	0	7	60
25	0	7	60
27	0	7	60
31	0	7	60
33	0	7	60
36	0	7	60
45	0	7	60
46	0	7	60
51	0	7	60
52	0	7	60

*Red highlighted rows indicate teams who responded to the TEQ Survey
*Percent in column four indicates the grade the team received for their performance

FIGURE 14

Respondents Performance vs. ME 382 Class Results Scatterplot

Best Raw Score (Based on obstacles completed) vs. ME 382 Team #

*Red dots indicate the teams of the participants in this study
*Blue dots indicate the teams of students who did not participate in this study

GYMNASTICS SCORING AND RANKING
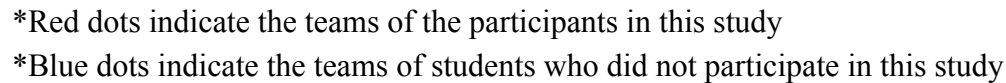
In NCAA collegiate gymnastics, gymnasts are scored out of 10 points for their individual

performances. Gymnasts perform on four apparatuses: vault, uneven bars, balance beam, and

floor exercise. Teams are allowed to put up a maximum of six gymnasts on each event. The top

five scores from each event are counted towards the total team score. The maximum possible

team score is 200 points. There are 82 NCAA member institutions that sponsor National

Collegiate Women's Gymnastics teams (Road to the Championships).

National rankings are determined by average team scores and NQS, or National

Qualifying Scores, during the regular season and postseason. NQS is calculated by taking a

team's top six team scores from the season of which three must be away meets. Once a team has completed six meets, they can drop their lowest team score, effectively raising their NQS and often their national ranking (Regular Season Standings). This means that early on in the season, national rankings don't have as much validity or significance in judging objective success as they would later in the season. NCAA rankings are not a perfect system for understanding a gymnastics team's objective success. However, they are still a useful metric in gaging how well a team is competing with the rest of the country. The OSU gymnastics team's scores and rankings for the 2020 season are shown in Figures 15, 16, and 17. This study will discuss OSU's perceived success by analyzing team meet scores and national rankings, which are based on NQS and team scores. For the purposes of this study, the OSU gymnastics team will be considered successful if they were nationally ranked in the top 25 based on their team scores.

FIGURE 15
OSU Gymnastics Individual TEQ Calculations and Objective Success

GYMNASTS INDIVIDUAL TEQ DATA	Team Effectiveness	Objective Metric	
MEET 1: OSU Critique Classic, 1/3/20			
Respondent ID	**TEQ Score**	**Team Meet Score**	**National Ranking**
G1	38.00	194.45	15th
G2	37.86		
G3	39.29		
G4	37.71		
G5	31.29		
G6	33.57		
MEET 1 AVERAGE:	**36.29**		
MEET 2: OSU vs. Utah, 2/15/20			
Respondent ID	**TEQ Score**	**Team Meet Score**	**National Ranking**
G1	39.6	196.275	21st
G2	34.7		
G3	36		
G4	30.6		
G5	35		
MEET 2 AVERAGE:	**35.17**		
MEET 3: OSU vs. UW, 3/6/20			
Respondent ID	**TEQ Score**	**Team Meet Score**	**National Ranking**
G1	38.7	196.75	15th
G2	37.3		
G3	39.3		
G4	39.3		
G5	39.9		
G6	37.9		
G7	39.6		
G8	36.3		
MEET 3 AVERAGE:	**38.5**		

Strength of TEQ Score Color Key	TEQ Score Range
Strong Team Effectiveness	33.6 to 40
Fairly Strong Team Effectiveness	27.2 to 33.6
Neutral Team Effectiveness	20.8 to 27.2
Fairly Weak Team Effectiveness	14.4 to 20.8
Very Weak Team Effectiveness	8 to 14.4

FIGURE 16

OSU Gymnastics TEQ Group Averages Calculations and Objective Success

GYMNASTS GROUP AVGS TEQ DATA			
Meet	**TEQ Score**	**Team Meet Score**	**National Ranking**
MEET 1	36.17	194.45	15th
MEET 2	35.17	196.275	21st
MEET 3	38.5	196.75	15th
GROUP AVGS RE-ORDERED BY MEET SCORE			
Meet	**TEQ Score**	**Team Meet Score**	**National Ranking**
MEET 1	36.17	194.45	15th
MEET 2	35.17	196.275	21st
MEET 3	38.5	196.75	15th
GROUP AVGS RE-ORDERED BY TEQ SCORE			
Meet	**TEQ Score**	**Team Meet Score**	**National Ranking**
MEET 2	35.17	196.275	21st
MEET 1	36.17	194.45	15th
MEET 3	38.5	196.75	15th

Strength of TEQ Score Color Key	TEQ Score Range
Strong Team Effectiveness	33.6 to 40
Fairly Strong Team Effectiveness	27.2 to 33.6
Neutral Team Effectiveness	20.8 to 27.2
Fairly Weak Team Effectiveness	14.4 to 20.8
Very Weak Team Effectiveness	8 to 14.4

FIGURE 17

OSU Gymnastics 2020 Season Results

OSU Gymnastics 2020 Season Results				
Meet	**Date**	**Team Score**	**National Ranking**	**NQS**
OSU vs. Bridgeport, UGA, Iowa	01/03/2020	194.45	15th	
OSU vs. Centenary and SPU	01/11/2020	195.325	27th	
OSU vs. UofA and SSU	01/17/2020	194.875	28th	
OSU vs. UofA	01/25/2020	196.4	25th	
OSU vs. Stanford	02/02/2020	196.825	22nd	
OSU vs. ASU and LSU	02/08/2020	196.7	21st	
OSU vs. Utah	02/15/2020	196.275	21st	
OSU vs. Cal	02/22/2020	196.6	18th	196.26
OSU vs. UCLA	02/29/2020	196.825	14th	196.56
OSU vs. UW	03/06/2020	196.75	15th	196.57
	Season Average:	196.1025	20.6	
	Final Team NQS:	196.57		

*Data from Roadtonationals.com article "Oregon State 2020"

The ME 382 student who reported the highest TEQ score was respondent E1 from Team #24 scoring a very strong 39.29 points or 98.21% overall. Respondent E1 scored their team with the maximum points possible in the categories of purpose and goals, roles, team relationships, and passions and commitment. Their lowest category was team processes, receiving 94% of the possible points in this category. Respondent E1's results show that Team #24 was highly effective and strong in every category.

Respondent E12 was also from Team #24 and responded with a slightly lower but still very strong TEQ score of 34.29, receiving 85.71% of the possible points. Despite this 5 point variance, both E1 and E12 still scored their team in the range of strong team effectiveness, as described in the continuums. Unlike respondent E9, respondent E12 did not give any perfect scores for individual categories. The most noticeable differences between E1 and E12's responses were in the categories of purpose and goals where E1 scored very strongly at 100% and E12 scored fairly strongly at 89%, problem solving where E1 scored very strongly at 97% and E12 scored fairly strong at 80%, and passions and commitment where E1 scored very strongly at 100% and E12 scored fairly strongly at 83%. Team #24 did not complete any of the obstacles in the ME 382 design competition, resulting in a 7th place ranking, or in other words, a 15-way tie for last place in the class.

These results from respondents E1 and E12 support part two of the hypothesis that individual perceptions of team effectiveness can differ among teammates, though the difference was slight. However, these results do not support part one of the hypothesis that objectively successful teams typically have strong team effectiveness. Since both E1 and E12 rated their

team as highly effective, based on the hypothesis, it would be expected that they would perform well. Instead, they were objectively unsuccessful. This suggests that engineering design teams can be highly effective but not achieve objective success. Professor Bryony DuPont designed the ME382 course with this outcome in mind, making sure that failure to perform in the design competition would not make or break a student's overall grade. The percent column in Figure 13 illustrates this, showing that students could receive no lower than a 60% grade just for participating in the competition.

Concerning the slight differences between E1 and E12's responses, a few hypotheses can be made about these respondents for why there were these differences. Since E1 scored 100% in roles, perhaps they are more inclined to define their own role within a team or take leadership in assigning roles than their teammates. Since E12 scored 89% in roles, perhaps they are more inclined to follow a leader and help the team in various roles where necessary. Since E1 scored 100% on passions and commitment and E12 scored 83%, perhaps E1 was more passionate and committed to the project due to personal preference or motivation.

The individual who reported the lowest TEQ score was respondent E9 from Team #13 scoring 26 points or 65% overall. According to the continuums in Figures 8 and 9, this score is considered neutral and not particularly weak or strong , sitting in the middle of the continuum. Respondent E9 scored the lowest in an individual category with 54% in roles. E9 and Team #13's next lowest categories were problem solving at 57% and skill and learning at 57%. Team #13's strongest category was purpose and goals, achieving 86% of the points possible in this category.

The highest ranking respondents were E4 of Team #41 and E5 of Team #21. Both of these teams ranked 2nd in the class in a four-way tie and were objectively successful. Of the teams who responded to the survey, the following seven did not complete any of the obstacles, resulting in a 7th place ranking: Teams #13, 22, 23, 24, 25, 36, and 45. Of the teams who responded to our survey, only a third were objectively successful in the competition, completing at least two obstacles. Of the whole class, only about 30% or 10 of the 33 ME 382 teams were able to successfully complete two or more obstacles in the competition. This shows that the survey sample was representative of the class.

ME 382 EIGHT DIMENSIONS OF TEAM EFFECTIVENESS ANALYSIS

Figure 11 shows group averages in each of the eight dimensions of team effectiveness. To analyze trends in these eight dimensions, respondents were grouped by their team's TEQ strength and then individual category percentages were averaged. The teams who were very strong in team effectiveness scored the highest in team relationships at a very strong 96.4%, team processes at a very strong 92.8%, and purpose and goals at a very strong 91.4% on average. They scored the lowest in skill and learning at a very strong 85.2%, passions and commitment at a very strong 87.4%, and roles at a very strong 88% on average. The teams who were fairly strong in team effectiveness scored the highest in team processes at a fairly strong 82.67%, team relationships at a fairly strong 81.83%, and purpose and goals at a fairly strong 76.17% on average. They scored the lowest in intergroup relationships at a neutral 69.67%, roles at a fairly strong 72.33%, and passions and commitment at a fairly strong 72.33% on average. Respondent

E9 was the only respondent who's team had a neutral overall TEQ score. Their team scored the highest in purpose and goals at a very strong 86%, intergroup relations at a fairly strong 71%, and team processes at a neutral 69%.

All three levels of TEQ strength scored relatively high in purpose and goals. Interestingly, neutral respondent E9 scored 10% higher than the group of teams with fairly strong team effectiveness. These results suggest that Team #13 had clarity on the purpose and goals of their project, but were not able to deliver in the other dimensions. Perhaps this team started the term off strong with a clear understanding of the task before them, but did not have the passion and organization to create an exceptional team dynamic.

All three levels of TEQ strength also scored relatively high in team relationships and intergroup relations. This suggests that all of the teams had strong interpersonal relationships and camaraderie even though they differed in team effectiveness and performance.

ACADEMIC DATA CONCLUSION

Some of the ME 382 survey results support part one of the hypothesis that objectively successful teams typically have strong team effectiveness. Teams #41, 21, 34, and 35 were objectively successful in placing at least 5th and completing obstacles in the design competition and all scored strongly in team effectiveness. The results of Team #13 support part one of the hypothesis because this team did not have notably strong team effectiveness and they were not objectively successful. However, Teams #22, 23, 24, 25, 36, and 45 scored strongly in team effectiveness but performed poorly. The majority of the teams scored fairly strongly or very strongly in team effectiveness and were objectively unsuccessful in the competition. The academic results of this study suggests that part one of the hypothesis is not always true. The reverse of this hypothesis assumes that objectively unsuccessful teams are typically weak in team effectiveness. However, these results suggest that objectively unsuccessful teams can have strong team effectiveness.

OSU GYMNASTICS TEAM EFFECTIVENESS

All 19 of the gymnasts who responded to the survey scored their team as strong in team effectiveness. Three of those 19 individual respondents rated the team as fairly strong through their TEQ score and the remaining 16 individuals rated the team as very strong. The individual OSU gymnast who reported the highest TEQ score was respondent G5 from the week of Meet 3 scoring 39.9 points or a very strong 99.64% overall. OSU had the highest group average TEQ score after Meet 3 with a team average of 38.5 points or a very strong 96.29%. The individual who reported the lowest TEQ score was respondent G4 from Meet 2 with a fairly strong 76.43%

overall. OSU had the lowest group average TEQ score after Meet 2 with a team average of 35.17 points and a very strong 87.93%. However, these scores all still indicate strong team effectiveness.

OSU GYMNASTICS OBJECTIVE SUCCESS

Figures 15, 16, and 17 show the metrics for objective success for the OSU gymnastics team. After Meet 1, OSU scored a 194.45 and ranked 15th in the nation. As seen in Figure 17, this competition was OSU's lowest team score of the 2020 season. However, this is typical of a gymnastics team performance considering imminent improvements and growth throughout the season. OSU was objectively successful after Meet 1 because they ranked among the top 25 teams in the country.

After Meet 2, OSU scored a 196.275 and ranked 21st in the nation. OSU's national ranking dropped from Meet 1, but their team score improved significantly. As discussed previously, this is an instance where national ranking does not perfectly encapsulate objective success. However, based on our requirement of being ranked in the top 25 in order to be considered objectively successful, OSU was still successful during this week of competition.

After Meet 3, OSU scored a 196.75, ranked 15th in the nation, and had completed enough meets to record an NQS of 196.57. While this wasn't OSU's highest ranking or team score of the season, it was their best NQS of the season.

From the weeks and meets that TEQ data was collected, OSU had their highest national ranking of 15th after Meet 1 and Meet 3. However, when looking at team scores, OSU did much better in Meet 3. OSU scored a season low 194.45 after Meet 1 and one of their highest team

scores of 196.75 after Meet 3. It takes significant improvement in execution to increase a gymnastics team score from a 194.45 to a 196.75. As previously discussed, after Meet 3, OSU's 15th place ranking is also considered a more significant ranking because it was calculated much later in the season when more meet scores were applied.

From the weeks that TEQ data was collected, OSU scored their lowest team score and national ranking after Meet 2 where they scored a 196.275 and ranked 21st in the nation. In the week leading up to this meet, gymnasts responded to the survey with their lowest group average TEQ score of 35.17, which is still considered very strong.

The gymnastics team's TEQ scores remained consistently very strong throughout the season. When looking at group averages in Figure 16, all of the TEQ scores are considered very strong. The team average TEQ scores also improved slightly as the season progressed from a very strong group average TEQ of 90.71% after Meet 1 to an even stronger 96.29% group average TEQ score after Meet 3. From this data, we conclude that the OSU gymnastics team was consistently strong in team effectiveness. The gymnasts improved their top team scores and NQS as the season progressed and remained in the top 25 for most of the season. This shows that the survey sample was representative of the 2020 season as a whole.

IMPACT OF COVID-19

In the 2019 season, the gymnastics team was ranked 15th heading into NCAA Championships where they finished 6th in the nation (Athletics Communications). Oregon State's highest national ranking of the 2020 season was 14th and their highest team score was a 196.825 against Stanford (Oregon State 2020). They finished the year ranked 15th after the

remaining regular season and postseason meets were cancelled due to the COVID-19 crisis

(Regular Season Standings). If the post-season had continued as normal, based on the 2019

season, OSU most likely would have finished their season at an even higher national ranking.

With their final regular season meet ahead of them, they were about to drop a low road score and

improve their NQS, moving them up in the rankings. Based on their consistent weekly

improvement in the national rankings and their team scores, the 2020 season was objectively

very successful for the OSU gymnastics team, and perhaps could have been even more

successful had the season not been cancelled early.

OSU GYMNASTICS EIGHT DIMENSIONS OF TEAM EFFECTIVENESS ANALYSIS

OSU scored consistently very strongly in all eight dimensions of team effectiveness with

only the following few slight outliers. Respondents G5 and G6 from Meet 1 and respondent G4

from Meet 2 were the only individuals with fairly strong instead of very strong responses to

overall team effectiveness scores. All three of these respondents scored very strongly in the

categories of purpose and goals, passions and commitment, and skill and learning. However, the

categories that they scored slightly lower on than the rest of their teammates were roles, team

processes, team relationships, intergroup relations, and problem solving.

Respondent G4 from Meet 2 scored particularly lower than the rest of the respondents.

They scored a neutral 66% in team relationships, a neutral 57% in intergroup relations, and a

neutral 63% in problem solving. Perhaps this individual experienced interpersonal or personal

issues which impacted the team dynamic in a unique way from their perspective. Even still, their

overall team TEQ score was fairly strong.

ATHLETIC DATA CONCLUSION

Over the course of the 2020 season, the OSU gymnastics team was consistently very strong in team effectiveness and objectively successful in their performance. The gymnasts rated the team as strong in team effectiveness throughout their season, even after their lowest team score of the year at their season opener. This gives evidence that the team was consistently very strong in team effectiveness, even when they hadn't achieved optimal objective success. The athletic results of this study support part one and two of the hypothesis that objectively successful teams typically have strong team effectiveness and that individual perceptions of team effectiveness can differ among teammates.

ATHLETICS/ACADEMICS COMPARISON AND CONCLUSION

Because the data collection method was not identical for the OSU gymnasts and the ME 382 students and the response rate was not as high as desired, comparisons of these athletic and academic teams are difficult. The ME 382 data represented more teams, resulting in more variance in team effectiveness and objective success than the OSU gymnastics team. However, some observations and comparisons can be made based on the responses received.

SIMILARITIES

The majority of OSU gymnasts and about half of the ME 382 students rated their teams as strong in team effectiveness. There were examples of both athletic and academic teams who achieved objective success and were strong in team effectiveness. These athletic and academic

teams are also similar in that they were made up of OSU students who are known to be high achievers. There are examples in both the academic and athletic data from this study to support part one of the hypothesis that objectively successful teams typically have strong team effectiveness. This conclusion supports part three of the hypothesis that athletic and academic teams share a similar correlation between team effectiveness and objective team success. However, this data cannot be considered statistically significant.

DIFFERENCES

The ME 382 survey results were different from the gymnast data in that they opposed part one of the hypothesis. Nearly all of the academic teams recorded fairly strong or very strong team effectiveness, but the majority of them were objectively unsuccessful in the competition. This shows that teams can be strong in team effectiveness but objectively unsuccessful.

With the ME 382 data, unlike the OSU gymnastics data, the only instance of data collection from multiple respondentents within the same team was with respondents E1 and E12, who both scored their team as strongly effective. With this instance in mind, no conclusions can be made on part two of the hypothesis that individual perceptions of team effectiveness can differ among teammates because no major differences were observed in either the athletic nor academic data. However, differences in individual team experiences, however slight, are inevitable, and thus differences in perceptions of team effectiveness are likely to occur.

CONCLUSION, DISCUSSION, AND FURTHER RESEARCH
ISSUES

The most prominent issues with this study were a low response rate and consequently a small data set and an inability to make clear conclusions based on the survey results. There was not enough data for conclusive evidence that supports the hypotheses or for statistically significant findings. Less than half of the OSU gymnastics team responded to the survey and only 11 of the 33 ME 382 teams responded.

Though the survey questions were identical for the gymnasts and engineering students, the data collection method and approach to data analysis were slightly different. Since the athletic respondents all belonged to the same team, it would have been insightful to have more TEQ data from ME 382 individuals within the same team. A higher response rate and more ME 382 responses from within the same team could have provided more data to support or refute part two of the hypothesis. This would have allowed for a more consistent and reliable comparison between academic and athletic teams.

Compared to past terms, this group of ME 382 teams had an unusually low success rate in the design competition. Typically the results are more spread throughout the possible outcomes of success. With this in mind, even if there was a higher response rate from ME 382 students, the data collected from this term likely would have still been difficult to analyze due to a lack of diverse outcomes. In addition, even though many of the ME 382 teams were not able to complete obstacles in the design competition and were therefore deemed objectively unsuccessful, they were successful in building a robot, completing the course, and receiving a grade at or above 60% for their performance in the competition. These types of success were not accounted for in the objective success analysis.

There were no examples of teams with weak or very weak team effectiveness, and no examples of athletic teams who were objectively unsuccessful. Consequently, the data set did not allow for a diverse or adequate comparison of team effectiveness and success. The COVID-19 crisis and subsequent cancellation of NCAA athletics also had an impact on this study. Additional data could not be collected during spring term because on-campus courses were switched to remote delivery and the 2020 gymnastics season ended prematurely.

AVOIDING BIASES

To avoid biases in this project, study team member Jaime Law did not participate in the study. In addition, no extra credit or grading consequences were enforced on the ME 382 students. This may have affected the response rate and created a lack of incentive to participate in the study. It's possible that there was sampling bias such as only respondents with strong team effectiveness were motivated to respond. It's also possible that people responded in an inauthentic way. Research shows that people have a tendency to present a favourable image of themselves on questionnaires. This phenomenon is called social desirability responding (Van de Mortel).

IMPROVEMENTS AND FURTHER RESEARCH

To reduce the possibility of biased research, a social desirability scale could be used to detect and control biases. To increase the response rate, incentives such as extra credit for the ME 382 students or gift cards could be used. A study team member could have made an in-person announcement to the ME 382 class and the gymnastics team. The survey could have been sent out multiple times to fall, winter, and spring term students of ME 382. The survey also

could be conducted with an academic team that worked together for longer than just one term. This could possibly give different insights on team effectiveness in long term teams. However, one study of team effectiveness in academic engineering students showed that there were no significant gains in team effectiveness or performance measures in classes that were together for a second semester, as compared to students who had been together for one semester (Varvel). The survey could have been sent to the OSU gymnastics team more times and over more competitive seasons. In addition, the survey could have been sent to different OSU sports teams. These changes could have provided a more diverse and descriptive data set to compare academic and athletic teams.

It could be insightful to have more qualitative data on the teams. In person interviews could have been conducted or written statements could have been taken about individual team experiences. This could provide a more in-depth look at individuals and how their personality types and preferences affect team dynamics and team goals. This could work especially well in studying the ME 382 students where the teams are formed based on Meyers Briggs types.

In comparing individual and team data, there was no data collected on individual performances. Objective individual success for the ME 382 students could have been measured by overall grades in the course. College gymnastics has both an individual and team score component. Individual gymnastics performances could have been compared to group averages. In both academics and athletics, individuals can be objectively successful while their team is not. This paradox could be an additional interesting area of study.

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