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Team Effectiveness and Project Management in a Student Team Environment

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Team Effectiveness and Project Management in a Student Team Environment

By

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This thesis has been examined and approved by the following members of the thesis committee.

Dr. Craig Evers, Advisor

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Abstract

The objective of this research study was to assess if students enrolled in MSU – Mankato's Automotive Engineering Technology (AET) program required a project management course. At present, a project management course is not included in the AET program. A survey instrument based on "The Team Effectiveness Critique" by Susan Trimble was developed to answer the research question. AET students enrolled in Senior Design courses were the main focus of this study. Survey results indicated that AET Senior Design students who had taken a project management course prior to a Senior Design course had good ratings in survey categories of Trust and Conflict, Goals and Objectives, and Communication. Findings of this research study indicated that a project management course might help enhance the overall experience of an AET Senior Design project.

Acknowledgement

I would like to thank my academic adviser and committee chair, Dr. Craig Evers for providing useful guidance throughout this research study. His expertise in research methods and statistical analysis has been very valuable to me. Special thanks to Dr. William Peterson for giving me initial guidance to come up with a meaningful research topic and Dr. Mezbahur Rahman for helping me with hypothesis testing. I am thankful to Dr. Kuldeep Agarwal and Dr. William Petersen for serving on my committee. The AMET faculty's willingness to assist in conducting the student surveys for this research study is greatly appreciated.

I would like to thank Dr. Susan Trimble for allowing me to use her survey instrument, "The Team Effectiveness Critique". I am grateful to Kimberly Berns and other staff members of the creative writing center for reading my paper. My gratitude is also extended to my peers Harshdeep Bhasin, Rahul Sharma, and Madhur Jain for providing encouragement and advice when needed. Finally, I would like to thank my parents Girish and Meena Patel, and sisters Rupa and Khyati for having faith in me and encouraging me to achieve my academic goals.

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Introduction

Problem Statement

Minnesota State University - Mankato AET Students Require a Project Management Course

According to the Automotive Engineering Technology (AET) department website (http://cset.mnsu.edu/aet/outcomes.html) one of the program outcomes mentions that upon graduation the student will be able to manage and lead a team. Effective teams and effective project management are directly related (Kliem, 2004, p. 160). The purpose of this research is to assess if students enrolled in the AET program need a project management course to effectively manage their capstone projects.

According to the 2012-2013 Minnesota State University – Mankato (MSU – Mankato) undergraduate course bulletin, during the senior year AET students must complete a capstone project as a requirement for graduation (AET Department, n.d.). "Capstone" refers to a senior level design course in which students learn to apply their engineering skills to real-world engineering projects (Todd, Magleby, Sorensen, Swan, & Anthony, 1995, p. 165).

Significance

Shenhar and Dvir (2007) mention that one of the fastest growing disciplines in organizations today is project management (p. 93). Project management is gaining increasing attention in both academia and industry, but problems such as missing dates, exceeding budgets and producing poor quality still exist (Kliem, 2004, p. 9). At present, a formal project management course is not included in the AET curriculum (AET

Department, n.d.). However, for students enrolled in the Manufacturing Engineering Technology[1] (MET) program, a project management course is a requirement for graduation (MET Department, n.d.).

Nevertheless, current AET students do have the option of taking the project management course MET 425 (Project Valuation and Management) as an elective. According to the 2012-2013 MSU - Mankato undergraduate course bulletin, the MET 425 course teaches students the skills required to plan and manage a project, as well as to perform economic justification for a project (MET Department, n.d.). Furthermore, some basic team building skills are taught through MET 144 (Product Development and Design), a required course for both AET and MET students.

According to Rooji (2009), "Project Management Institute (PMI) describes project management as the application of a body of knowledge, skills, tools, and techniques to project activities to meet project requirements" (p. 854). Kerzner (2009) defines successful project management as being able to achieve the project within time and cost and at the desired performance level (p. 3). Engineers spend most of their formal education in learning the engineering discipline, and not methods that help them manage people and projects (Powers and Summers, 2009, p. 5). This particular deficiency suggests that there is a need for project management to be formally taught in universities offering engineering or technical degrees. Further, standard project management tools can be used to improve the structure of student projects (Moor and Drake, 2001, p.395).

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[1] Note: AET and MET are two programs offered at MSU - Mankato by the Automotive and Manufacturing Technology (AMET) Department.

According to Kapp (2009), employers are often looking for graduates who can work effectively in a team based environment. Moreover, Thamhain (2004) states that the process of team building has become more complex and requires individuals to have more sophisticated management skills. Inexperienced students struggling with technical as well as program management and team building issues, may find it challenging to meet the requirements of a senior design project (Massie and Massie, 2006, p.36). It is important for AET graduates to possess the skills required to successfully implement project management.

As previously mentioned, AET students at MSU - Mankato are required to complete a capstone project successfully in order to graduate. Moor and Drake (2001) mention that students often work on the wrong task, or manage their effort poorly due to lack of experience in managing a project (p. 389). This can result in loss of valuable time and resources. If the department's budget is limited, this unintentional misuse of resources can be harmful to the department. Moreover, the assigned project may not be accomplished within the established deadline, which as mentioned earlier, is a common problem.

Deliverables

1. Identify an appropriate survey instrument to measure performance of the Senior Design teams
2. Conduct a survey of the AET Junior and Senior Design students[2]

[2] The Junior Design course is a pre-requisite for the AET Senior Design course

   i. Junior Design students will be surveyed to evaluate the difference in opinion between the two groups

3. Conduct a survey of the MET Senior Design students[3]
   i. Draw a comparison between AET and MET students
4. Document results of the survey and give demographic information
5. Analyze the survey results
   i. An analysis of the survey results will be done to aid the AMET faculty in making appropriate adjustments to the curriculum
   ii. The analysis will also help the department to identify the needs of project teams

Limitations

This study was limited to only the AET Junior and Senior Design students and MET Senior Design students. In the Junior Design course, students formulate their teams and develop proposals for their final projects. The projects are officially initiated in the Senior Design course[4]. During Junior and Senior Design courses a student's project management skills are thoroughly tested. Therefore, this research study examined students enrolled in the Junior and Senior Design courses only. Moreover, only students who were present in-

[3] The MET program does not offer a Junior Design course and as a result only MET Senior Design students were surveyed.

[4] For both the MET and AET students the Senior Design course requirement is split into two courses – Senior Design 1 (typically offered in the Fall semester) and Senior Design 2 (typically offered in the Spring semester).

class at the time of the survey were surveyed. No attempt was made to contact students externally.

Methodology

The methodology section aims to explain the data collection tool, survey instrument design, selection criteria for survey participants (sampling frame), survey timeline, survey approval process, and survey implementation. Primary data for this research study was collected by conducting surveys. The Data Collection Tool segment of this section explains why a survey instrument was an appropriate data collection tool for this research study.

Data Collection Tool

A survey design provides a quantitative or numerical description of trends, attitudes, or opinions of a population by studying a sample of the population (Creswell, 2003, p.153). The goal of this research study was to assess whether or not students enrolling in the AET program at MSU – Mankato need a project management course. To answer the abovementioned research question, a data collection tool that could estimate the performance of a team based on project management parameters was required.

A survey can be used for evaluating programs and conducting research when the information has to come directly from humans (Fink, 2009, p.4). According to Rea and Parker (1997), the three main methods used to collect primary data are survey research, direct measurement, and observation (p. 2). Given the time and resources available, both direct measurement and observation were not suitable for this research study.

For the purpose of comparisons among individuals, the survey offers an additional advantage of being repeatable (Rea and Parker, 1997, p. 5). Since the intention of this research study was to collect sample data multiple times during the academic year, it was

important to select a data collection tool that would be repeatable and consistent. Owing to the advantageous reasons mentioned above, it was decided that a suitable survey instrument had to either be designed or identified for the purpose of this research study. The Survey Instrument Design segment of this section will describe how the survey instrument used in this research study was developed.

Survey Instrument Design

The survey instrument used in this research study was derived from the "Team Effectiveness Critique" found in the article, *Assessing Team Performance,* written by Dr. Susan Trimble[5]. The "Team Effectiveness Critique" can be found in Appendix A. Dr. Trimble's approval was acquired for the usage of "Team Effectiveness Critique" in this research study. According to (Trimble and Rottier, 1998) the Team Effectiveness Critique is a short ten item form to gauge team members' perceptions regarding the ten dimensions of teaming[6] (p. 6). Another instrument evaluated for this research study with "Team Effectiveness Critique" was the "Collective Effort Classroom Technique" (CECAT) developed by Dr. Charles Walker and Thomas Angelo (Appendix A).

According to Walker and Angelo (1998) the CECAT instrument's purpose is to stimulate the healthy development of student groups (p. 103). The CECAT instrument contains twenty questions that can help monitor student groups. These twenty questions

[5] Dr. Trimble is currently a professor at Georgia Southern University for the Department of Teaching and Learning

[6] Note – Only nine questions relevant to project management were used in final survey instruments for this research study

can be grouped into six categories related to group structure and group process (Walker and Angelo, 1998, p.107). The "Team Effectiveness Critique: contains questions that relate to ten different aspects of teamwork out of which, nine questions are related to project management. Since the "Team Effectiveness Critique" contained more questions that can be easily related to project management, it was considered a suitable instrument of data collection for this research study. The next two paragraphs describe how the questions contained in the "Team Effectiveness Critique" relate to both project management and team effectiveness.

The nine survey questions derived from the "Team Effectiveness Critique" for this research study can be found in Appendix B. These nine selected questions were compared to three group theories to verify if they were related to team effectiveness. The three group theories used for comparison are as follows:

- The GRPI[7] Model of Team Effectiveness – Developed by Irwin Rubin, Martin Plovnick and Ron Fry - 1977
- The Discipline of Teams – Developed by Jon Katzenbach and Douglas Smith – 1993
- Social Loafing Theory – Developed by Steven Karau and Kipling Williams – 1993

The fourth edition of Project Management Body of Knowledge (PMBOK) was referenced to check conformity of these nine questions to known project management

[7] GRPI stands for Goals, Roles, Processes and Workflow, and Interpersonal Relationships

practices. Table 1 summarizes how each of the nine questions are related to one or more abovementioned group theories. After validity of the nine chosen questions was established for this research study, the next task was to identify a sampling frame and a survey timeline that satisfied the goals of this research.

Table 1

Comparison of the Nine Survey Questions to Relevant Group Theories

	Group Theories that Mention if the Question is Related to Team Effectiveness		
Survey Question	GRPI Model	Discipline of Teams	Social Loafing Theory
Q1 - Goals and Objectives	x	x	
Q2 - Utilization of Talent	x		
Q3 - Trust and Conflict	x		
Q4 - Leadership	x		
Q5 - Team Procedures	x	x	
Q6 - Communication	x	x	
Q7 - Problem Solving	x	x	
Q8 - Creativity		x	
Q9 - Evaluation			x

Note. GRPI = Goals, Roles, Processes and Workflow, and Interpersonal Relationships

Survey Sampling Frame and Survey Timeline

The survey sampling frame for this research study consisted of students enrolled in the following courses at MSU – Mankato:

- AET 387 – Junior Design Project
- AET 488 – Senior Design Project I
- AET 489 – Senior Design Project II
- MET 488 – Senior Design Project I
- MET 489 – Senior Design Project II

The purpose of the Junior Design course is to help students form a team and allow them to develop a proposal for their capstone projects. The capstone project is officially initiated during Senior Design I. Senior Design II is the final phase of the project, and at the end of this course students are expected to present their final product. Typically, AET and MET capstone projects at MSU – Mankato involve working in teams. Therefore, students enrolled in the Junior and Senior Design courses were a suitable target population for this study.

MET students were intentionally included in this study because they are required to take MET 425 prior to registering for Senior Design I. The researcher wanted to find out if the MET students who possess prior project management knowledge performed better as a team compared to the AET students. After the sampling frame was finalized, the next step in the research process was to establish a survey timeline. The timeline established for this research study is shown in Table 2.

Table 2

Survey Timeline

Survey Sample Group	Semester During Which the Survey was Conducted		
	Fall '11 (Trial 1)	Spring '12 – Start (Trial 2)	Spring '12 – End (Trial 3)
AET Junior Design		x	x
AET Senior Design I	x		
AET Senior Design II		x	x
MET Senior Design I	x		
MET Senior Design II		x	x

Note. AET = Automotive Engineering Technology; MET = Manufacturing Engineering Technology.

AET and MET Senior Design II and AET Junior Design courses are typically offered during the Spring semester. Students enrolled in these courses were surveyed twice, once during the start and once during the end of the Spring ’12 semester. This was done to capture changes in student perception regarding a particular question over the course of a semester. In the case of AET and MET Senior Design I courses, it was only possible to survey the students once late in the Fall ’11 semester.

Final Survey Instruments

For the purpose of this research study two survey instruments were formulated, namely, Survey Instrument - I (Appendix C) and Survey Instrument - II (Appendix D). Survey Instrument - II was used only for surveying the AET and MET Senior Design II students during the end of Spring ’12 semester. During all other occasions Survey Instrument - I was used.

Both Survey Instrument - I and Survey Instrument - II contain two sections. The first section, which is the same for both survey instruments, contains questions aimed at collecting demographic information. The second sections of Survey Instrument – I and Survey Instrument - II contains nine questions (Q.1 –Q.9). These nine questions related to project management and team effectiveness[8] are derived directly from the “Team Effectiveness Critique”.

Survey Instrument – II has an additional question (Q.10), which was specifically designed for the students enrolled in the AET and MET Senior Design II courses. As

[8] Henceforth these nine questions will be referred to as the “nine survey categories”

mentioned before Senior Design II is the final phase of the capstone project. Question 10 was designed to reveal any survey categories that might need improvement at the end of a capstone project[9]. The next phase of this research study involved acquiring the appropriate approval for research involving human subjects at MSU – Mankato.

Survey Approval and Implementation

The Institutional Review Board (IRB) at MSU – Mankato requires that all research involving human subjects conducted at or through the university have IRB approval (IRB, n.d.). Since this research study involved human subjects, IRB approval was required prior to conducting any survey. The document indicating IRB approval for Survey Instrument - I can be found in Appendix E. For Survey Instrument – II it can be found in Appendix F. The IRB also required survey participants to fill out an informed consent form prior to taking the survey. The consent form is located in Appendix G[10].

After getting approval from the IRB for survey research, a protocol for conducting surveys was established. This protocol is as follows:

1. Acquire instructor approval for surveying the students of his/her class
2. Address the purpose of the research to students who will be taking the survey
3. Hand out the surveys, consent forms, and two envelopes
4. Request the students to fill the consent form prior to completing the survey

[9] Question 10 was designed by partnering with Principal Investigator, Dr. Craig Evers

[10] Same consent form was used for Survey Instrument I and Survey Instrument II

5. After completing the surveys, request the students to store the consent forms and surveys in separate envelopes that were provided earlier
6. Wait outside the classroom while the students complete the survey
7. Collect the completed surveys for data analyses, and hand over the envelope containing consent forms to Dr. Craig Evers[11] (Principal Investigator)

[11] The IRB requires that the consent forms be stored with the Principal Investigator in a lockbox.

Analysis of Results

The Analysis of Results section will explain the various methods used to analyze survey sample data and how to interpret the results achieved by implementing these methods. A comprehensive list of major findings and methods that validate the findings will be provided as well. Basic demographic information regarding the survey sample population will be provided in the Demographic Information segment of this section.

Demographic Information

Table 2, shown in the Methodology section of this paper, gives information regarding the five groups (survey sample groups) that were surveyed for this research study. AET Senior Design I and II survey groups had the most number of respondents. This was beneficial since AET Senior Design group is the main focus of this research study. Table 3, shown below, summarizes sample population information for the five survey sample groups.

The final data set used for statistical analysis did not contain data from invalid surveys. As a result, the sample population data in Table 3 reflects only those respondents whose survey was valid. Incomplete surveys were considered invalid. Number of respondents for the AET Junior Design group was especially low during the start of the Spring ‘12 semester.

In AET 387 (Junior Design Project), students form teams toward the end of the course. When a survey was conducted during the start of the Spring ‘12 semester, AET Junior Design students were asked to predict how their Senior Design team would perform in each of the nine survey categories. Since AET Junior Design students had

difficulty in answering some of the survey questions, the data set for AET Junior Design students contained many invalid surveys. Thus, AET Junior Design data set was used to only gauge student perception regarding the nine survey categories prior to a Senior Design project. No conclusive inference could be made from this particular data set.

Table 3

Information Regarding the Survey Sample Population

Survey Sample Group	Number of Valid Survey Participants		
	Fall '11 Single Survey (Trial 1)	Spring '12 Start (Trial 2)	Spring '12 End (Trial 3)
AET Senior Design I	34		
	50_a		
AET Senior Design II		34	30
		50_a	53.3_a
MET Senior Design I	18		
	88.9_a		
MET Senior Design II		16	15
		81.3_a	86.7_a
AET Junior Design		12	19
		50_a	52.6_a

Note. AET Junior Design is offered only during the Spring semesters hence, no data is available for this survey group during the Fall' 11 survey trials.
[a]This number represents the proportion of survey participants who had successfully completed MET 325[12] (Project Management) course prior to taking the survey.

Normal Probability Plots

[12] When the survey was originally composed the AMET Department offered two separate courses, MET 325 – Project Management and MET 421 – Project Valuation and Justification. The AMET department now offers a combined course MET 425, known as Project Valuation and Management (H. Petersen, personal communication, 2011).

Some statistical methods used to analyze survey sample data required sample data to be derived from a normal population distribution. Therefore, before any analysis of data could be initiated, it was important to conduct a normal probability analysis of the survey sample data. Normal probability plots were constructed for each of the nine survey categories. This was repeated for all three survey trials, namely Fall ’11 Single Survey (Trial 1), Spring ’12 – Start (Trial 2), and Spring ’12 – End (Trial 3). Minitab 15, a statistical analysis software, was used to construct the normal probability plots.

A 95% confidence interval was used to estimate if data points for each of the nine survey categories were normal. Triola (2004) suggests that if data points of a normal probability plot follow a straight line, then the data set is considered to be normal and at most, two outliers are considered acceptable. Normal probability plots for data collected from surveys of the five survey sample groups can be found in Appendix H. The normal probability plots confirmed that all data sets used in this research study were normal. Hence, it can be said that the sample data for this research study was collected from a population that was normally distributed. Once the normality of the population distribution was established, the next task was to perform hypothesis tests of statistical significance.

One Proportion Hypothesis Test for Statistical Significance

According to Triola (2004), “A hypothesis test (or test of significance) is a standard procedure for testing a claim about a property of a population” (p. 368). A one proportion (p) hypothesis test was used in this research study to determine which of the

nine survey categories were statistically significant[13]. The researcher partnered with Dr. Mezbahur Rahman[14] (Technical Adviser) to formulate a hypothesis test of statistical significance. The null (H_0) and alternate hypothesis (H_1) for the one proportion (p) hypothesis test of statistical significance used in this research study is as follows:

H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to *p.*

H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than *p.*

A significance level (α) of 0.05 was used for all hypothesis tests. If the exact p-value obtained from the hypothesis test was less than significance level (α), the survey category was considered to be statistically significant. If the exact p-value was greater than significance level (α) the survey category was not considered to be statistically significant. The hypothesis tests were performed at proportion (*p)* levels of 0.50, 0.48, and 0.46 to detect changes in significance for any of the nine survey categories. If a survey category was found to be significant at all three proportion levels and during all three trials (trial 1, trial 2, and trial 3), then it was considered to be a critically significant survey category. Critically significant survey categories were then selected for further specialized statistical analyses.

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[13] Statistically significant results are interpreted in this research study as findings that are highly unlikely to occur by chance (Triola, 2004).

[14] Dr. Rahman is currently a professor at MSU – Mankato for the Department of Mathematics and Statistics.

Results of the one proportion hypothesis tests for AET Senior Design students is shown in Table 4 and results for MET Senior Design students is shown in Table 5 below. For AET Senior Design students, a total of six survey categories were found to be critically significant. On the other hand, only three survey categories were found to be critically significant for the MET Senior Design group. Hypothesis test results with exact p-values for all five survey sample groups can be found in Appendix I.

Table 4

One Proportion Hypothesis Test of Statistical Significance at Three Different Levels of Proportion (p) – AET Senior Design Students

Survey Category	Results for Fall '11 Single Survey (Trial 1)			Results for Spring '12 – Start (Trial 2)			Results for Spring '12 – End (Trial 3)		
	0.50 (*p*)	0.48 (*p*)	0.46 (*p*)	0.50 (*p*)	0.48 (*p*)	0.46 (*p*)	0.50 (*p*)	0.48 (*p*)	0.46 (*p*)
Q1 - Goals and Objectives[a]	1	1	1	1	1	1	1	1	1
Q2 - Utilization of Talent[a]	1	1	1	1	1	1	1	1	1
Q3 - Trust and Conflict[a]	1	1	1	1	1	1	1	1	1
Q4 - Leadership	0	0	0	0	0	0	0	0	0
Q5 - Team Procedures	0	0	0	1	1	1	0	0	0
Q6 - Communication[a]	1	1	1	1	1	1	1	1	1
Q7 - Problem Solving[a]	1	1	1	1	1	1	1	1	1
Q8 - Creativity[a]	1	1	1	1	1	1	1	1	1
Q9 - Evaluation	0	1	1	1	1	1	0	0	0

Note. The number "1" indicates that the question was found to be significant and the number "0" indicates that the question was not found to be significant. Q = Question.
[a]Indicates that the question was found to be significant during all three trials and at all three levels of proportion. These questions were considered to be critically significant.

Table 5

One Proportion Hypothesis Test of Statistical Significance at Three Different Levels of Proportion (p) – MET Senior Design Students

Survey Category	Results for Fall '11 Single Survey (Trial 1)			Results for Spring '12 – Start (Trial 2)			Results for Spring '12 – End (Trial 3)		
	0.50 (*p*)	0.48 (*p*)	0.46 (*p*)	0.50 (*p*)	0.48 (*p*)	0.46 (*p*)	0.50 (*p*)	0.48 (*p*)	0.46 (*p*)
Q1 - Goals and Objectives[a]	1	1	1	1	1	1	1	1	1
Q2 - Utilization of Talent	0	0	0	0	0	0	1	1	1
Q3 - Trust and Conflict[a]	1	1	1	1	1	1	1	1	1
Q4 - Leadership	0	0	0	0	0	0	0	1	1
Q5 - Team Procedures	0	0	0	0	0	0	0	0	0
Q6 - Communication	1	1	1	1	1	1	0	0	0
Q7 - Problem Solving[a]	1	1	1	1	1	1	1	1	1
Q8 - Creativity	0	0	0	1	1	1	0	0	0
Q9 - Evaluation	0	0	0	0	0	0	0	0	0

Note. The number "1" indicates that the question was found to be significant and the number "0" indicates that the question was not found to be significant. Q = Question.
[a]Indicates that the question was found to be significant during all three trials and at all three levels of proportion. These questions were considered to be critically significant.

Pearson's Correlation Coefficient "r"

After critically significant survey categories were identified, the next step was to identify existence of correlation between the critically significant survey categories. According to Levin, Fox, & Forde (2010), "Correlation coefficients numerically express strength and direction of a straight line correlation" (pg. 348-349). Minitab 15 was used to perform Pearson's correlation test among critically significant survey categories for the AET and MET Senior Design students. Figure 1 indicates fifteen possible pairs of critically significant survey categories for the AET Senior Design students that were

tested for correlation. Figure 2 indicates three possible pairs of critically significant survey categories for the MET Senior Design students that were tested for correlation.

Pair 1	Pair 6	Pair 10	Pair 13	Pair 15
Goals and Objectives Utilization of Talent	Utilization of Talent Trust and Conflict	Trust and Conflict Communication	Communication Problem Solving	Problem Solving Creativity
Pair 2	**Pair 7**	**Pair 11**	**Pair 14**	
Goals and Objectives Trust and Conflict	Utilization of Talent Communication	Trust and Conflict Problem Solving	Communication Creativity	
Pair 3	**Pair 8**	**Pair 12**		
Goals and Objectives Communication	Utilization of Talent Problem Solving	Trust and Conflict Creativity		
Pair 4	**Pair 9**			
Goals and Objectives Problem Solving	Utilization of Talent Creativity			
Pair 5				
Goals and Objectives Creativity				

Figure 1. Pairs of critically significant survey categories tested for correlation – AET Senior Design Students.

Pair 1	Pair 3
Goals and Objectives Trust and Conflict	Trust and Conflict Problem Solving
Pair 2	
Goals and Objectives Problem Solving	

Figure 2. Pairs of critically significant survey categories tested for correlation – MET Senior Design Students.

All pairs of critically significant survey categories shown in Figure 1 and Figure 2 were tested for correlation during all three trials. A significance level (α) of 0.05 was used for the correlation analysis. By default, Minitab 15 gives the user a p-value and a value for Pearson's correlation coefficient "r". If the p-value for a pair of critically

significant survey categories was less than α, then the correlation between the pair was considered to be statistically significant.

Figure 3 below indicates how "r" value can be used to indicate the strength and direction of correlation between two variables. A positive correlation indicates that students who had high scores for survey category (x) also had high scores for survey category (y). A negative correlation indicates that students who had low scores for survey category (x) also had low scores for survey category (y) (Levin, Fox, & Forde, 2010, pg. 347).

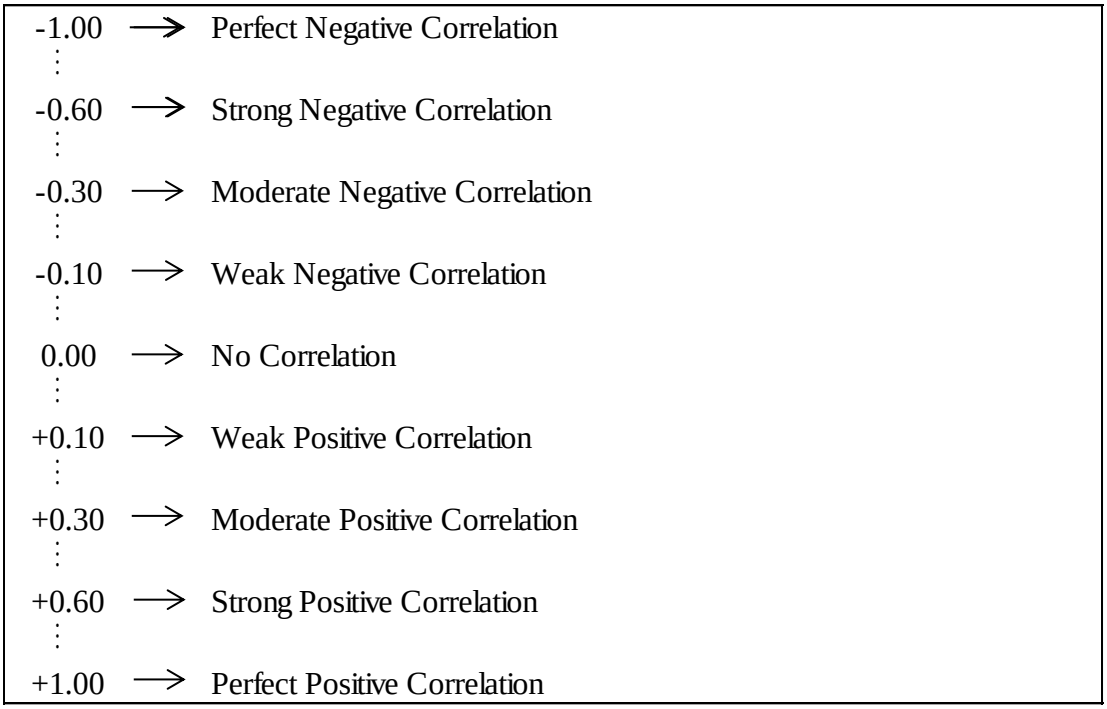
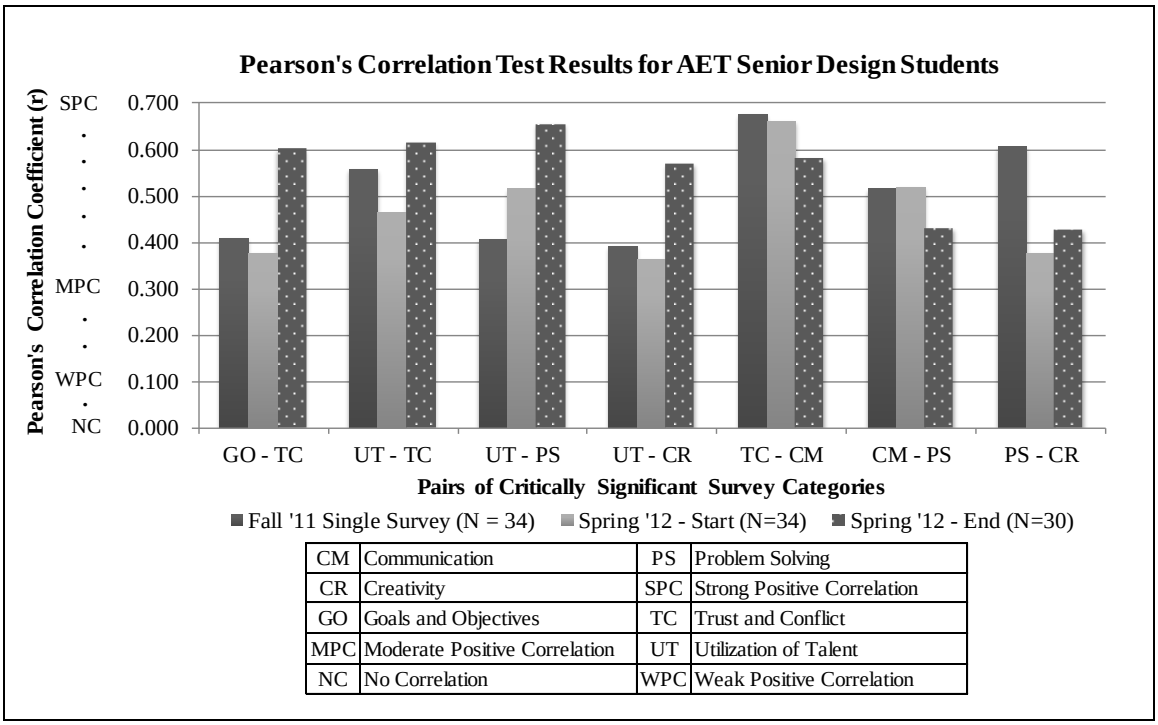


Figure 3. Range of values "r" and the strength of correlation that it indicates. Adapted from "Elementary Statistics in Social Research," by J. Levin, J. Fox, and D. Forde, 2010, p.349. Copyright 2010 by Allyn and Bacon Pearson.

If a pair of survey categories (Figure 1 and Figure 2) was found to be significant at α of 0.05 during all three trials, then correlation between the pair was considered to be critically significant. For AET Senior Design students seven critically significant pairs of

survey categories were identified. Figure 4, shown below, summarizes this information. No critically significant pairs of survey categories were identified for MET Senior Design students. Complete correlation tables for the AET and MET Senior Design groups can be found in Appendix J.



CM	Communication	PS	Problem Solving
CR	Creativity	SPC	Strong Positive Correlation
GO	Goals and Objectives	TC	Trust and Conflict
MPC	Moderate Positive Correlation	UT	Utilization of Talent
NC	No Correlation	WPC	Weak Positive Correlation

Figure 4. Pearson's Correlation Test Results for AET Senior Design Students. All pairs of variables were found to be statistically significant at $\alpha = 0.05$. Scale for Pearson's correlation coefficient is shown to the left, alongside the y-axis.

AET Senior Design students with good ratings in the survey category of Utilization of Talent might also achieve good ratings in the survey categories of Trust and Conflict, Problem Solving, and Creativity (Figure 4). Categories of Trust and Conflict and Communication had strong correlation during Trial 1 and Trial 2, which suggests, AET Senior Design students with good communication skills are more likely to do well in the survey category of Trust and Conflict. The next segment of this section will give information regarding Somer's D_{yx} association test.

Somers' D_{yx} Test of Association between Ordinal Variables

An association test was required to assess if students with prior formal project management (PM) knowledge[15] had better survey ratings compared to students without prior formal PM knowledge. The Somers' D_{yx} association test is one such tool used to find out if there is an association between any two ordinal variables (Fox, 2002, pg. 159). A variable whose values can be rank-ordered is known as ordinal (Fox, 2002, pg. 10). Only critically significant survey categories (Table 5) were analyzed using Somers' D_{yx} method to detect if they were associated to project management.

Both variables used for Somer's D_{yx} analysis in this research study, are ordinal variables that can be rank ordered. These ordinal variables are:

- Formal project management coursework
  - MET 325 not taken
  - MET 325 taken

  } Rank Order
- Survey scores
  - 5-7
  - 1-3

  } Rank Order

A survey score of four was considered as a response that indicated a student's uncertainty regarding his/her team's performance in a particular survey category. Hence, these

[15] For the purpose of this research study, students who had taken the MET 325 (Project Management) course prior to the survey were considered to have formal project management knowledge.

responses were omitted from the Somers' D_{yx} analysis. The logic behind Somers' D_{yx} association test is shown in Appendix K. Formula for Somers' "D_{yx}" is shown below:

$$D_{yx} = \text{(Same - Opposite) / (Same – Opposite + } T_y)^{16}$$

The denominator in the formula for "D_{yx}" ties in the value of "Ty", which is the sum of pairs that are tied to the dependent variable "x" (survey scores). As a result, the Somers' D_{yx} method takes into account all possible combinations of pairs in its formula. For the purpose of Somers' D_{yx} analysis in this research study, the dependent variable "x" is always survey scores and the independent variable "y" is always project management coursework. Somers' D_{yx} analysis results for AET Senior Design students are shown in Figure 5 below.

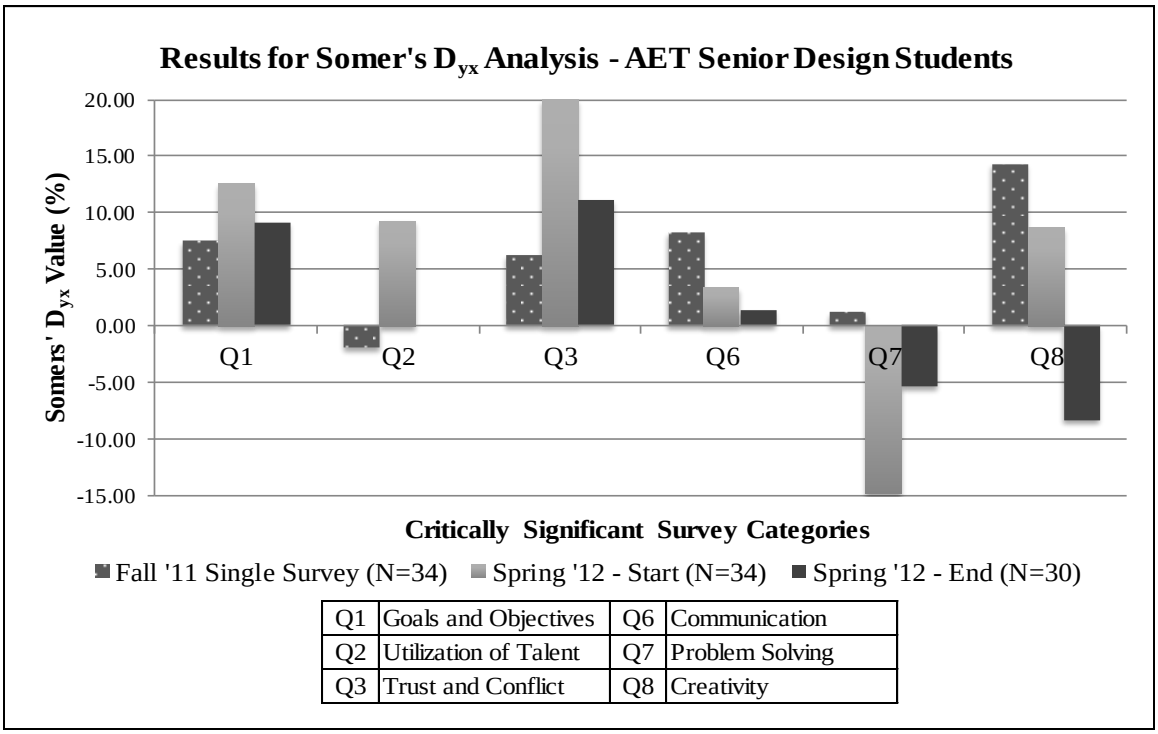


Figure 5. Results for Somers' D_{yx} Analysis – AET Senior Design Students. Q = Question.

[16] Appendix K gives definitions for the terms "same", "opposite", and "T_y"

Moderate association was detected between project management and survey category Trust and Conflict during Trial 2. Therefore, during Trial 2, AET Senior Design students with formal project management knowledge might have had higher scores for the survey category of Trust and Conflict. During Trials 1 and 2 a mild association was detected between the survey category of Creativity and project management.

Project management had no impact on the survey category of Problem Solving. There was a mild association between the survey category of Goals and Objectives and project management during all three survey trials. Categories of Utilization of Talents and Communication had a minimal association to project management for the AET Senior Design students. Somers' D_{yx} analysis results for MET Senior Design students are shown in Figure 6 below.

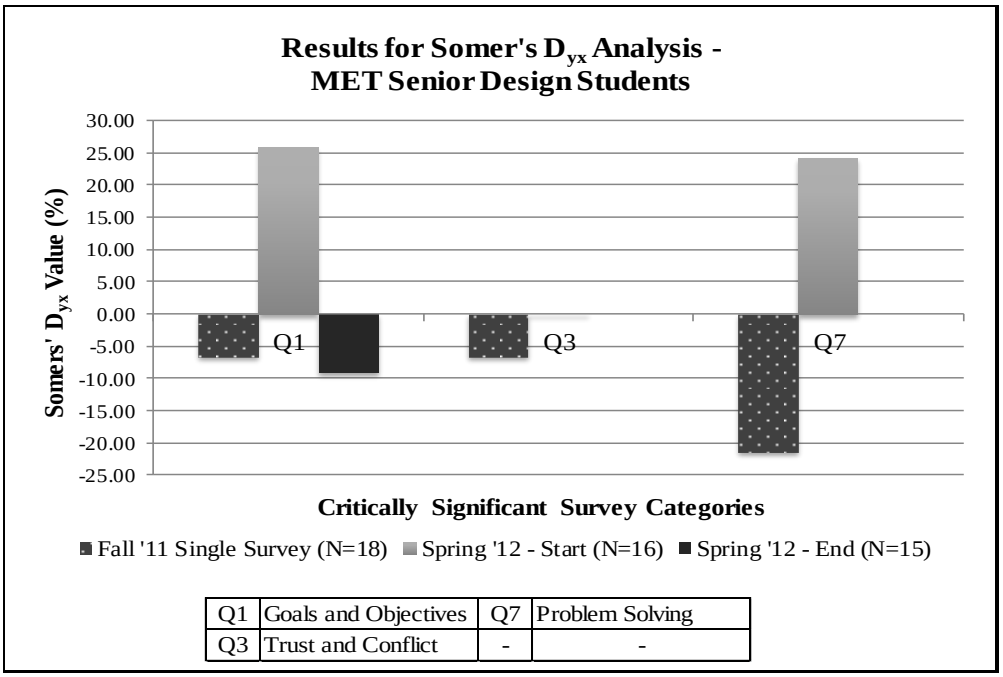


Figure 6. Results for Somers' D_{yx} Analysis – MET Senior Design Students. Q = Question.

For MET Senior Design students, moderate association was detected between project management and survey categories of Goals and Objectives, and Problem Solving during Trial 2. No survey category was associated to project management during Trials 1 and 3 for the MET Senior Design students. Complete tables of Somers' D_{yx} analysis for the AET and MET Senior Design students can be found in Appendix L.

Next, the Descriptive Statistics segment of this section will give brief information regarding specialized percentage graphs and percentage tables created to identify initial trends in survey sample data. Results for Question 10, which was included in Trial 3 for AET and MET Senior Design students, will also be discussed in this segment.

Descriptive Statistics

The researcher collaborated with Principal Investigator, Dr. Craig Evers to design specialized percentage graphs with the following capability:

- Show percentages for students who rated the nine survey categories between the scores of 5-7 (high scores)
- Show percentages for students who rated the nine survey categories between the scores of 1-3 (low scores)

High and low scores for each of the nine survey categories were shown for all three trials on one graph (Appendix M). This made it relatively easy to identify survey categories with exceptionally high or low scores. The percentage tables will be described next.

According to Fox (2002), when comparison of two or more distributions with different number of cases is required, the distributions can be standardized by using percentages instead of frequencies (pg. 31-32). Therefore, percentages are used in this

research study since the number of participants was not the same for the five survey sample groups. Grouped percentage tables were created to draw a comparison between students who took MET 325 (Project Management) prior to the survey and those who did not take MET 325 prior to the survey. Grouped percentage table for AET and MET Senior Design Students is shown below (Table 6 and Table 7).

Table 6

Comparison of Scores – Students who Took MET 325 vs. Students who Did Not Take MET 325 Prior to the Survey – AET Senior Design Students

Variable[a]	MET 325 Taken		MET 325 Not Taken	
	Scores 1-3	Scores 5-7	Scores 1-3	Scores 5-7
Fall '11 Single Survey	(N) = (17)		(N) = (17)	
Q1 - Goals and Objectives	6	94	12	76
Q2 - Utilization of Talent	6	59	6	76
Q3 - Trust and Conflict	0	76	6	88
Q6 - Communication	6	76	12	65
Q7 - Problem Solving	6	76	6	65
Q8 - Creativity	0	65	12	71
Spring '12 - Start	(N) = (17)		(N) = (17)	
Q1 - Goals and Objectives	0	94	12	82
Q2 - Utilization of Talent	6	65	18	82
Q3 - Trust and Conflict	0	88	18	71
Q6 - Communication	12	76	12	59
Q7 - Problem Solving	18	65	6	82
Q8 - Creativity	6	82	12	65
Spring '12 - End	(N) = (16)		(N) = (14)	
Q1 - Goals and Objectives	6	94	14	79
Q2 - Utilization of Talent	6	75	7	86
Q3 - Trust and Conflict	0	88	7	57
Q6 - Communication	6	75	7	71
Q7 - Problem Solving	13	69	7	64
Q8 - Creativity	6	69	0	71

Note. [a]These are variables that were found to be critically significant using one proportion hypothesis test of significance. Q = Question; MET 325 = Project Management.

Table 7

Comparison of Scores – Students who Took MET 325 vs. Students who Did Not Take MET 325 Prior to the Survey – MET Senior Design Students

Variable[a]	MET 325 Taken		MET 325 Not Taken	
	Scores 1-3	Scores 5-7	Scores 1-3	Scores 5-7
Fall '11 Single Survey	(N) = (16)		(N) = (2)	
Q1 - Goals and Objectives	6	88	0	100
Q3 - Trust and Conflict	6	88	0	50
Q7 - Problem Solving	19	69	0	100
Spring '12 - Start	(N) = (13)		(N) = (3)	
Q1 - Goals and Objectives	8	92	33	67
Q3 - Trust and Conflict	0	85	0	67
Q7 - Problem Solving	8	77	33	67
Spring '12 - End	(N) = (13)		(N) = (2)	
Q1 - Goals and Objectives	8	77	0	100
Q3 - Trust and Conflict	0	92	0	100
Q7 - Problem Solving	0	85	0	50

Note. [a]These are variables that were found to be critically significant using one proportion hypothesis test of significance. Q = Question; MET 325 = Project Management.

For complete grouped percentage tables with non-critically significant survey categories included, please refer to Appendix N. A grouped percentage table for AET Junior Design students is also available in Appendix N.

The following paragraph will discuss results for survey Question 10, which was introduced in Survey Instrument - II during survey Trial 3. Only AET and MET Senior Design students were requested to answer this question. Surveys designed for AET Junior Design students did not contain this question. Figure 7, shown below, gives an overview of survey Question 10.

10. From the 9 categories given below choose 3 that you think your team needs to improve the most. Put 1-3 in the needs column with 1 being the highest need for improvement.

Number	Category	Need for Improvement
1	Goals and Objectives	
2	Utilization of Talents	
3	Trust and Conflict	
4	Leadership	
5	Team Procedures	
6	Interpersonal Communication	
7	Problem Solving/Decision Making	
8	Experimentation/Creativity	
9	Evaluation	

Figure 7. Question 10 - Introduced During Trial 3 - Spring ’12 End.

For AET Senior Design students, the survey categories of Goals and Objectives, and Trust and Conflict received the most number of votes for a need for improvement score of 1 (Appendix O). Cumulatively, survey category of Communication received the most number of votes (total 15 votes) for Question 10 (Figure 8). It should also be noted that 57.70% of valid AET Senior Design respondents felt the survey category of Communication needed improvement.

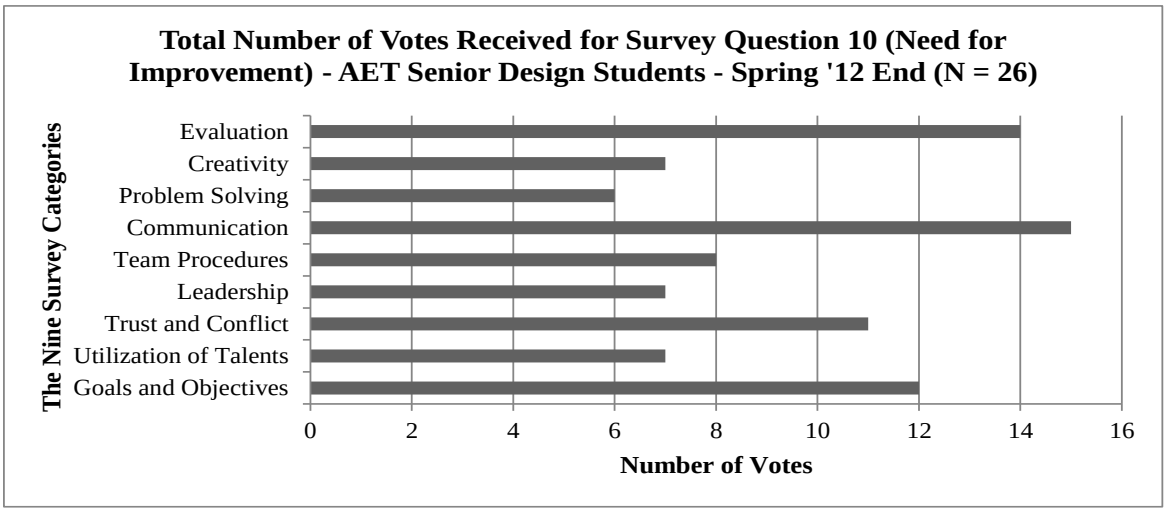


Figure 8. Total Number of Votes Received for Survey Question 10 – AET Senior Design Students – Spring ’12 End. N = Number of valid respondents.

For AET Senior Design students, the top three categories requiring improvement were Goals and Objectives, Communication, and Evaluation (Figure 8). A bar chart was constructed, using the top three survey categories needing improvement[17], to detect if an AET Senior Design student's formal PM knowledge had an impact on the number of votes for Question 10 (Figure 9).

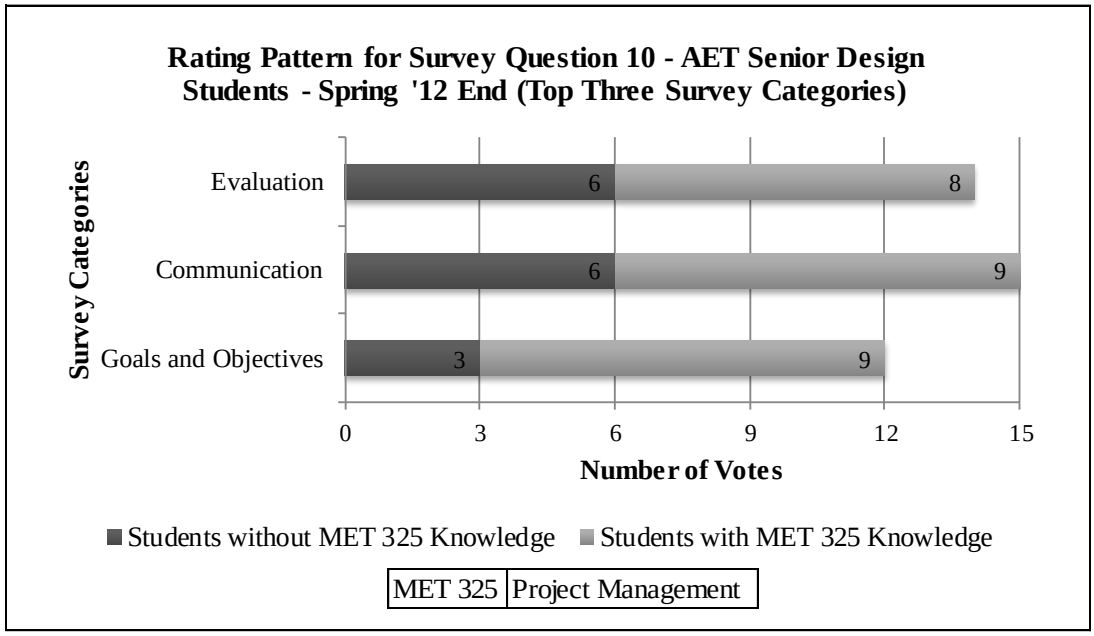


Figure 9. Rating Pattern for Survey Question 10 – AET Senior Design Students – Spring '12 End - Top Three Categories.

Nine of the twelve votes (75%) for the survey category of Goals and Objectives came from AET Senior Design students with formal project management knowledge. AET Senior Design students with formal PM knowledge had a different perception regarding their teams' goals and objectives. AET Senior Design students with formal PM knowledge might have been aware of the advantages of having well defined project goals

[17] Votes for other survey categories were low. Hence, only top three categories were selected for bar chart analysis shown in Figure 9.

and objectives. As a result, at the end of their capstone projects, many AET Senior Design students with formal PM knowledge felt the survey category of Goals and Objectives needed more improvement.

There were only thirteen valid MET Senior Design respondents for survey Question 10. Therefore, conclusive inferences could not be made for MET Senior Design students. Appendix O contains individual bar charts that show the number of votes each category received, for a need for improvement score of 1, 2, and 3 respectively.

Major Findings

Major Finding 1 – AET Senior Design students with formal project management knowledge had good ratings for the survey category of Trust and Conflict.

The percentage graph shown in Figure 10 below indicates that 88% of AET Senior Design students with formal project management (PM) knowledge gave Trust and Conflict a rating of 5 or higher during Trials 2 and 3.

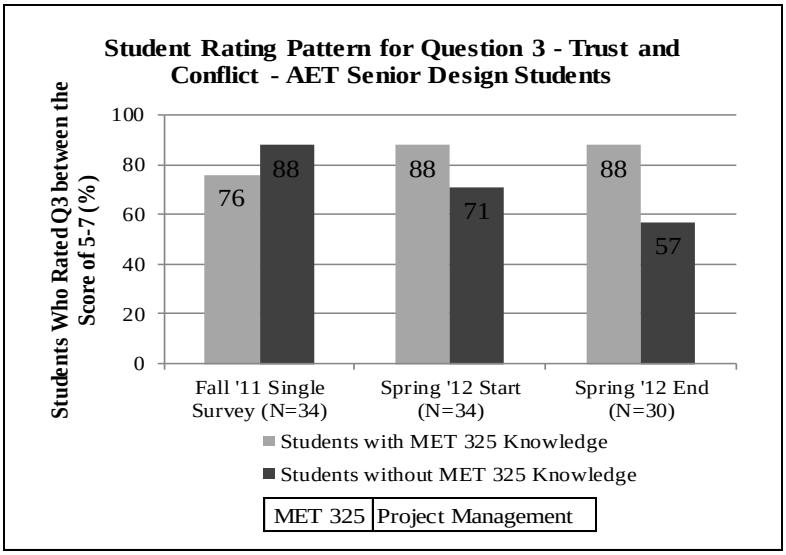


Figure 10. Student Rating Pattern for Question 3 – Trust and Conflict – AET Senior Design Students.

On the other hand, ratings for AET Senior Design students without formal PM knowledge were satisfactory (88%) during Trial 1 but, dropped to 57% during Trial 3. It should also be noted that 36% of AET Senior students without formal PM knowledge gave this survey category a rating of four during Trial 3. A rating of four suggests these AET Senior Design students were unsure as to how their team dealt with Trust and Conflict.

Moderate association was detected between project management and the survey category of Trust and Conflict during Trial 2 (Figure 5). A moderate association indicates that project management might have helped AET Senior Design students with formal PM knowledge achieve good ratings in the survey category of Trust and Conflict during Trial 2.

Major Finding 2 – AET Senior Design students with formal PM knowledge had good ratings for the survey category of Creativity.

For AET Senior Design students with formal PM knowledge, the rating for Creativity rose from 65% during Trial 1 to 82% during Trial 2 (Figure 11). Therefore, AET Senior Design students with formal PM knowledge could have felt that members of their team were not fully using their creative abilities during Trial 1.

AET Senior Design students at MSU – Mankato are required to present the final product of their design projects by the end of the spring semester. Hence, AET Senior Design students are under pressure to perform well during the spring semester (C. Evers, personal communication, 2012). This pressure to perform might have triggered the high

ratings for the survey category of Creativity amongst AET Senior Design students with formal PM knowledge during Trial 2.

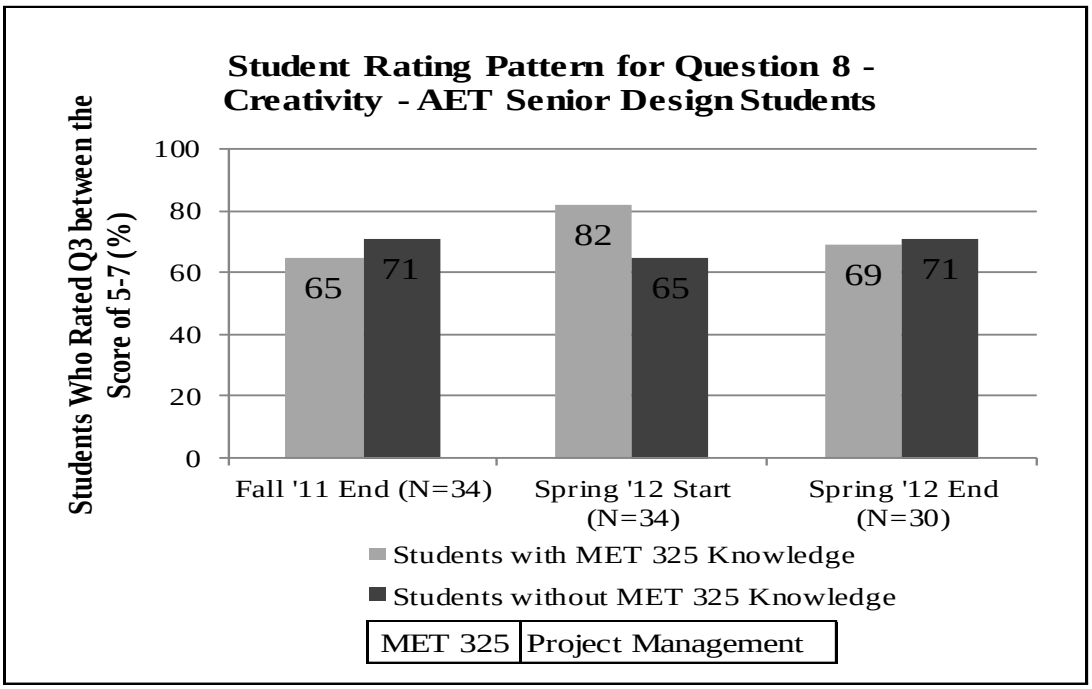


Figure 11. Student Rating Pattern for Question 8 – Creativity – AET Senior Design Students. Please note – only one survey was conducted during Fall '11semester.

Major Finding 3 – AET Senior Design students with formal PM knowledge had strong, consistent ratings in the survey category of Goals and Objectives during all three survey trials.

Figure 12 below shows that, AET Senior Design students with formal PM knowledge consistently had a rating of 94% for the survey category of Goals and Objectives during all three survey trials. A project management approach in clearly setting a team's goals and objectives during the initiating phase of a project might have been the reason for high ratings in this survey category by AET Senior Design students who had formal PM knowledge.

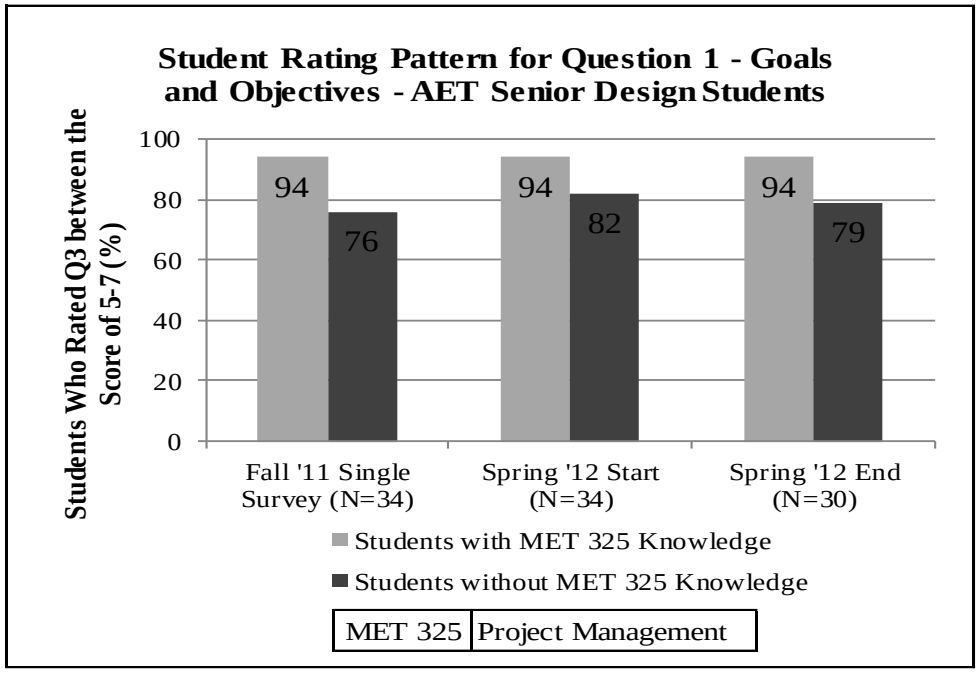


Figure 12. Student Rating Pattern for Question1 – Goals and Objectives – AET Senior Design Students.

Major Finding 4 – AET Senior Design students with prior formal PM knowledge demonstrated good consistent ratings in the survey category of Communication.

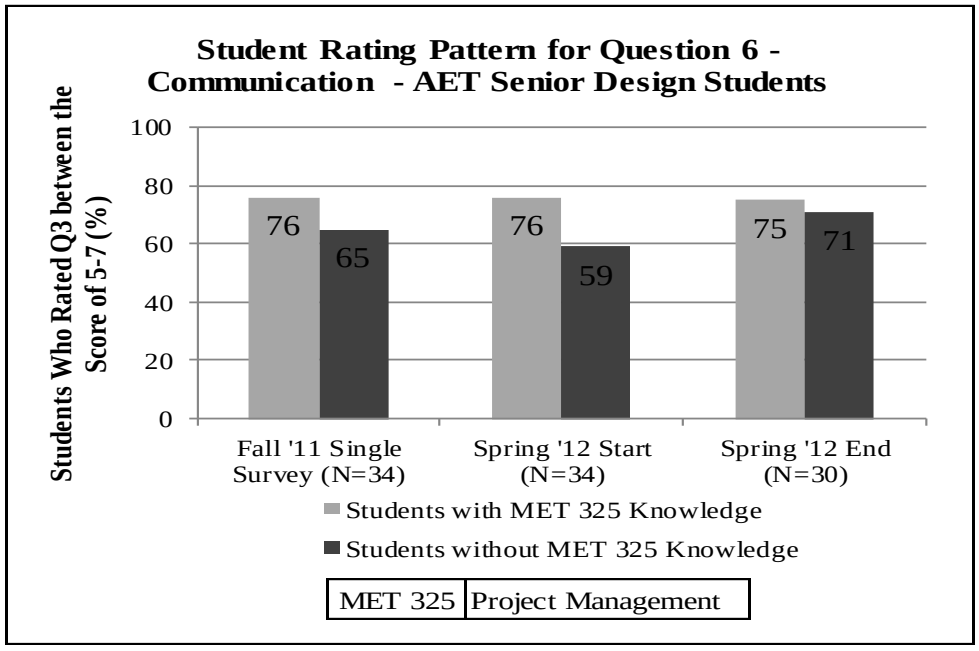


Figure 13. Student Rating Pattern for Question 6 – Communication – AET Senior Design Students.

AET Senior Design students with formal PM knowledge had consistent ratings (above or equal to 75%) during all three survey trials for the category of Communication. During Trial 2 the rating for AET Senior Design students without formal PM knowledge was 17% lower than AET Senior Design students with formal PM knowledge. Figure 13, shown above, summarizes these findings.

Major Finding 5 – AET Senior Design students with formal PM knowledge had lower ratings during all three trials for the survey category of Utilization of Talent compared to AET Senior Design students without formal PM knowledge.

Ratings for AET Senior Design students with formal PM knowledge were at least 11% lower compared to AET Senior Design students without formal PM knowledge during all three survey trials (Refer to Figure 14 below). Figure 15 below shows the actual wording for Question 2 as it appeared on both Survey Instrument I & II.

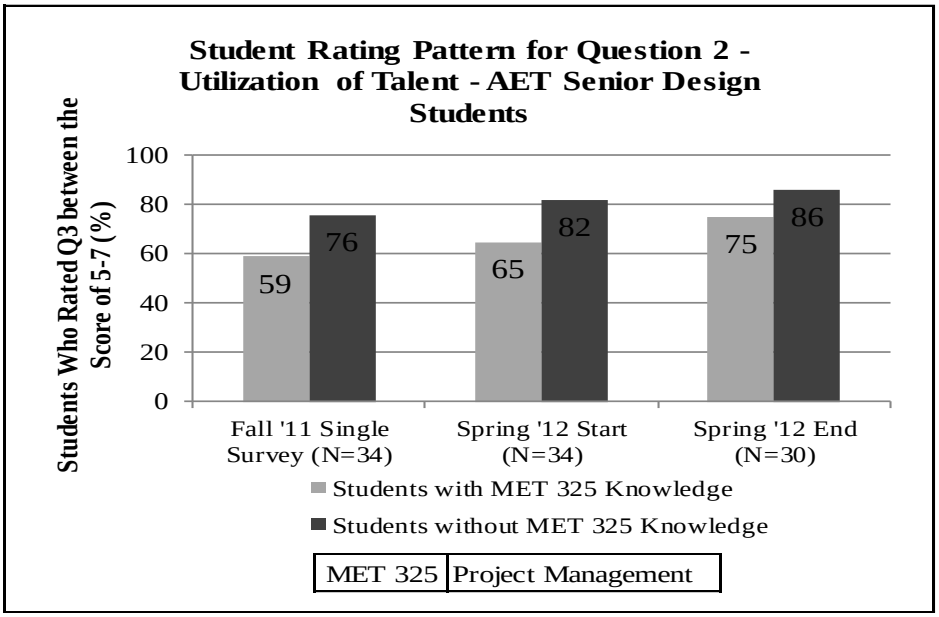


Figure 14. Student Rating Pattern for Question 2 – Utilization of Talent – AET Senior Design Students.

It is clear from Figure 14 that during all three survey trials AET Senior Design students with formal PM knowledge felt their team's talent pool was not fully utilized. In contrast, AET Senior Design students without formal PM knowledge felt their team's performance in this survey category was satisfactory.

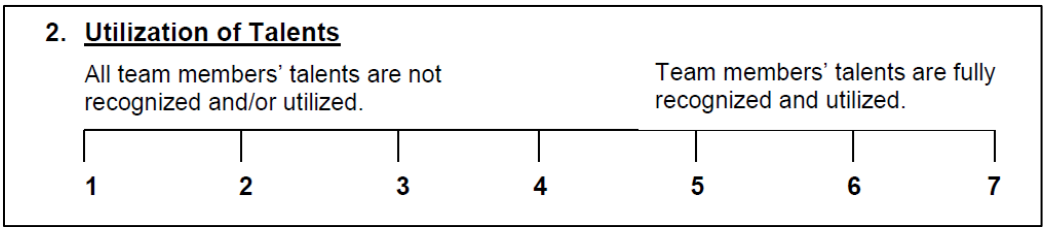


Figure 15. Q2 – Utilization of Talents.

Major Finding 6 – MET Senior Design students with formal PM knowledge had strong, consistent ratings in the survey category of Goals and Objectives.

According to Somers's D_{yx} results presented in Figure 6, association between PM and survey category of Goals and Objectives rose 18.97 percentage points during Trial 2 for MET Senior Design students. This might indicate that a structured project management approach could have helped MET Senior Design students with formal PM knowledge achieve a 92% rating level during survey Trial 2.

It should also be noted that the sample size of MET Senior Design students with formal PM knowledge was low during all three trials[18] (13-16). As a result, inference from this dataset should not be considered conclusive. Nevertheless, both MET and AET Senior Design students with formal PM knowledge had good ratings in the category of

[18] There were at least two respondents during all three survey trials in the MET Senior Design group who had not taken MET 325. This further reduced the sample size of MET Senior Design students with formal PM knowledge.

Goals and Objectives. Figure 16 shown below highlights the percentage ratings discussed above.

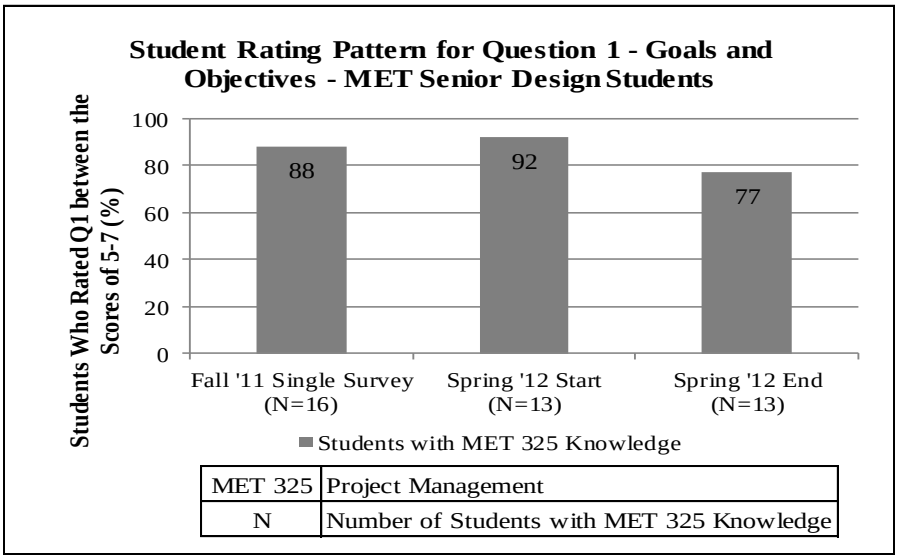


Figure 16. Student Rating Pattern for Question 1 – Goals and Objectives – MET Senior Design Students.

Major Finding 7 – Ratings for the Survey Category of Problem Solving increased progressively for MET Senior Design Students with formal PM knowledge.

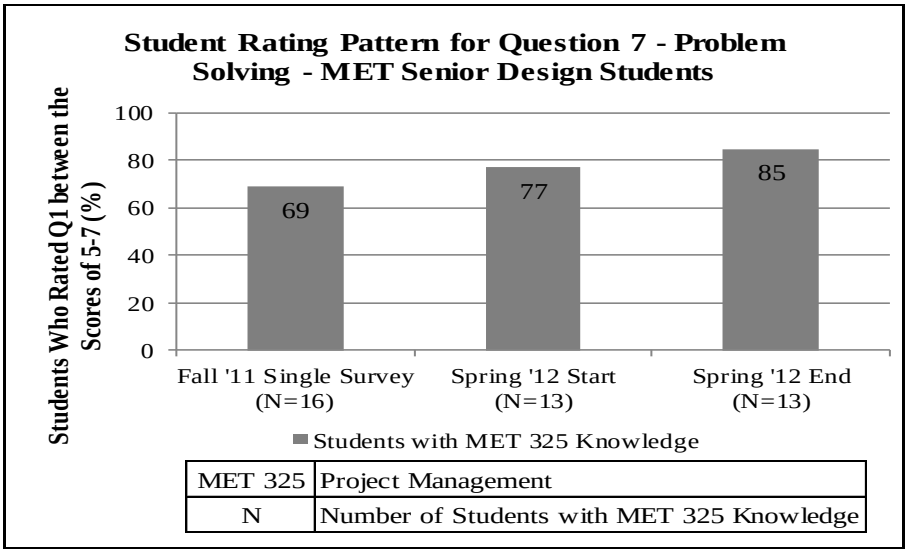


Figure 17. Student Rating Pattern for Question 7 - Problem Solving – MET Senior Design Students.

Rating for survey category of Problem Solving rose 8 percentage points during both Trial 1 and Trial 2 (Figure17) for MET Senior Design students with formal PM knowledge. A moderate association was detected between project management and the survey category of Problem Solving during Trial 2 for MET Senior Design students with formal PM knowledge (Refer to Figure 6).

Figure 6 shows that Somers' D_{yx} value for the survey category of Problem Solving rose 45.67 percentage points during Trial 2. The teams for MET Senior Design projects are typically small (3- 4 members). This combined with the fact that most MET Senior Design students have formal project management knowledge might have made the task of problem solving easier for MET Senior Design students.

Discussion

The discussion section of this research paper will briefly restate the problem, methods and procedures used for data collection, and the major findings. Limitations to the findings of this study will also be stated. Finally, a comprehensive list of recommendations for the AMET faculty and recommendations for future research will be provided.

Restatement of the Problem

Over the years, AET Senior Design projects at MSU – Mankato have become more complex and technology intensive. The number of members in an AET Senior Design team has also grown, with each team having a minimum of at least four members. These factors suggest there might be a need for AET students to acquire formal project management knowledge to perform well in Senior Design courses (Senior Design Project I and Senior Design Project II).

Since AET students are not required to take a project management course to complete the program, the researcher felt it was important to assess if AET students were in need of a project management course. To answer this question, the researcher formulated a research methodology, briefly described in the Methods and Procedures segment below.

Methods and Procedures

Data collection for this research study was done by conducting surveys. Survey instruments developed for this research study (Survey Instrument – I and Survey Instrument – II) were based on the "Team Effectiveness Critique" written by Dr. Susan

Trimble. The "Team Effectiveness Critique" contains nine questions which directly relate to team effectiveness and project management. These nine questions (also known as the nine survey categories) were used in the final survey instruments designed for this research study.

Students enrolled in the AET and MET Senior Design courses, and AET Junior Design courses were surveyed to collect information regarding the effect of project management on the nine survey categories. The nine survey categories are as follows: Goals and Objectives, Utilization of Talents, Trust and Conflict, Leadership, Team Procedures, Communication, Problem Solving, Creativity, and Evaluation.

The AET Junior Design group was surveyed twice, once during the start of the Spring '12 semester and once during the end of the Spring '12 semester. AET and MET Senior Design groups were surveyed thrice. Once during the Fall '11 semester (Senior Design Project I) and twice during the Spring '12 semester (Senior Design Project II). The surveys for AET Junior Design and MET Senior Design students were conducted in-class. On the other hand, surveys for AET Senior Design students were conducted during individual team meetings[19]. Next, a summary of the major findings of this research study will be provided.

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[19] Students enrolled in AET Senior Design Project I and Senior Design Project II courses formally meet in a classroom only for presentations and project updates. The instructors of these courses had requested these student gatherings be devoted to presentations and project updates only. As a result, the researcher surveyed AET Senior Design students during individual team meetings.

Summary of Major Findings

- *Major Finding 1* – AET Senior Design students with formal project management knowledge had good ratings for the survey category of Trust and Conflict
- *Major Finding 2* – AET Senior Design students with formal PM knowledge had good ratings for the survey category of Creativity
- *Major Finding 3* – AET Senior Design students with formal PM knowledge had strong, consistent ratings in the survey category of Goals and Objectives during all three survey trials
- *Major Finding 4* – AET Senior Design students with prior formal PM knowledge demonstrated good consistent ratings in the survey category of Communication
- *Major Finding 5* – AET Senior Design students with formal PM knowledge had lower ratings during all three trials for the survey category of Utilization of Talent compared to AET Senior Design students without formal PM knowledge
- *Major Finding 6* – MET Senior Design students with formal PM knowledge had strong, consistent ratings in the survey category of Goals and Objectives
- *Major Finding 7* – Ratings for the Survey Category of Problem Solving increased progressively for MET Senior Design Students with formal PM knowledge

Limitations to the Findings of this Research Study

- The five survey sample groups had unequal sample sizes. Further, only the AET Senior Design group (Senior Design I and Senior Design II) had thirty or more valid respondents during the three survey trials. Sample size

for the AET Junior Design and the MET Senior Design group was rather small, less than 20 valid respondents

- Five AET Senior Design teams were surveyed during Trial 1, but an additional team was surveyed during Trial 2 and Trial 3. During Trial 1, the researcher was under the assumption that only five AET Senior Design teams were in existence
- AET Senior Design groups were surveyed during team meetings for all three survey trials, but the AET Junior Design and MET Senior Design groups were surveyed in-class
- Some AET Senior Design teams were surveyed before the team meeting and some teams were surveyed after the team meeting. Perceptions of teams surveyed prior to the team meeting can be different from those surveyed after the team meeting

Next, recommendations based on the findings of this research study will be discussed.

Recommendations for the AMET Department Faculty

Based on the findings of this research it is recommended that the AMET faculty modify AET Junior Design and AET Senior Design (Senior Design Project I and Senior Design Project II) courses. At present, the AET Junior Design course (AET 387) is offered as a half semester course. AET students are expected to form teams and select a research topic at the end of the Junior Design course. The AET Junior Design course should be converted into a full semester course. The second half of the course should be focused on the following project management concepts:

- Project Definition – Students should be taught to properly identify the scope, goals and objectives, and expectations of a project
- Project Scheduling – Students should be trained in scheduling project activities using a Gantt chart
- Project Analysis – Useful tools like the Critical Path Method (CPM), and Program Evaluation and Review Technique (PERT) which help in analyzing a project should be taught

AET Junior Design students can internalize some of these concepts if they are asked to do related activities in the form of class assignments (Pimmel, 2001, p. 413). Therefore, after the abovementioned project management concepts have been taught, student teams should create a plan for their capstone project. Next, students should be asked to evaluate other teams' project plans. In doing so, students will gain additional communication skills and useful suggestions regarding their team's project plan. It is also recommended that team leaders of AET Senior Design teams give presentations to AET Junior Design students on some of the lessons they learned. Recommendations for AET Senior Design courses will be discussed in the following paragraph.

During survey Trial 3 (final phase of an AET Senior Design project), at least fifty seven percent of AET Senior Design students felt their team needed improvement in the survey category of Communication (Figure 9). To help AET Senior Design students communicate more effectively the AMET faculty should incorporate a formalized approach to team meetings. The following ideas should be incorporated in the weekly meetings of AET Senior Design teams:

- During AET Senior Design Project I, project teams should be asked to design a suitable template for a team meeting agenda. This will help in incorporating a structured approach towards team meetings
- Responsibility of creating an agenda and conducting team meeting should be rotated weekly among team members
- The agenda should be submitted to the faculty adviser at least a day before each team meeting

In the near future, a formal project management course should be incorporated into the AET curriculum. Prior to that, experimentation can be done at the Junior Design level.

Recommendations for Further Research

This research study was specifically designed to assess if students of the AET program needed a project management course. There are additional research topics related to this research study that need further attention. These additional topics are as follows:

- Ratings for survey categories of Leadership and Team Procedures had considerable variability for both AET and MET Senior Design students during all three survey trials (Appendix M). But, these categories were not statistically significant (Table 4 and Table 5). Nevertheless, research can be done to identify why these two survey categories had variability for the AET and MET Senior Design groups
- AET Senior Design students with formal PM knowledge had consistently lower ratings in the survey category of Utilization of Talent compared to

students without formal PM knowledge. Further research should be conducted to explain this distinct difference of opinion

- If this research was to be repeated, it is recommended that the same group of students be surveyed from the Junior Design to the Senior Design courses. Owing to schedule challenges at the time of this research study, it was not possible to survey the same group of students

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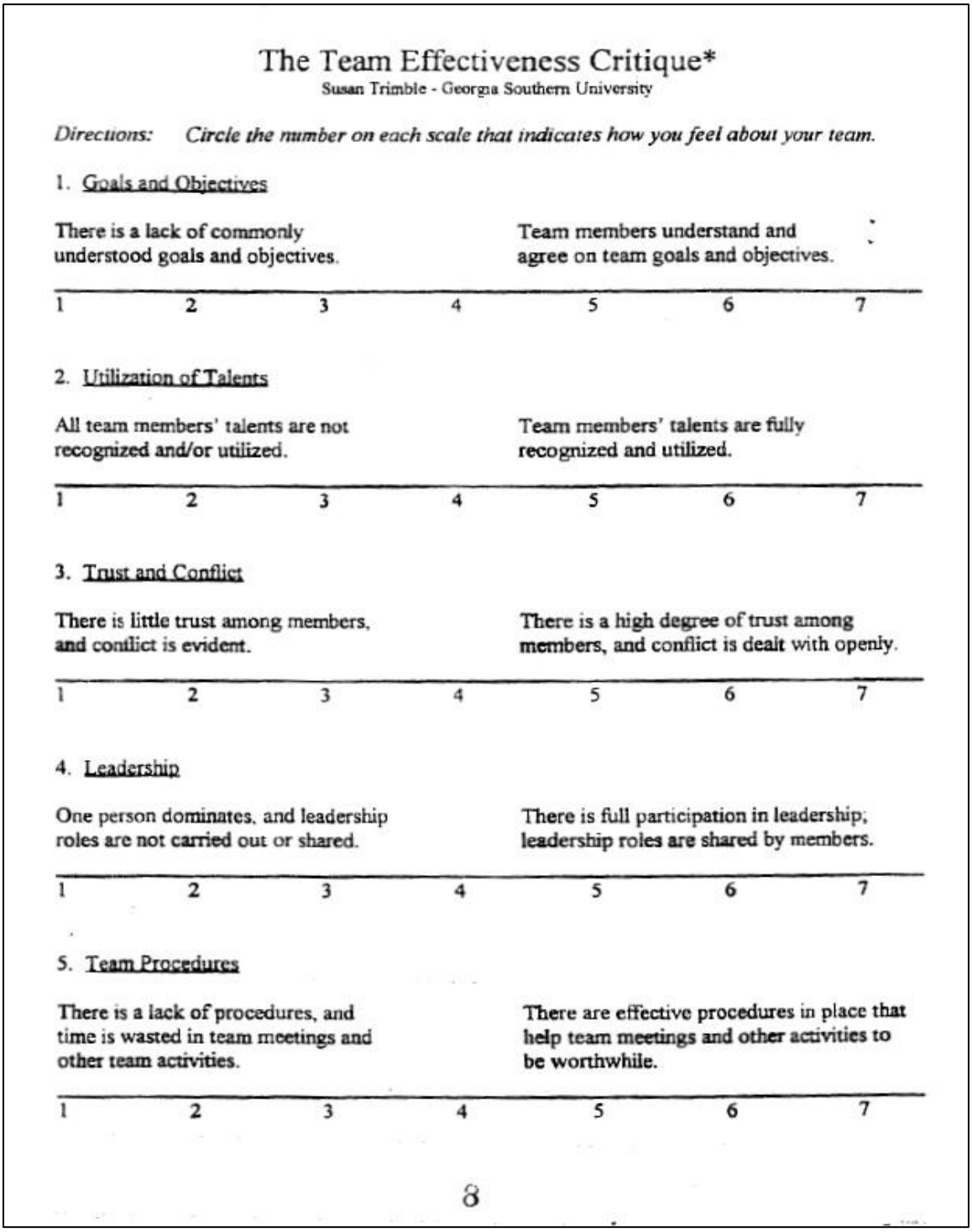
Appendix A



The Team Effectiveness Critique*

Susan Trimble - Georgia Southern University

Directions: *Circle the number on each scale that indicates how you feel about your team.*

1. Goals and Objectives

There is a lack of commonly understood goals and objectives. — Team members understand and agree on team goals and objectives.

1 2 3 4 5 6 7

2. Utilization of Talents

All team members' talents are not recognized and/or utilized. — Team members' talents are fully recognized and utilized.

1 2 3 4 5 6 7

3. Trust and Conflict

There is little trust among members, and conflict is evident. — There is a high degree of trust among members, and conflict is dealt with openly.

1 2 3 4 5 6 7

4. Leadership

One person dominates, and leadership roles are not carried out or shared. — There is full participation in leadership; leadership roles are shared by members.

1 2 3 4 5 6 7

5. Team Procedures

There is a lack of procedures, and time is wasted in team meetings and other team activities. — There are effective procedures in place that help team meetings and other activities to be worthwhile.

1 2 3 4 5 6 7

8

Figure A1. The Team Effectiveness Critique (Page 1) – By Susan Trimble.

Appendix A

6. Interpersonal Communication

Communication among members is closed and guarded.						Communication among members is open, relaxed, and often lively.
1	2	3	4	5	6	7

7. Problem Solving/Decision Making

Decisions are made in a haphazard fashion leaving some members feeling left out.						The team has well-established approaches to problem solving and decision making wherein everyone participates.
1	2	3	4	5	6	7

8. Experimentation/Creativity

The team resists new approaches and rarely attempts to change routines or traditional formats of working with students.						The team is constantly trying out new ways to increase the learning and well-being of all students.
1	2	3	4	5	6	7

9. Evaluation

The group never discusses its functioning, activities, or effect on students' achievement and well-being.						The team often evaluates its functioning, activities, and their effects on students' achievement and well-being.
1	2	3	4	5	6	7

10. Connections with the school and community

The team rarely interacts with other teachers and staff in the school, the administration, parents, or the community in planning team activities.						The team constantly interacts with others in the school, the administration, parents, and the community in planning team activities.
1	2	3	4	5	6	7

**adapted from "The Team Effectiveness Critique" by Mark Alexander, University Associates, 1985 Annual: Developing Human Resources, pp. 105-106.*

9

Figure A2. The Team Effectiveness Critique (Page 2) – By Susan Trimble.

Appendix A

Exhibit 10.3. A Summative Assessment of Group Work

Please indicate your level of agreement with each of the following statements using a five-point agree-disagree rating scale, where 1 = strongly disagree, 2 = disagree, 3 = uncertain, 4 = agree, and 5 = strongly agree (the higher the number, the more you agree).

1. _____ My group performed excellently.
2. _____ All the members of the group worked equally hard.
3. _____ As our work progressed, the group became more cohesive.
4. _____ I was proud to be a member of the group and I highly respected most of the people I worked with.
5. _____ Most of the members of the group highly valued working in a collective with others.
6. _____ What the group achieved (or tried to achieve) was considered important and valuable to other members of the group.
7. _____ What the group achieved (or tried to achieve) was valuable and important to me.
8. _____ The group's task was intrinsically interesting.
9. _____ Other members of my group not only knew what I was doing, they could easily see what I was doing and monitor my work.
10. _____ Performance standards for the group were set in advance to allow us to evaluate the overall performance of the entire group as we worked.
11. _____ The group I worked in was just the right size.
12. _____ Performance standards for individuals were set in advance to allow each person to evaluate his or her contribution while he or she worked for the group.
13. _____ The effort I exerted was instrumental in helping me obtain the outcomes I wanted to achieve as an individual.
14. _____ My performance was evaluated by the instructor or by other members of my group.
15. _____ The task of the group required us to meet and work side by side most of the time; we did not work alone and then combine our efforts only at the end.
16. _____ I exerted a lot of effort to help the group achieve its goals.
17. _____ I had a lot of things to contribute to the group's work such as knowledge, skill, effort, time, and other essentials.
18. _____ My performance as an individual directly affected how well the group as a whole performed.
19. _____ My contribution to the group's work was unique; no one else did exactly what I did.
20. _____ The task of the group was challenging.

_____ Total score

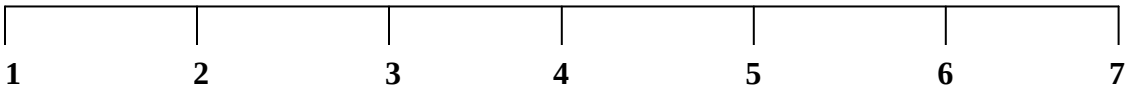
Figure A3. The CECAT Instrument – By Charles Walker and Thomas Angelo.

Appendix B

1. Goals and Objectives

There is a lack of commonly understood goals and objectives.

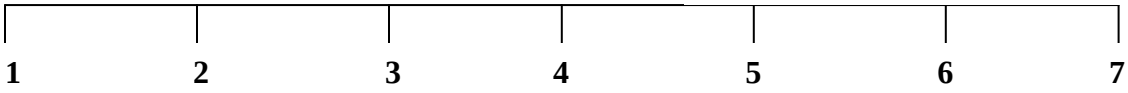
Team members understand and agree on team goals and objectives.



2. Utilization of Talents

All team members' talents are not recognized and/or utilized.

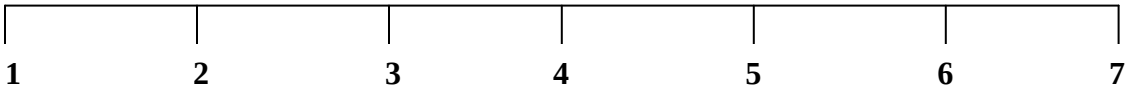
Team members' talents are fully recognized and utilized.



3. Trust and Conflict

There is little trust among members, and conflict is evident.

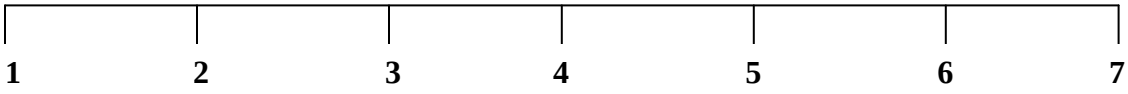
There is a high degree of trust among members, and conflict is resolved openly.



4. Leadership

One person dominates, and leadership roles are not carried out or shared.

There is full participation in leadership; leadership roles are shared by



5. Team Procedures

There is a lack of procedures, and time is wasted in team meetings and other team activities.

There are effective procedures to guide team functioning; team members support these procedures and regulate themselves.

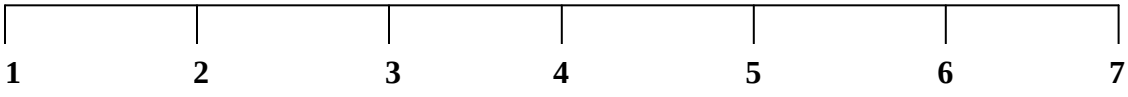


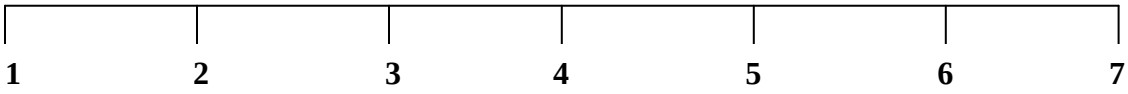
Figure B1. The Nine Survey Questions Derived from the Team Effectiveness Critique – Page 1.

Appendix B

6. Interpersonal Communication

Communication among members is closed and guarded.

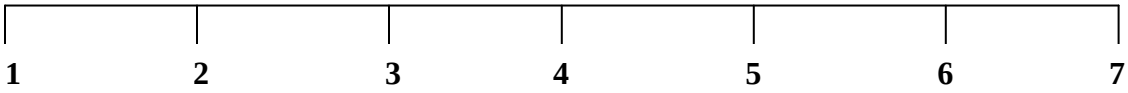
Communication among members is open, participative.



7. Problem Solving/Decision Making

Decisions are made in a haphazard fashion leaving some members feeling left out.

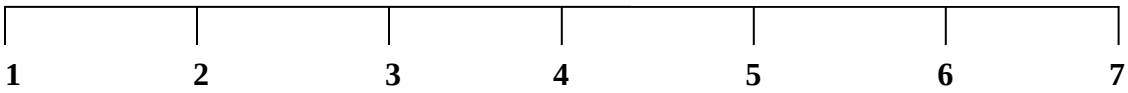
The team has well-established and agreed upon approaches to problem solving and decision making wherein everyone participates.



8. Experimentation/Creativity

The team is rigid and does not experiment with how things are done.

The team experiments with different ways of doing things and is creative in its approach.



9. Evaluation

The group never evaluates its functioning or process.

The group often evaluates its functioning and process.

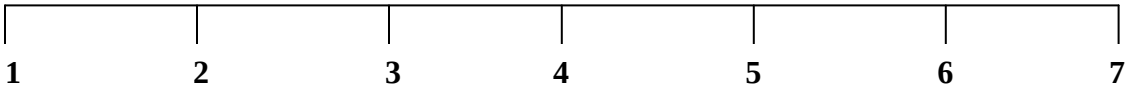
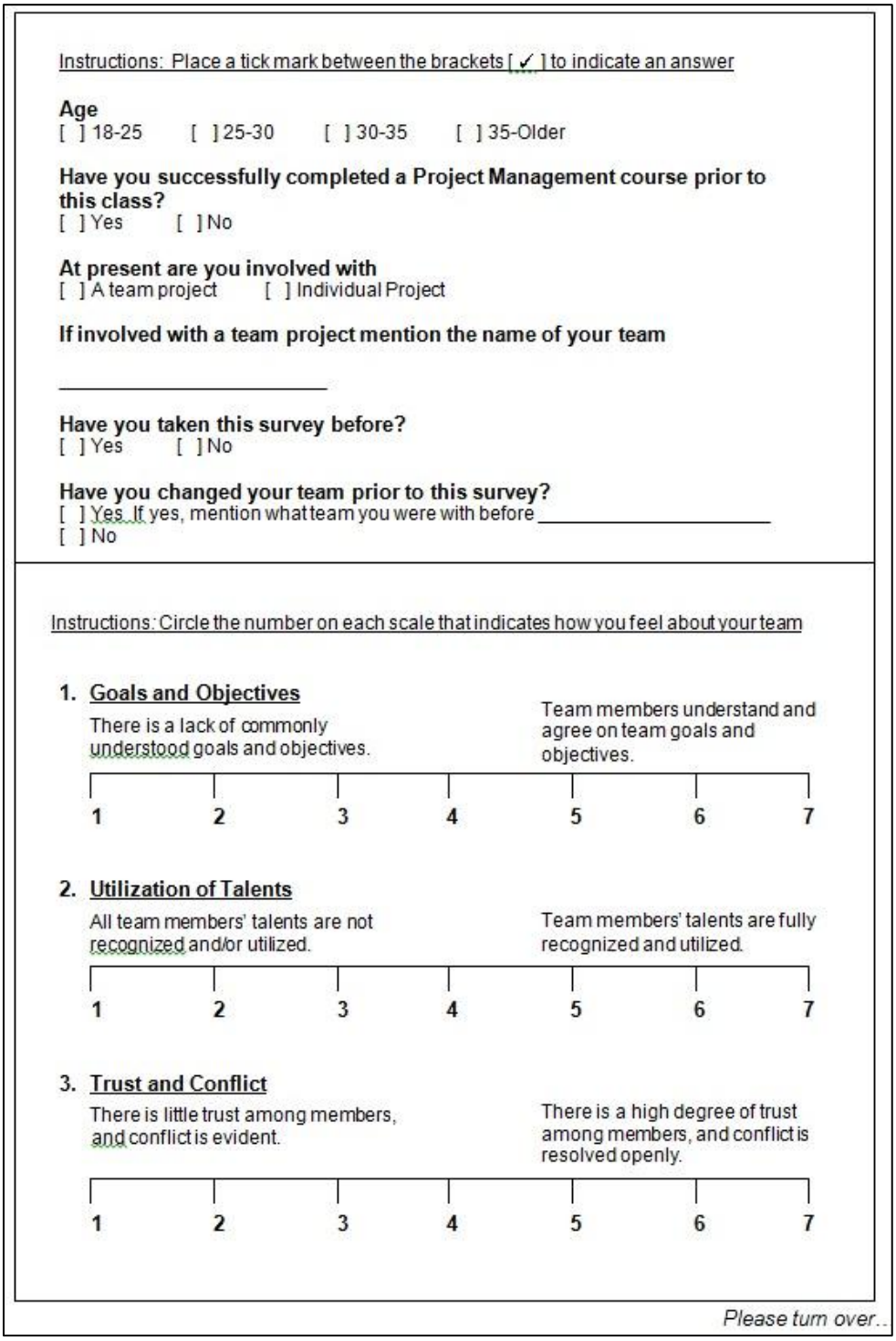


Figure B2. The Nine Survey Questions Derived from the Team Effectiveness Critique – Page 2.

Appendix C



Instructions: Place a tick mark between the brackets [✓] to indicate an answer

Age
[ ] 18-25 [ ] 25-30 [ ] 30-35 [ ] 35-Older

Have you successfully completed a Project Management course prior to this class?
[ ] Yes [ ] No

At present are you involved with
[ ] A team project [ ] Individual Project

If involved with a team project mention the name of your team

_____

Have you taken this survey before?
[ ] Yes [ ] No

Have you changed your team prior to this survey?
[ ] Yes If yes, mention what team you were with before _____
[ ] No

Instructions: Circle the number on each scale that indicates how you feel about your team

1. **Goals and Objectives**

There is a lack of commonly understood goals and objectives. — Team members understand and agree on team goals and objectives.

1 2 3 4 5 6 7

2. **Utilization of Talents**

All team members' talents are not recognized and/or utilized. — Team members' talents are fully recognized and utilized.

1 2 3 4 5 6 7

3. **Trust and Conflict**

There is little trust among members, and conflict is evident. — There is a high degree of trust among members, and conflict is resolved openly.

1 2 3 4 5 6 7

Please turn over..

Figure C1. Survey Instrument I – Page 1.

Appendix C

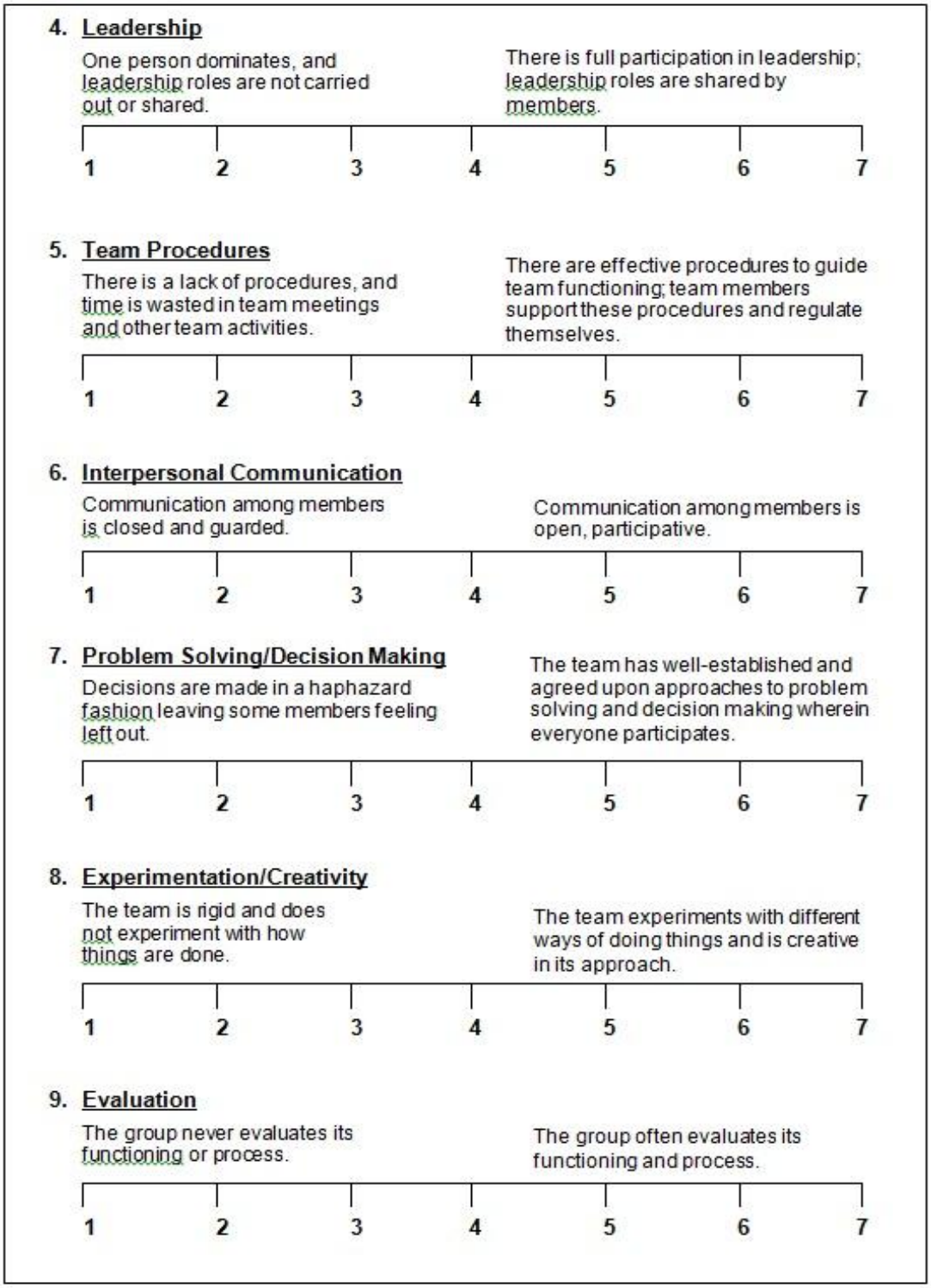
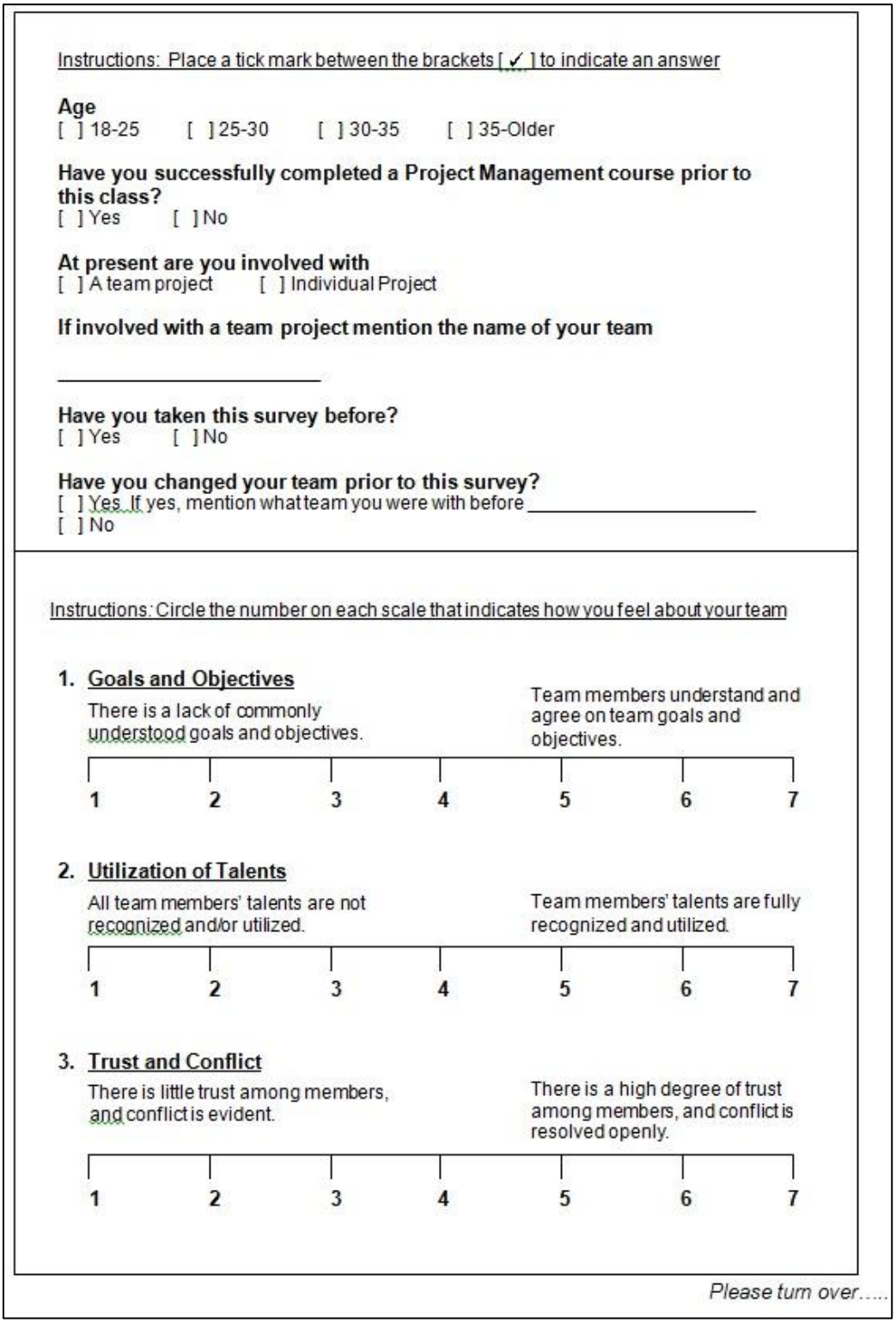


Figure C2. Survey Instrument I – Page 2.

Appendix D



Instructions: Place a tick mark between the brackets [✓] to indicate an answer

Age
[ ] 18-25 [ ] 25-30 [ ] 30-35 [ ] 35-Older

Have you successfully completed a Project Management course prior to this class?
[ ] Yes [ ] No

At present are you involved with
[ ] A team project [ ] Individual Project

If involved with a team project mention the name of your team

_____

Have you taken this survey before?
[ ] Yes [ ] No

Have you changed your team prior to this survey?
[ ] Yes. If yes, mention what team you were with before _____
[ ] No

Instructions: Circle the number on each scale that indicates how you feel about your team

1. **Goals and Objectives**

There is a lack of commonly understood goals and objectives. — Team members understand and agree on team goals and objectives.

1 2 3 4 5 6 7

2. **Utilization of Talents**

All team members' talents are not recognized and/or utilized. — Team members' talents are fully recognized and utilized.

1 2 3 4 5 6 7

3. **Trust and Conflict**

There is little trust among members, and conflict is evident. — There is a high degree of trust among members, and conflict is resolved openly.

1 2 3 4 5 6 7

Please turn over.....

Figure D1. Survey Instrument II – Page 1.

Appendix D

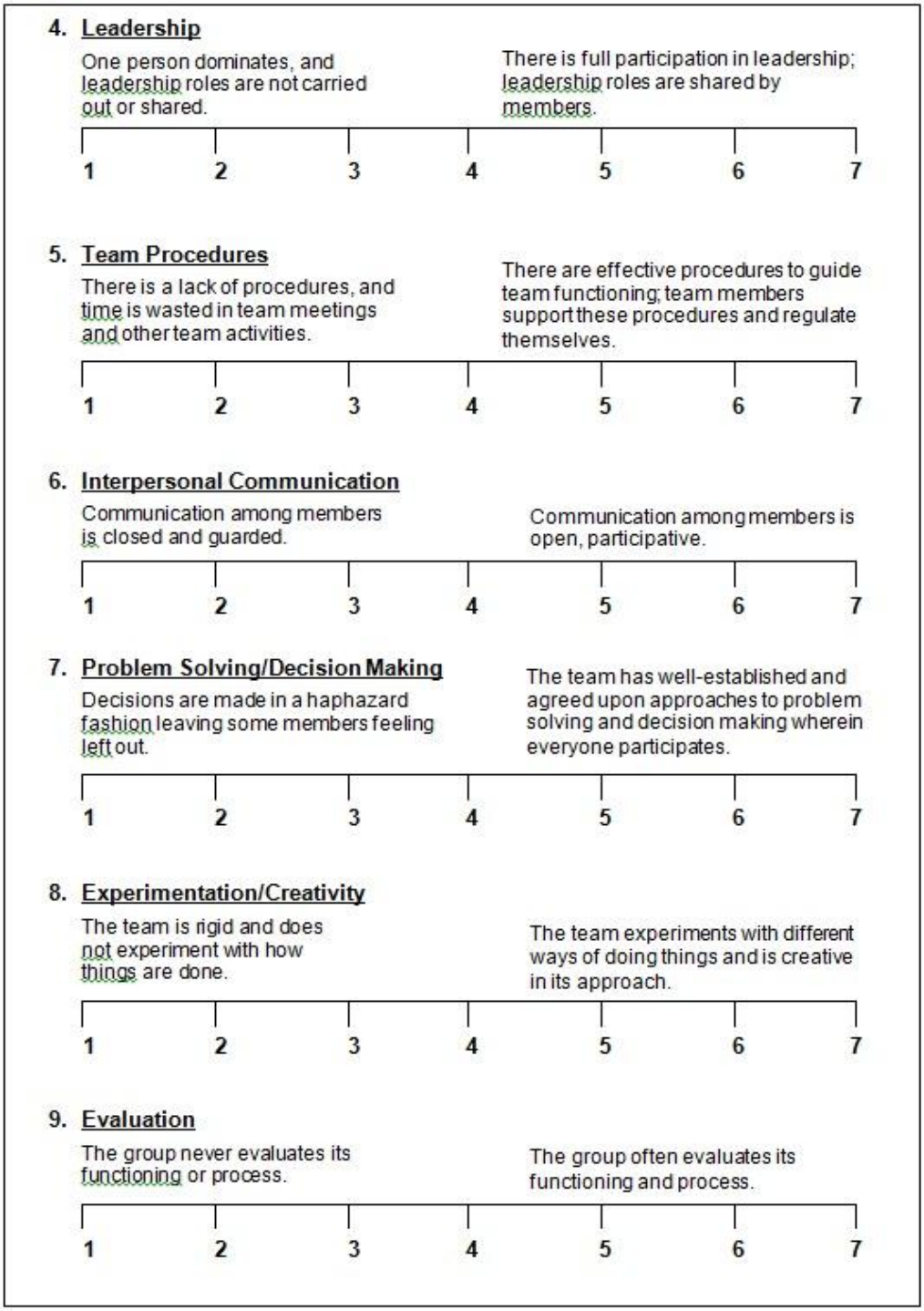


Figure D2. Survey Instrument II – Page 2.

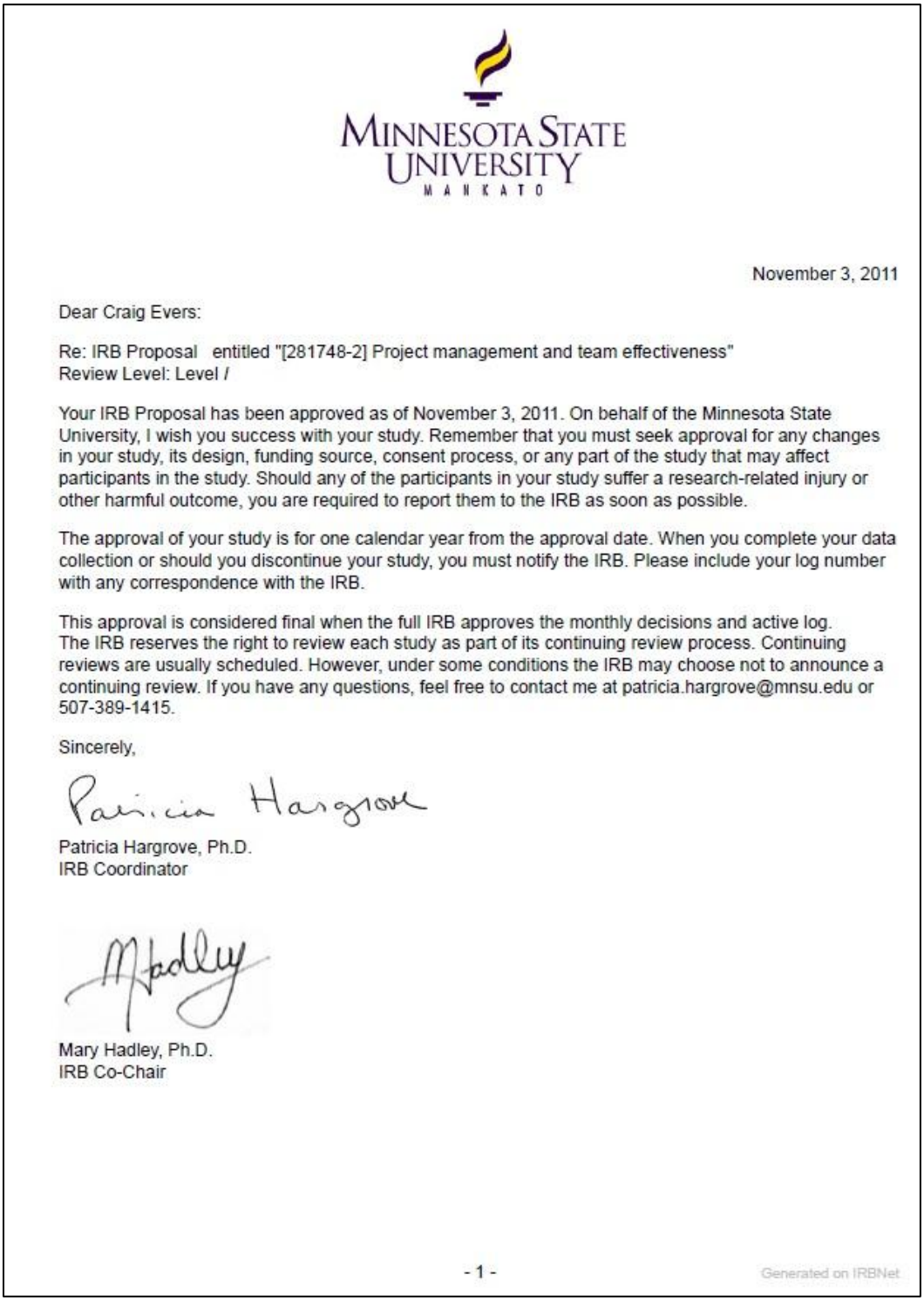
Appendix D

10. From the 9 categories given below choose 3 that you think your team needs to improve the most. Put 1-3 in the needs column with 1 being the highest need for improvement.

Number	Category	Need for Improvement
1	Goals and Objectives	
2	Utilization of Talents	
3	Trust and Conflict	
4	Leadership	
5	Team Procedures	
6	Interpersonal Communication	
7	Problem Solving/Decision Making	
8	Experimentation/Creativity	
9	Evaluation	

Figure D3. Survey Instrument II – Page 3.

Appendix E



MINNESOTA STATE UNIVERSITY
MANKATO

November 3, 2011

Dear Craig Evers:

Re: IRB Proposal entitled "[281748-2] Project management and team effectiveness"
Review Level: Level /

Your IRB Proposal has been approved as of November 3, 2011. On behalf of the Minnesota State University, I wish you success with your study. Remember that you must seek approval for any changes in your study, its design, funding source, consent process, or any part of the study that may affect participants in the study. Should any of the participants in your study suffer a research-related injury or other harmful outcome, you are required to report them to the IRB as soon as possible.

The approval of your study is for one calendar year from the approval date. When you complete your data collection or should you discontinue your study, you must notify the IRB. Please include your log number with any correspondence with the IRB.

This approval is considered final when the full IRB approves the monthly decisions and active log. The IRB reserves the right to review each study as part of its continuing review process. Continuing reviews are usually scheduled. However, under some conditions the IRB may choose not to announce a continuing review. If you have any questions, feel free to contact me at patricia.hargrove@mnsu.edu or 507-389-1415.

Sincerely,

Patricia Hargrove

Patricia Hargrove, Ph.D.
IRB Coordinator

Mary Hadley, Ph.D.
IRB Co-Chair

- 1 -

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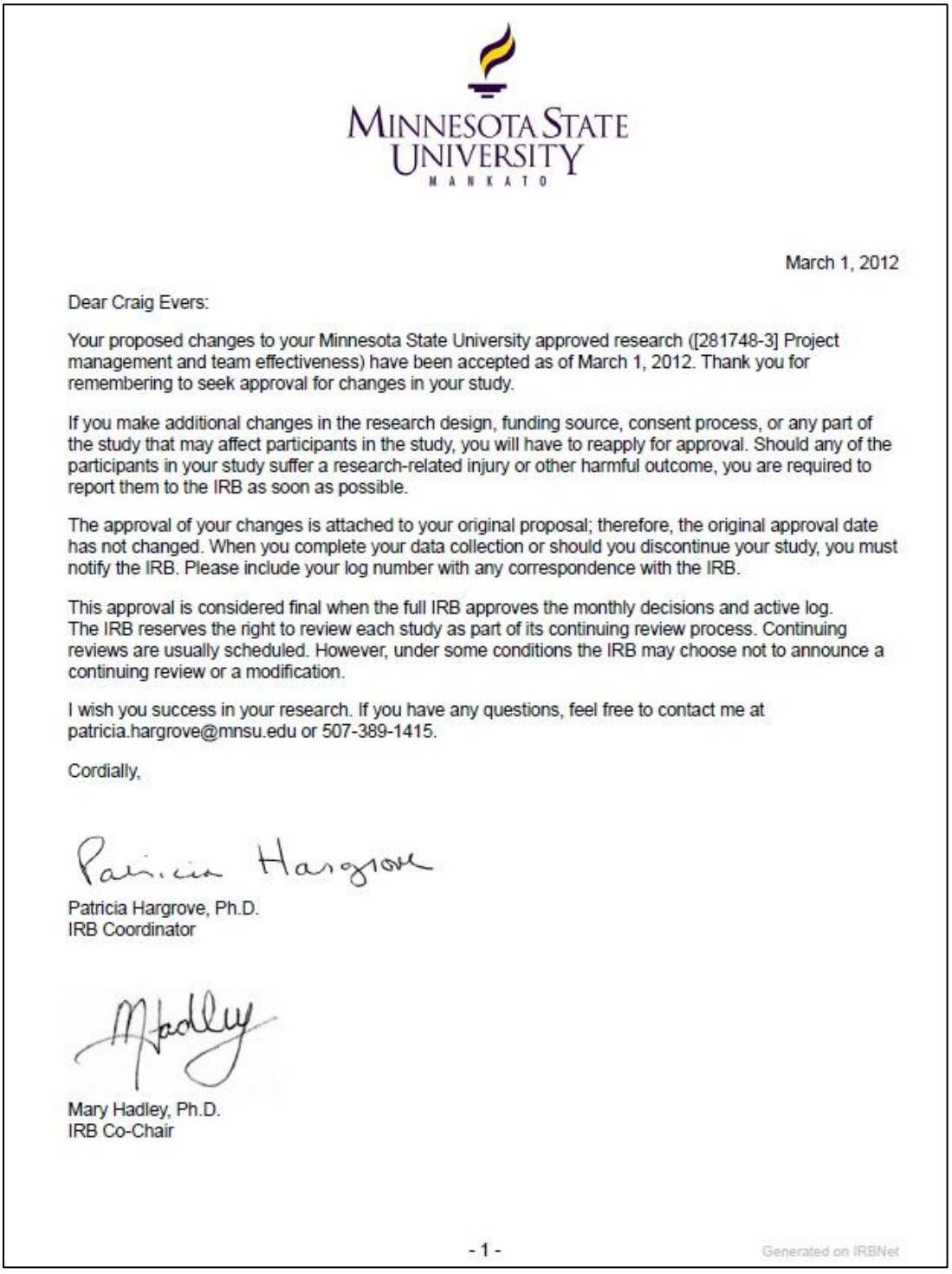
Figure E1. IRB Approval for Survey Instrument – I.

Appendix F



MINNESOTA STATE UNIVERSITY
MANKATO

March 1, 2012

Dear Craig Evers:

Your proposed changes to your Minnesota State University approved research ([281748-3] Project management and team effectiveness) have been accepted as of March 1, 2012. Thank you for remembering to seek approval for changes in your study.

If you make additional changes in the research design, funding source, consent process, or any part of the study that may affect participants in the study, you will have to reapply for approval. Should any of the participants in your study suffer a research-related injury or other harmful outcome, you are required to report them to the IRB as soon as possible.

The approval of your changes is attached to your original proposal; therefore, the original approval date has not changed. When you complete your data collection or should you discontinue your study, you must notify the IRB. Please include your log number with any correspondence with the IRB.

This approval is considered final when the full IRB approves the monthly decisions and active log. The IRB reserves the right to review each study as part of its continuing review process. Continuing reviews are usually scheduled. However, under some conditions the IRB may choose not to announce a continuing review or a modification.

I wish you success in your research. If you have any questions, feel free to contact me at patricia.hargrove@mnsu.edu or 507-389-1415.

Cordially,

Patricia Hargrove

Patricia Hargrove, Ph.D.
IRB Coordinator

Mary Hadley

Mary Hadley, Ph.D.
IRB Co-Chair

- 1 -

Generated on IRBNet

Figure F1. IRB Approval for Survey Instrument – II.

Appendix G

This research is a survey of project management and team effectiveness. You will be asked questions **that will relate to how well your project team is performing**. All of your information will be kept private. It can be viewed only by authorized research staff members. The survey takes about **10 min** to complete.

I understand that I can contact **Dr. Craig Evers** at **507-389-5023/craig.evers@mnsu.edu** about any concerns I have about this project. I understand that I also may contact the Minnesota State University, Mankato Institutional Review Board Administrator, Dr. Barry Ries, at 389-2321 or barry.ries@mnsu.edu with any questions about research with human participants at Minnesota State University, Mankato.

I understand that participation in this project is voluntary and I have the right to stop at any time. My decision whether or not to participant will not affect my relationship with Minnesota State University, Mankato. By completing this questionnaire, I agree to participate in this study and state that I am at least 18 years of age. Also, I am aware that there are no direct benefits to me as a result of my participation in this research.

I understand that none of my answers will be released and no names will be recorded. I understand that the risks of participating in this study are less than minimal. I understand that participating in this study will help **in understanding the relationship between project management and team performance/effectiveness.**

If I am concerned about my mental health after answering the questions, I can seek a referral for mental health services at http://locator.apa.org/ or http://www.nmha.org/help/. Neither the investigators nor Minnesota State University, Mankato will be responsible for the cost of mental health services if you decide to request them.

Please print this page for your records before continuing.

- o I am at least 18 years of age

MSU IRB LOG # 281748-2
Date of MSU IRB approval: 11/3/11

Figure G1. Consent form for Survey Instrument I and II.

Appendix H

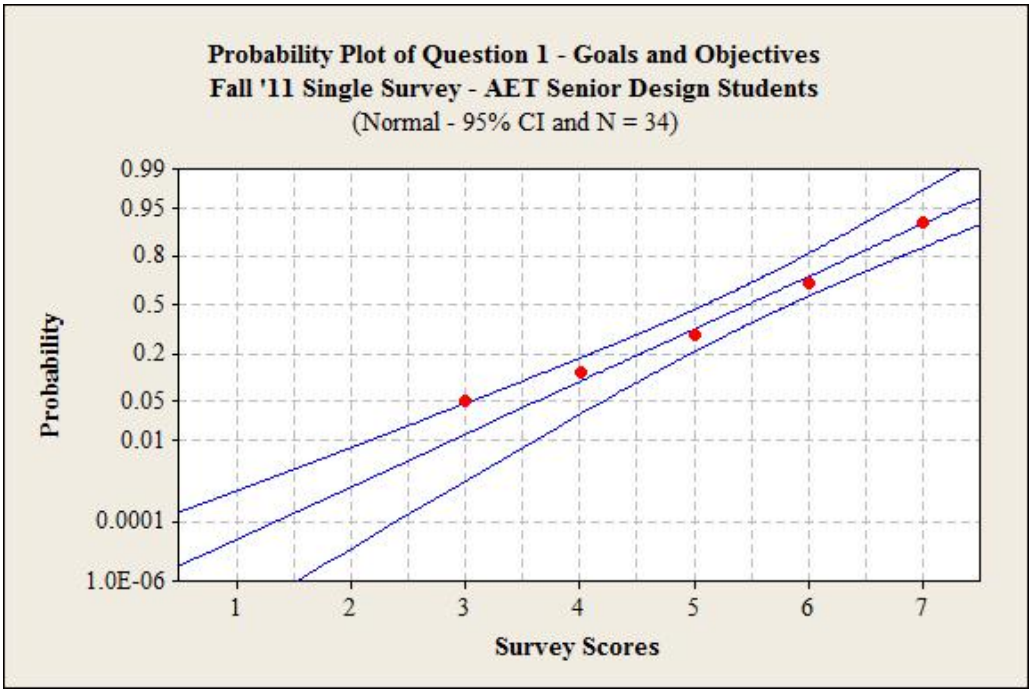


Figure H1. Normal probability plot of Question 1 – Goals and Objectives. AET Senior Design students – Fall ’11 Single Survey.

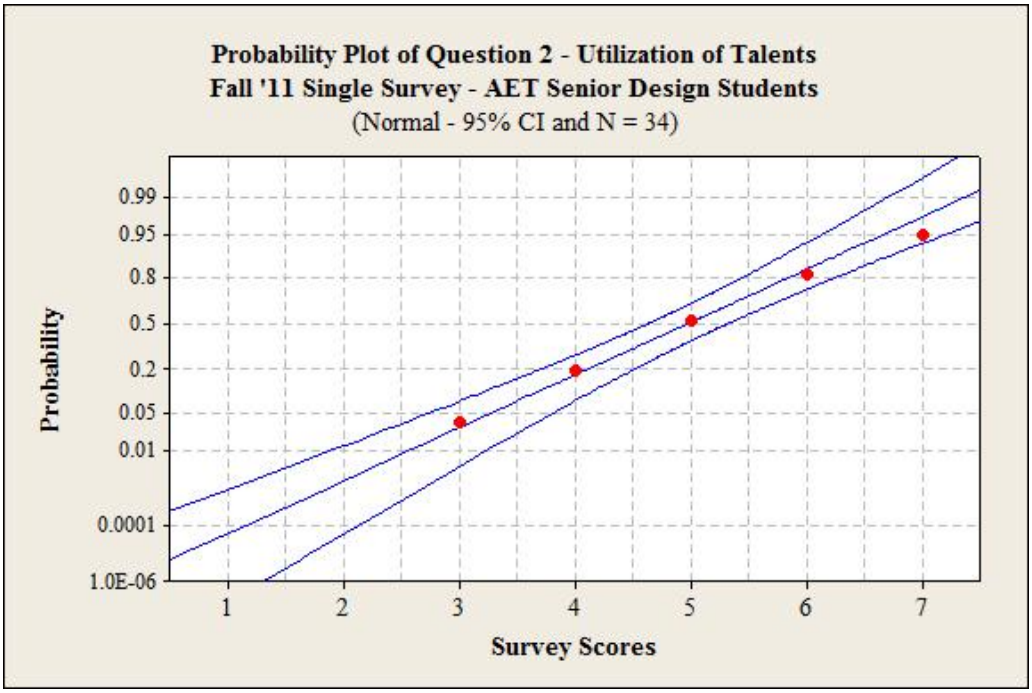


Figure H2. Normal probability plot of Question 2 – Utilization of Talents. AET Senior Design students – Fall ’11 Single Survey.

Appendix H

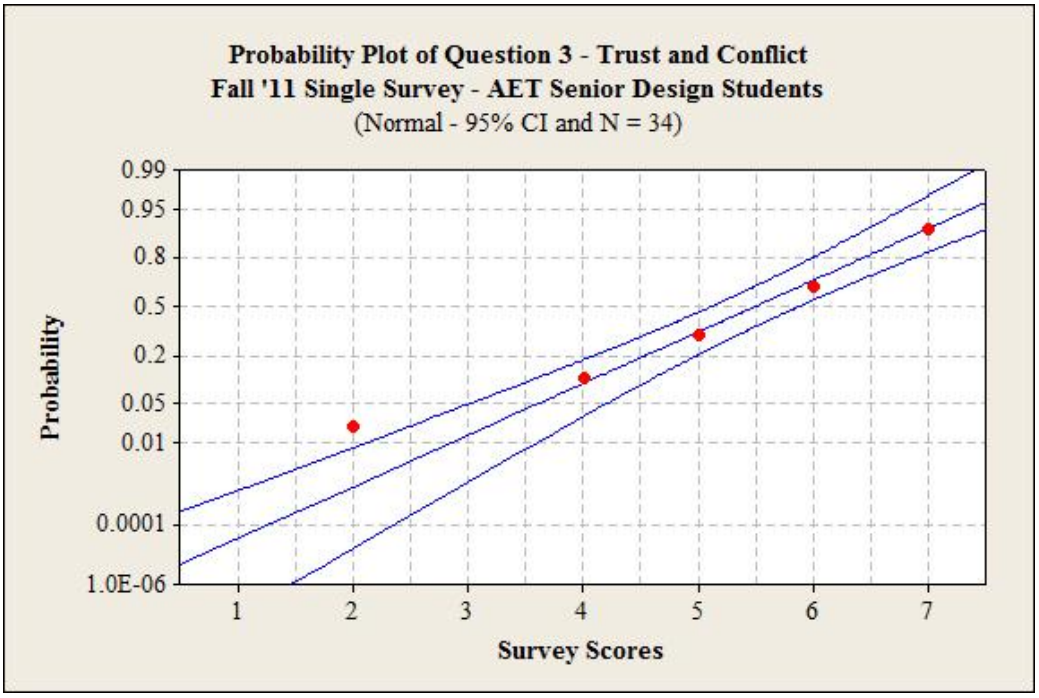


Figure H3. Normal probability plot of Question 3 – Trust and Conflict. AET Senior Design students – Fall ’11 Single Survey.

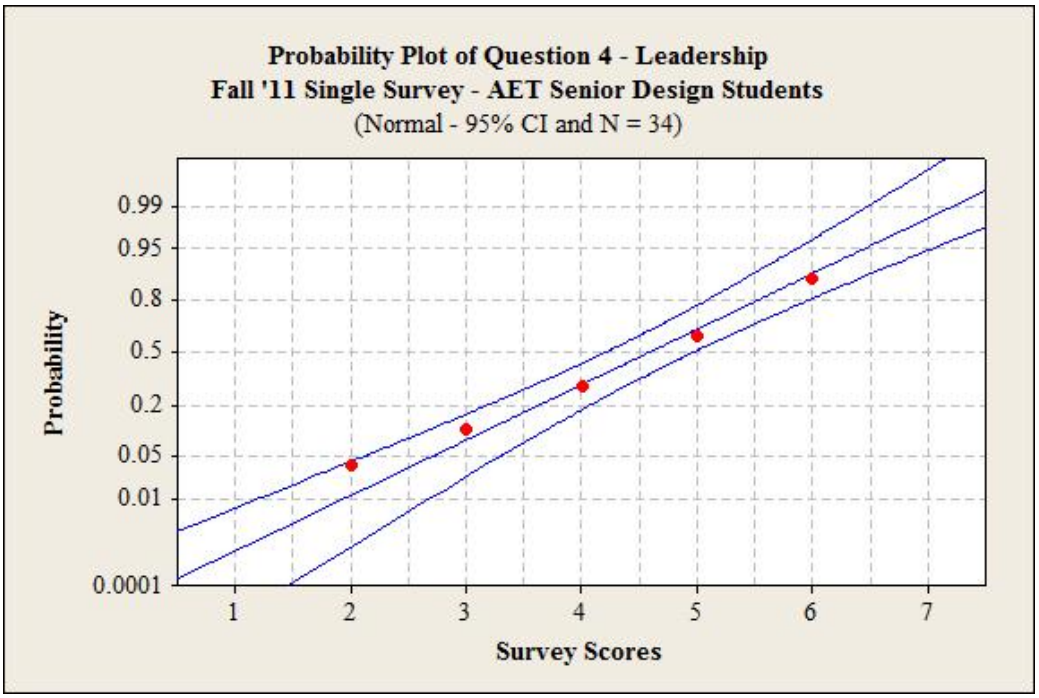


Figure H4. Normal probability plot of Question 4 – Leadership. AET Senior Design students – Fall ’11 Single Survey.

Appendix H

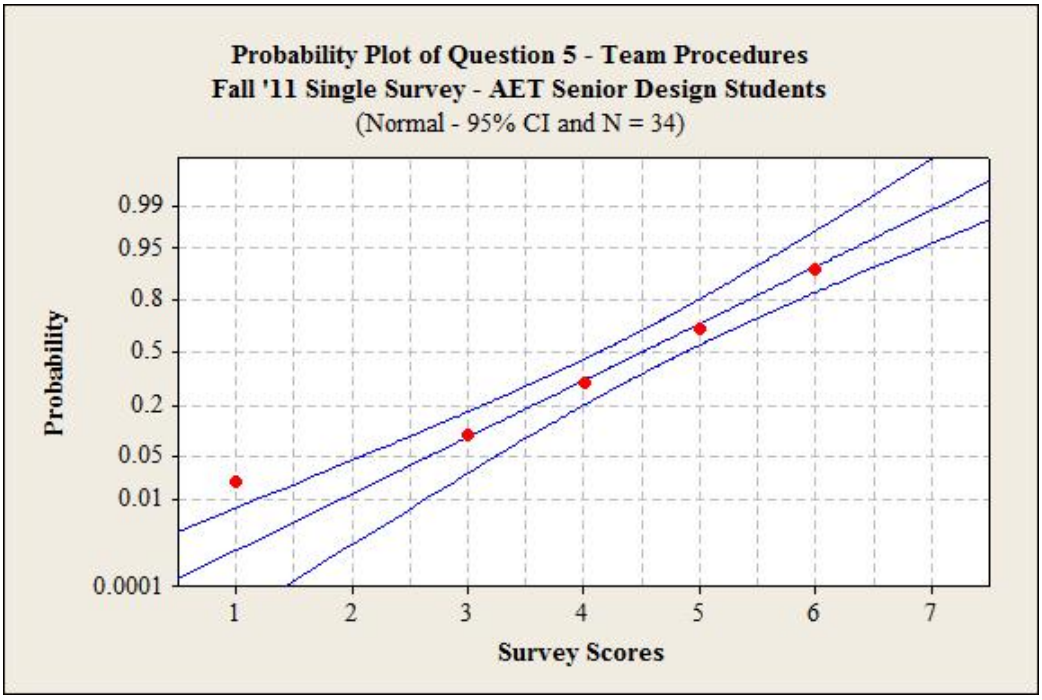


Figure H5. Normal probability plot of Question 5 – Team Procedures. AET Senior Design students – Fall '11 Single Survey.

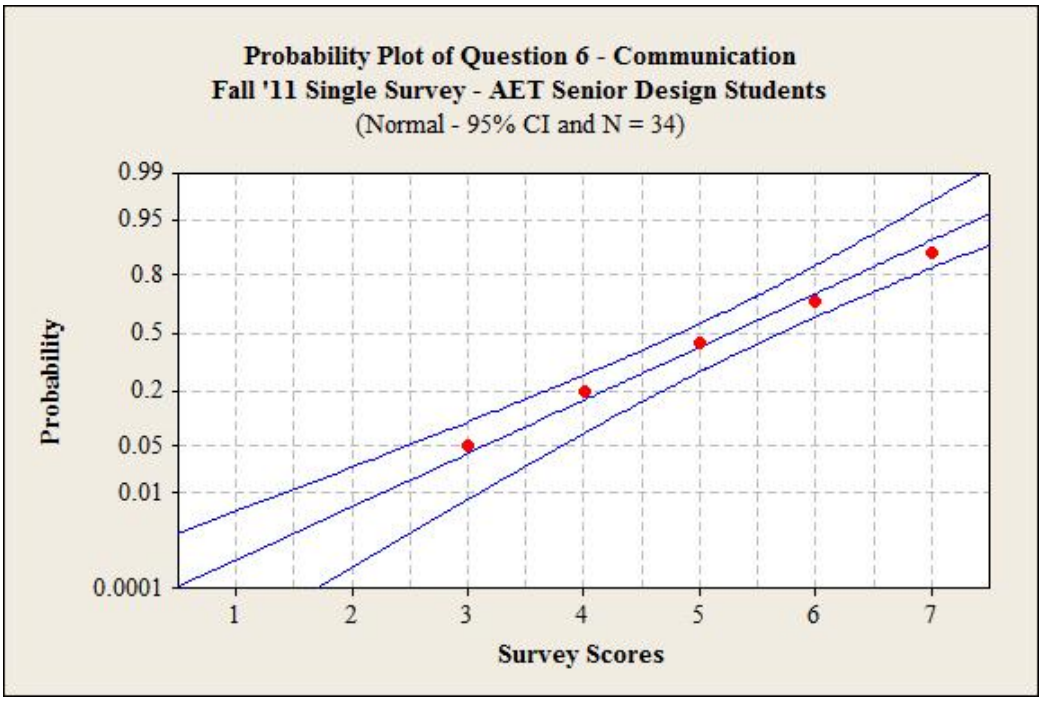


Figure H6. Normal probability plot of Question 6 – Communication. AET Senior Design students – Fall '11 Single Survey.

Appendix H

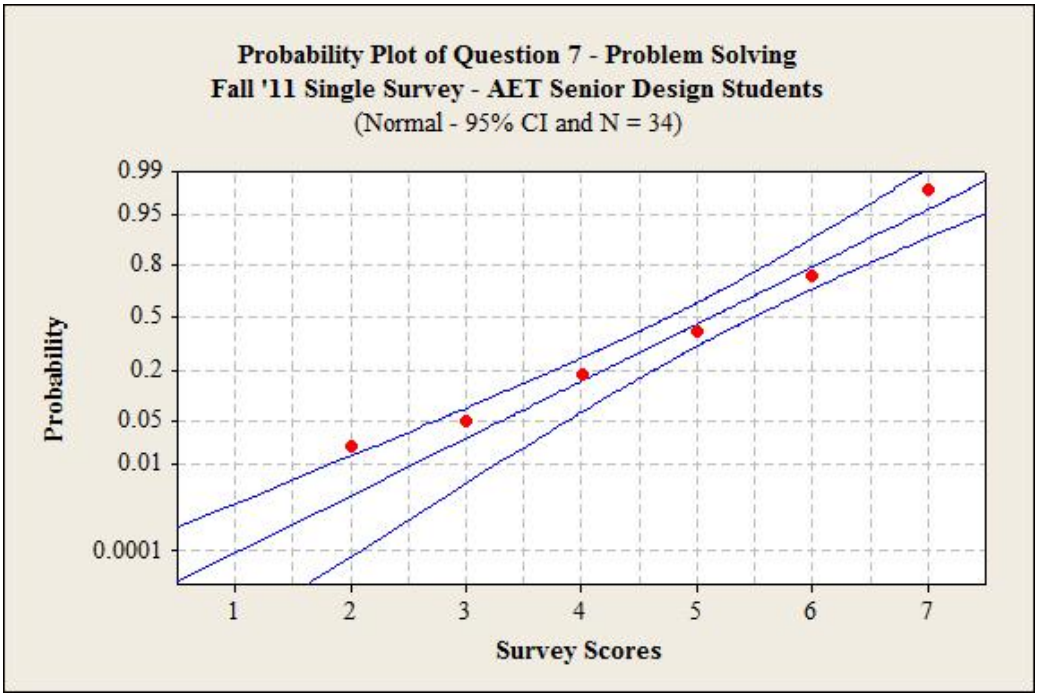


Figure H7. Normal probability plot of Question 7 – Problem Solving. AET Senior Design students – Fall ’11 Single Survey.

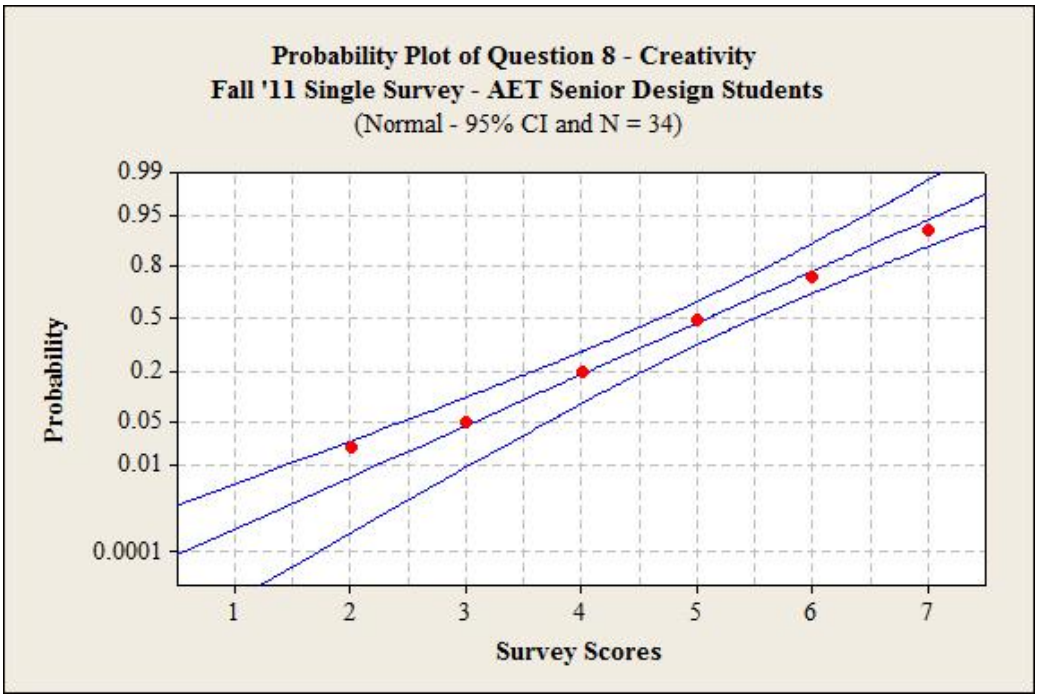


Figure H8. Normal probability plot of Question 8 – Creativity. AET Senior Design students – Fall ’11 Single Survey.

Appendix H

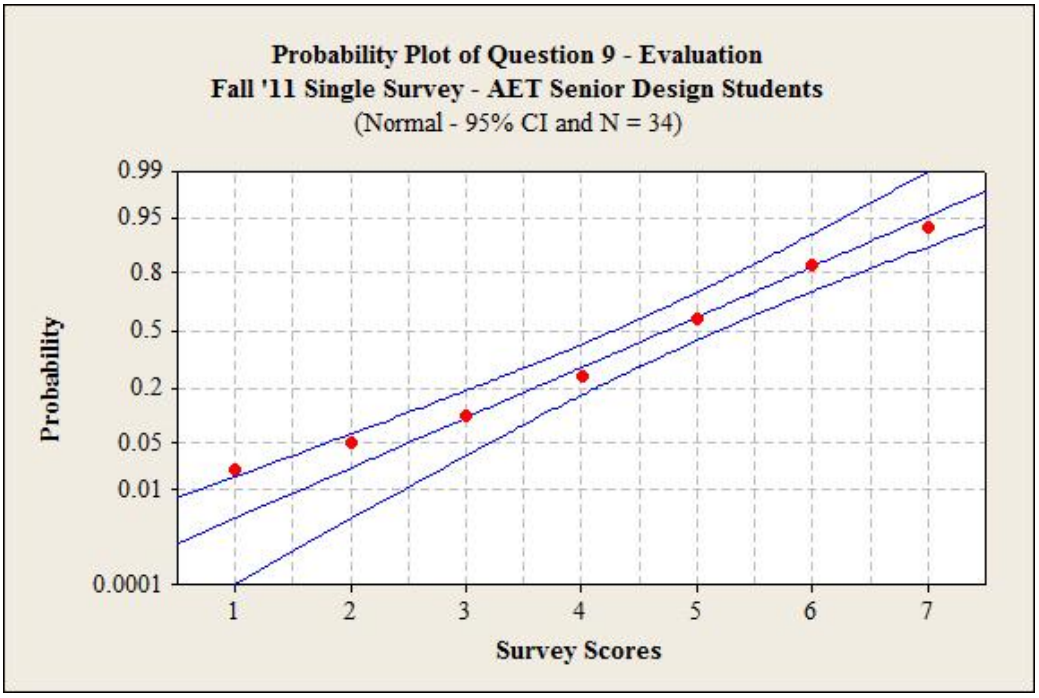


Figure H9. Normal probability plot of Question 9 – Evaluation. AET Senior Design students – Fall ’11 Single Survey.

Appendix H

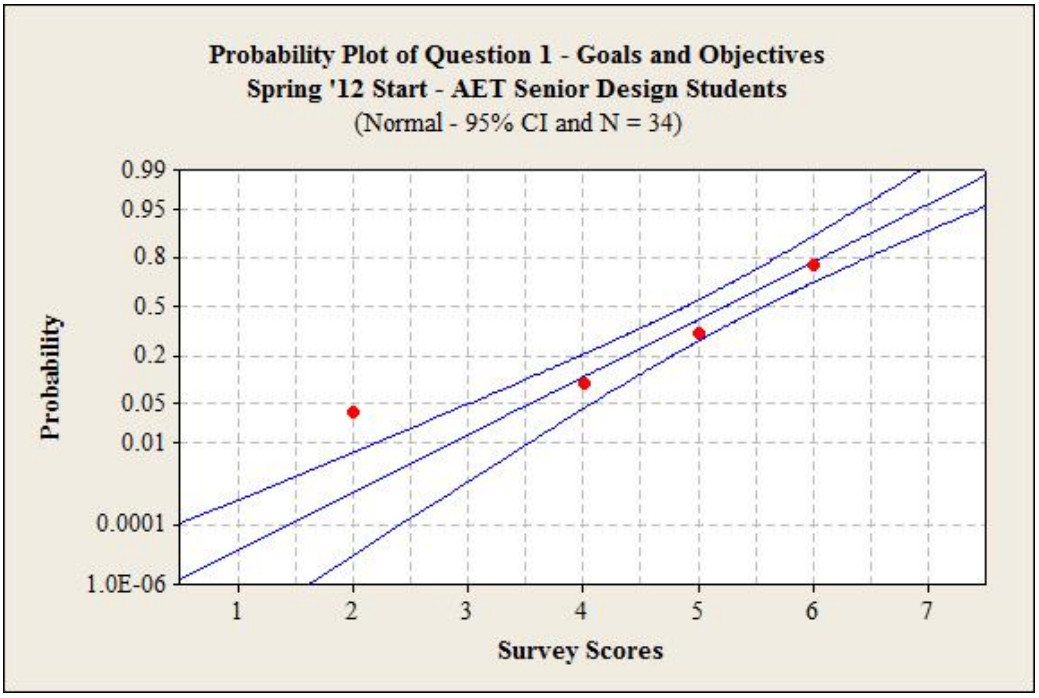


Figure H10. Normal probability plot of Question 1 – Goals and Objectives. AET Senior Design students – Spring '12 - Start.

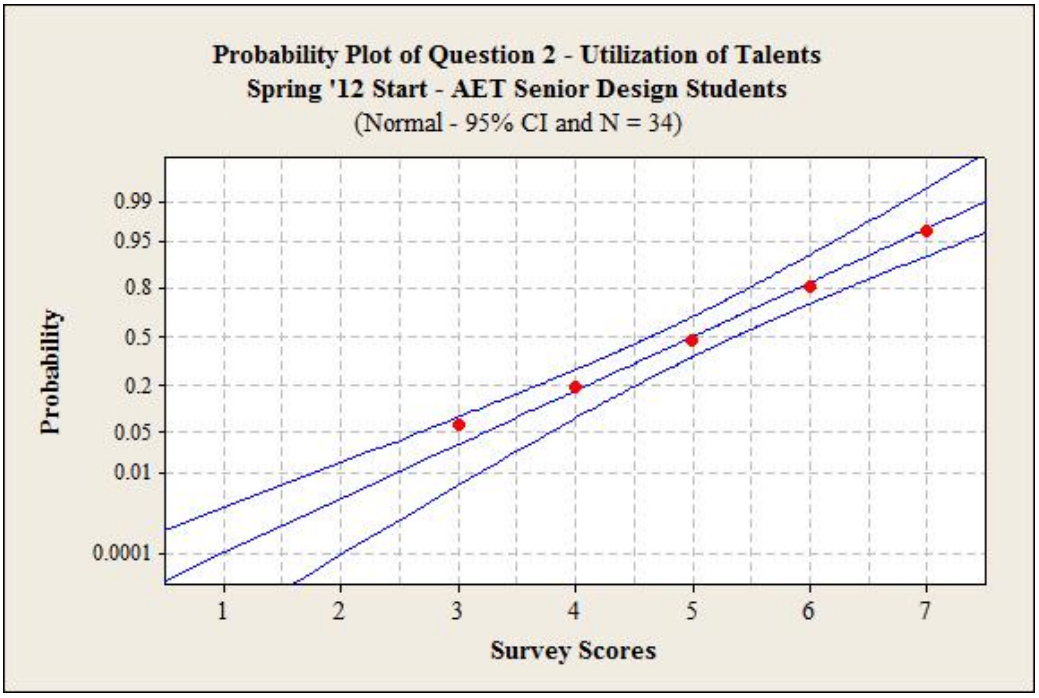


Figure H11. Normal probability plot of Question 2 – Utilization of Talents. AET Senior Design students – Spring '12 - Start.

Appendix H

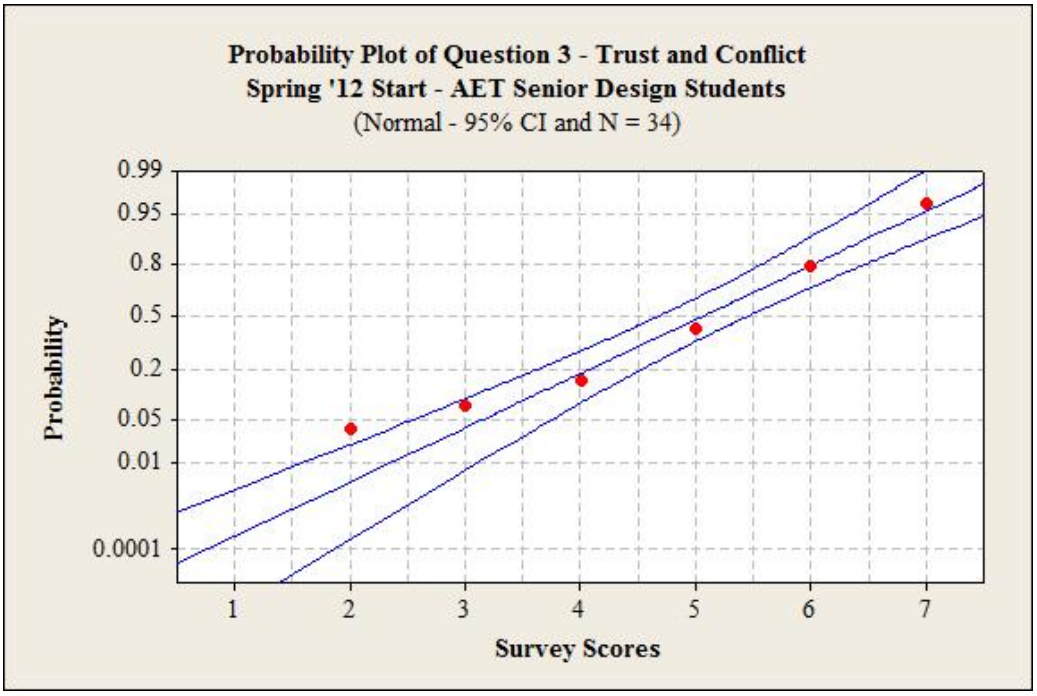


Figure H12. Normal probability plot of Question 3 – Trust and Conflict. AET Senior Design students – Spring '12 - Start.

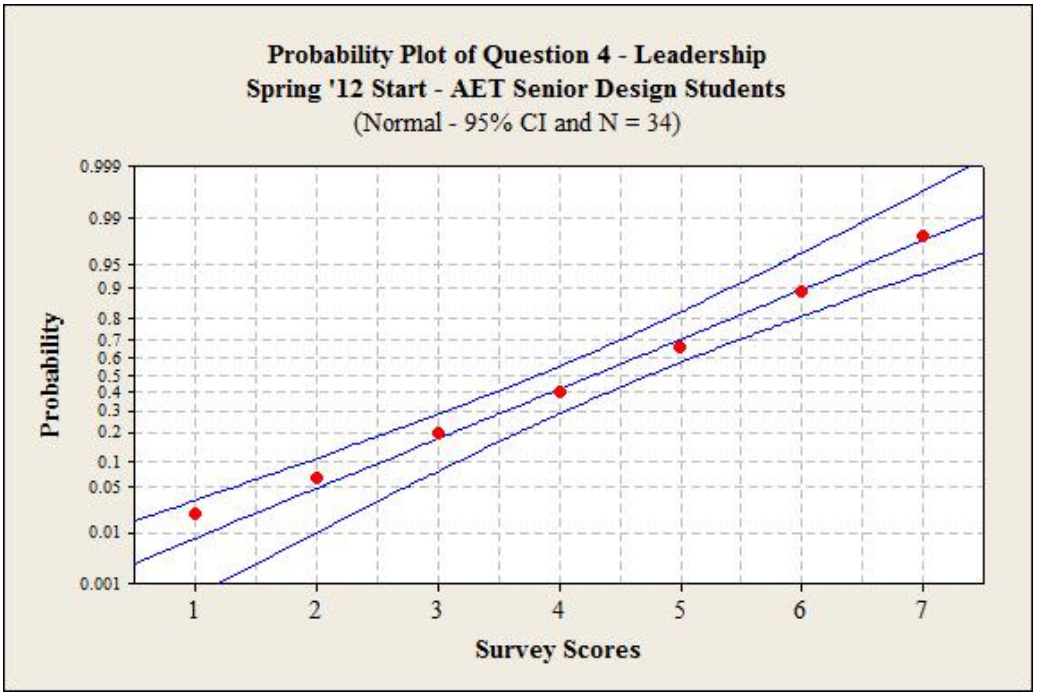


Figure H13. Normal probability plot of Question 4 – Leadership. AET Senior Design students – Spring '12 - Start.

Appendix H

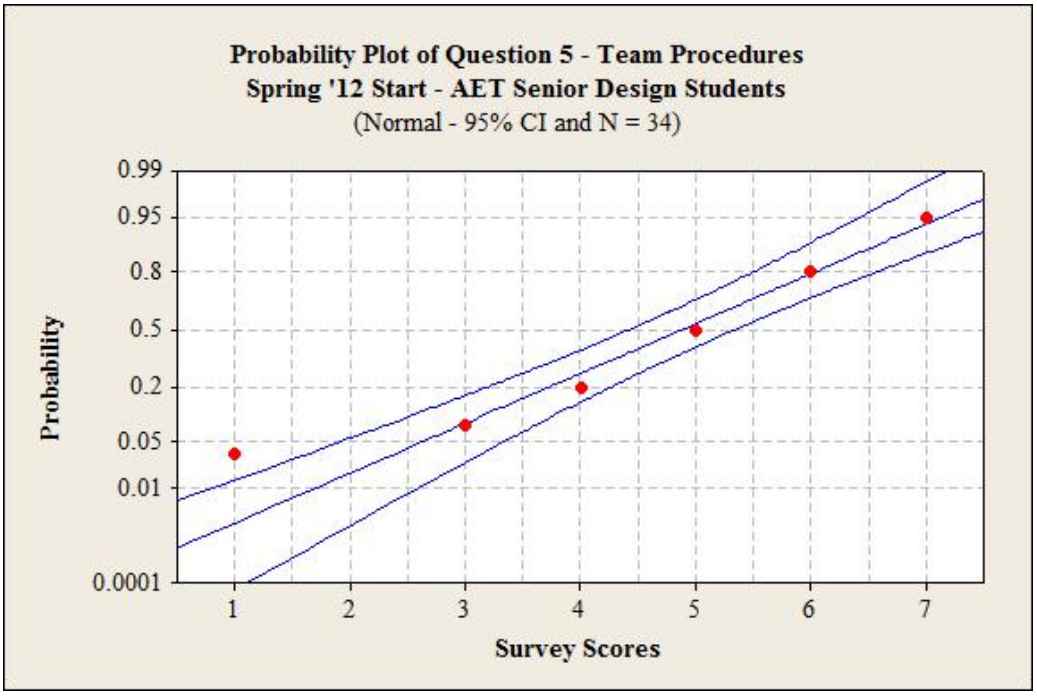


Figure H14. Normal probability plot of Question 5 – Team Procedures. AET Senior Design students – Spring '12 - Start.

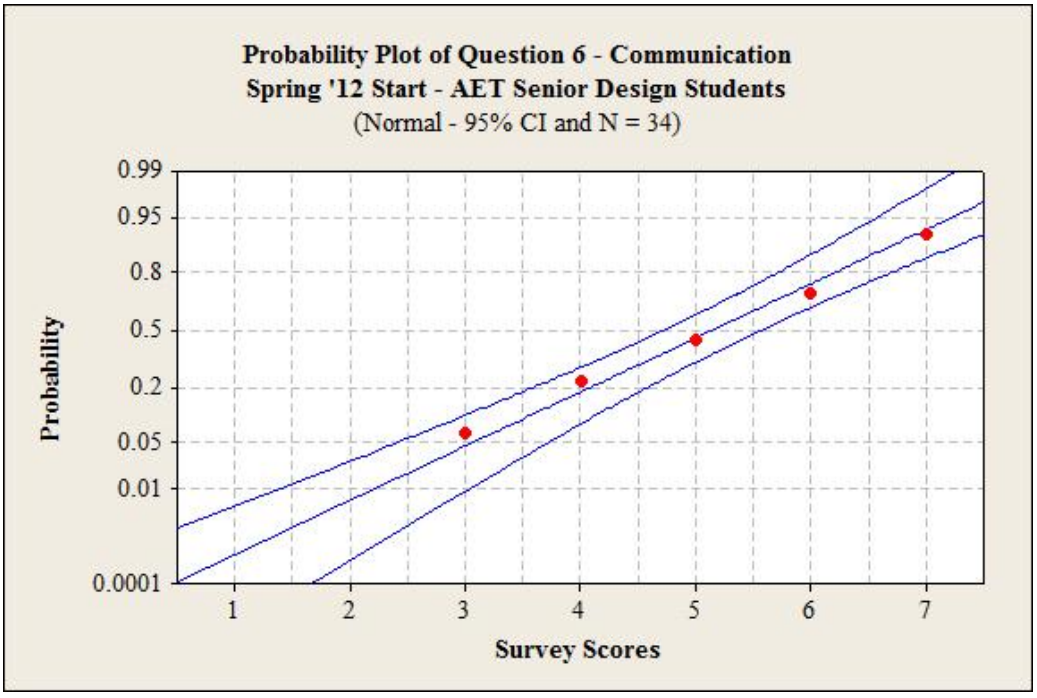


Figure H15. Normal probability plot of Question 7 – Problem Solving. AET Senior Design students – Spring '12 - Start.

Appendix H

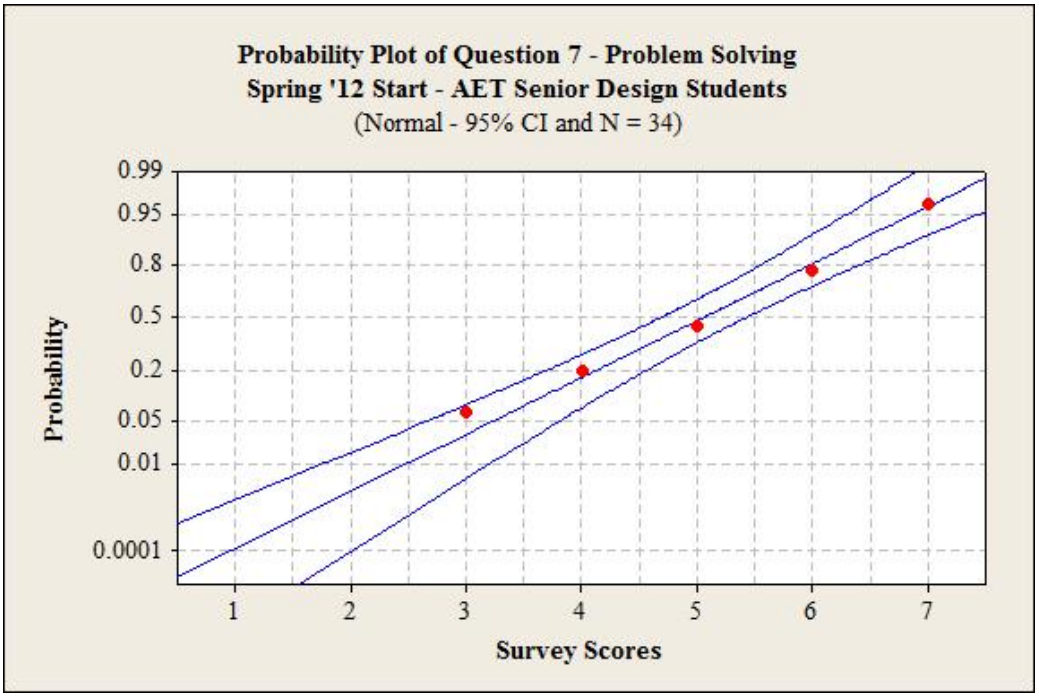


Figure H16. Normal probability plot of Question 7 – Problem Solving. AET Senior Design students – Spring '12 - Start.

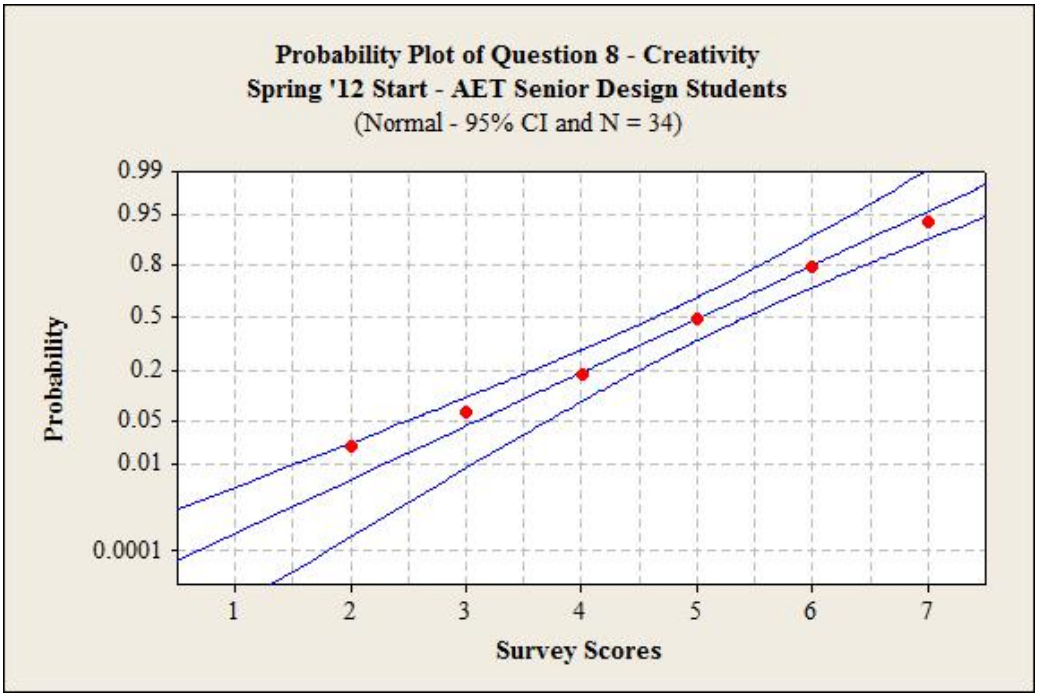


Figure H17. Normal probability plot of Question 8 – Creativity. AET Senior Design students – Spring '12 - Start.

Appendix H

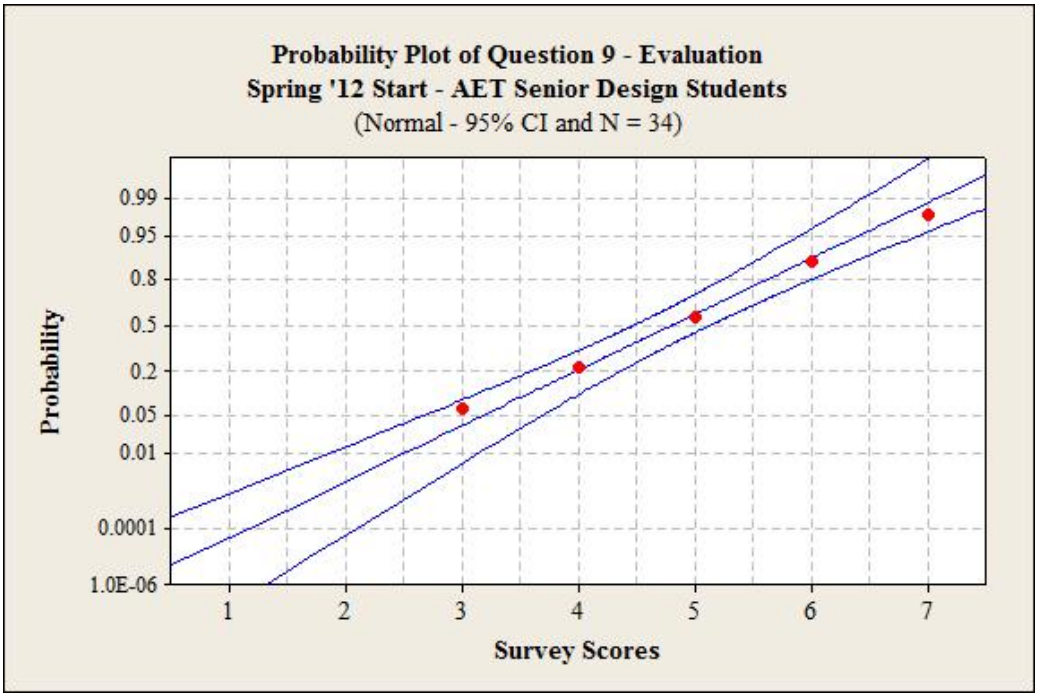


Figure H18. Normal probability plot of Question 9 – Evaluation. AET Senior Design students – Spring ‘12 - Start.

Appendix H

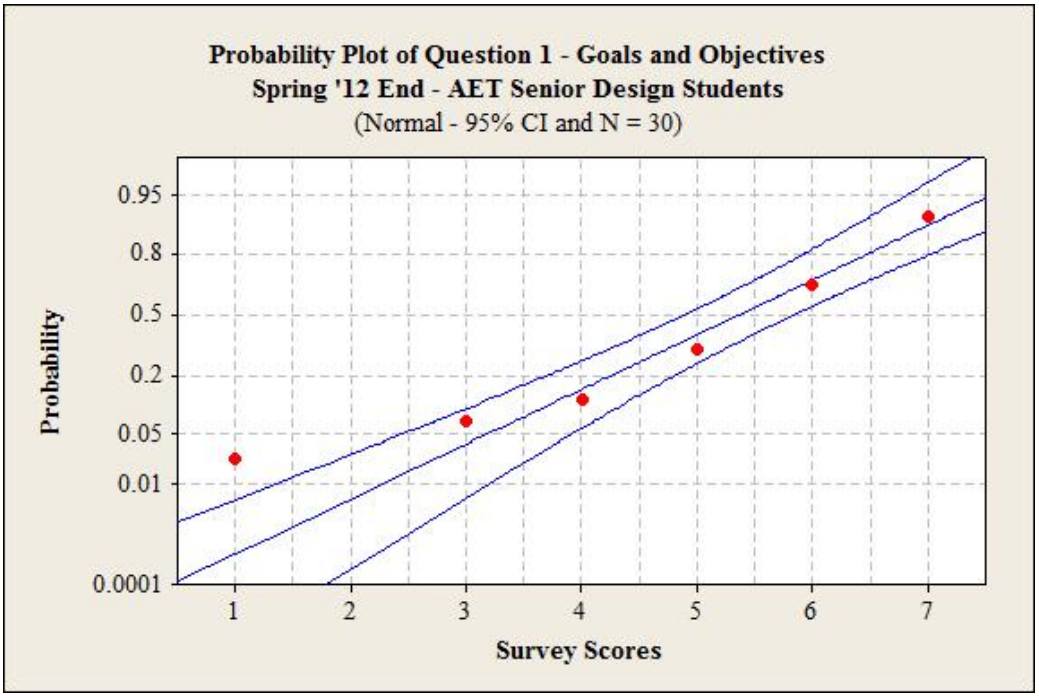


Figure H19. Normal probability plot of Question 1 – Goals and Objectives. AET Senior Design students – Spring '12 - End.

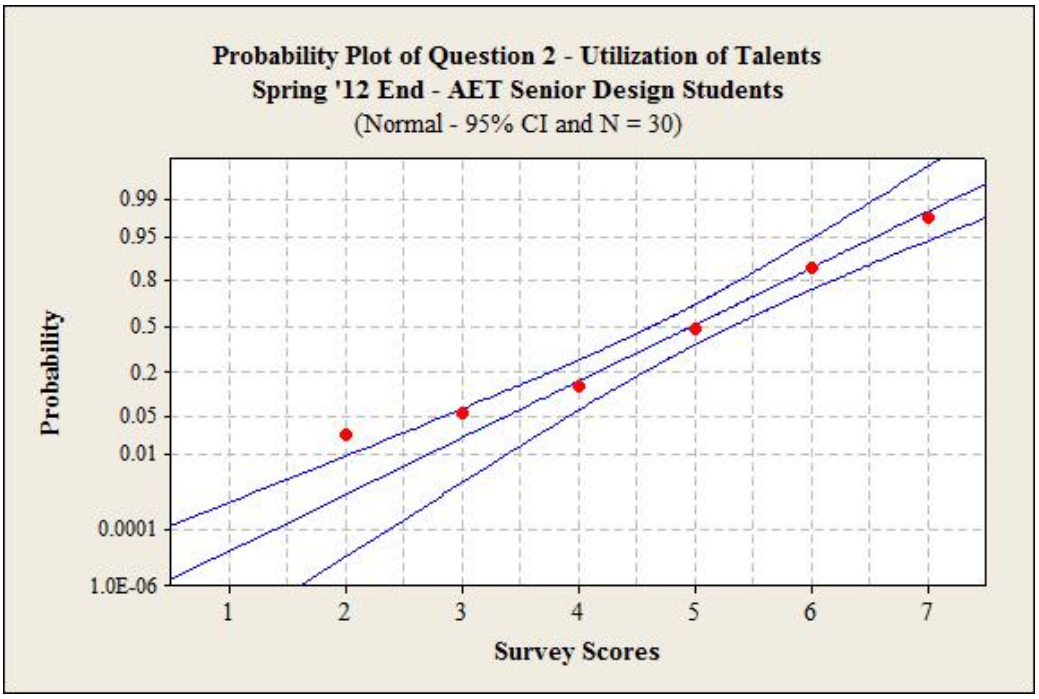


Figure H20. Normal probability plot of Question 2 – Utilization of Talents. AET Senior Design students – Spring '12 - End.

Appendix H

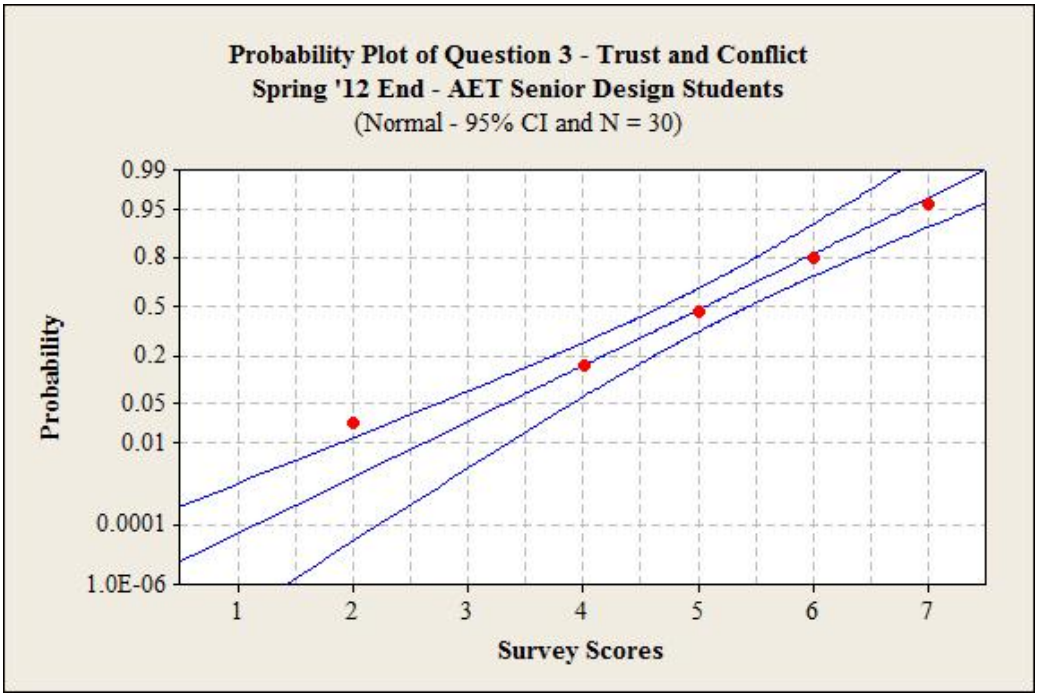


Figure H21. Normal probability plot of Question 3 – Trust and Conflict. AET Senior Design students – Spring '12 - End.

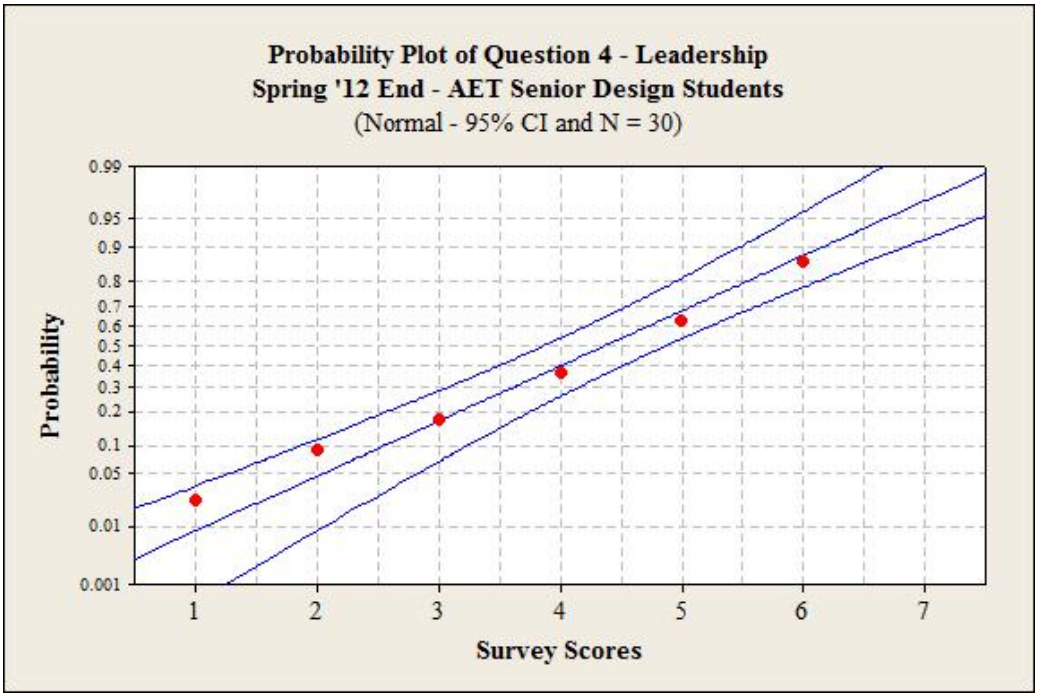


Figure H22. Normal probability plot of Question 4 – Leadership. AET Senior Design students – Spring '12 - End.

Appendix H

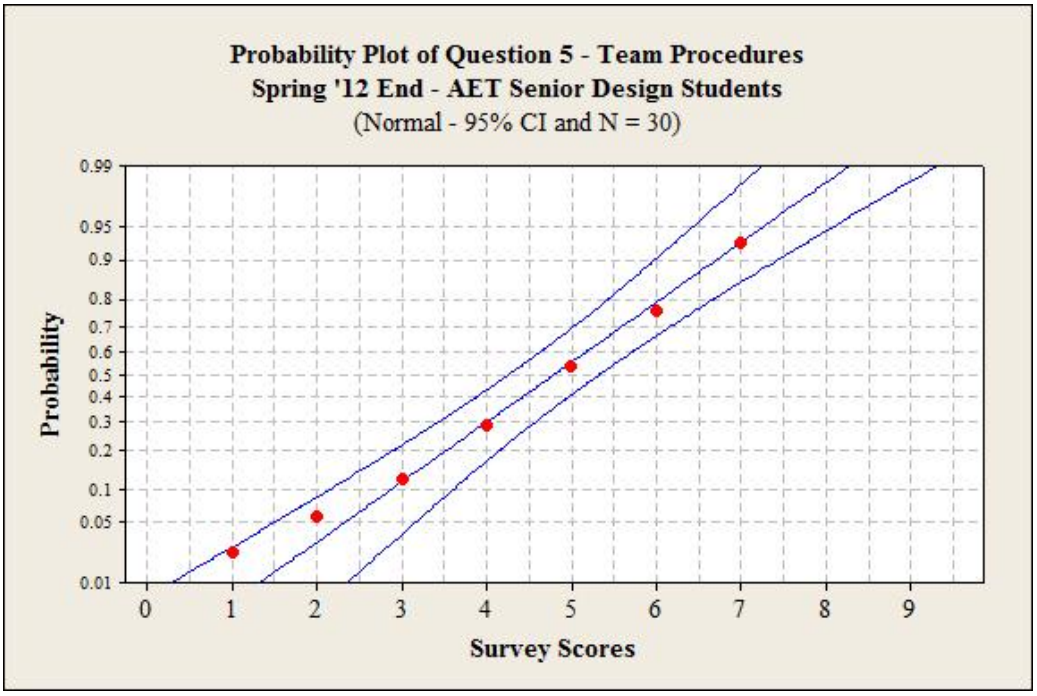


Figure H23. Normal probability plot of Question 5 – Team Procedures. AET Senior Design students – Spring '12 - End.

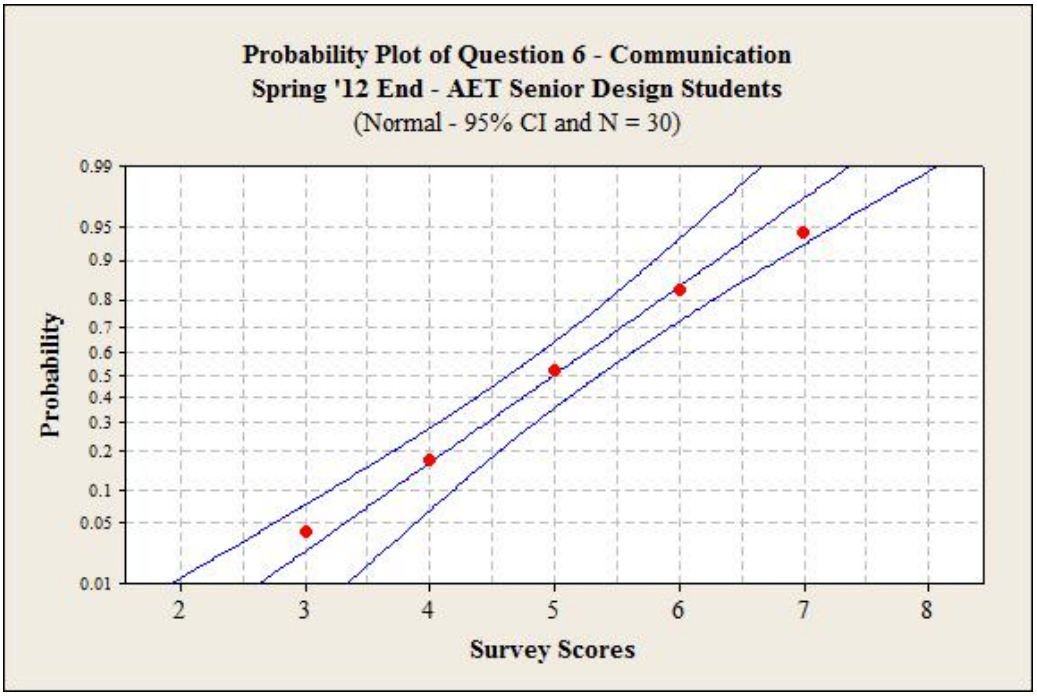


Figure H24. Normal probability plot of Question 6 – Communication. AET Senior Design students – Spring '12 - End.

Appendix H

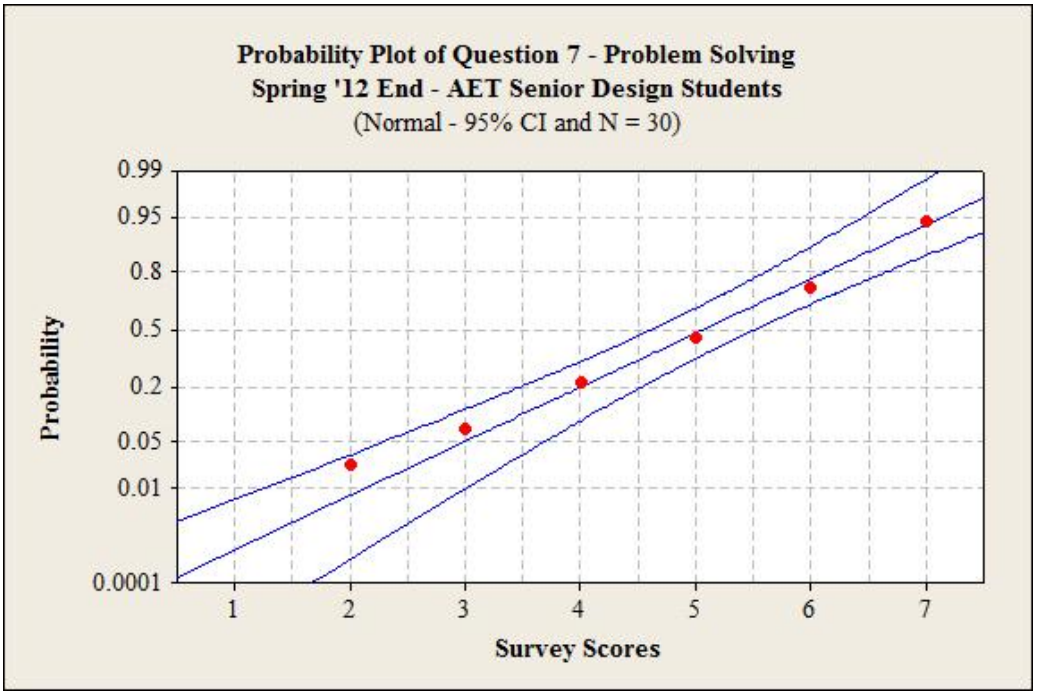


Figure H25. Normal probability plot of Question 7 – Problem Solving. AET Senior Design students – Spring '12 - End.

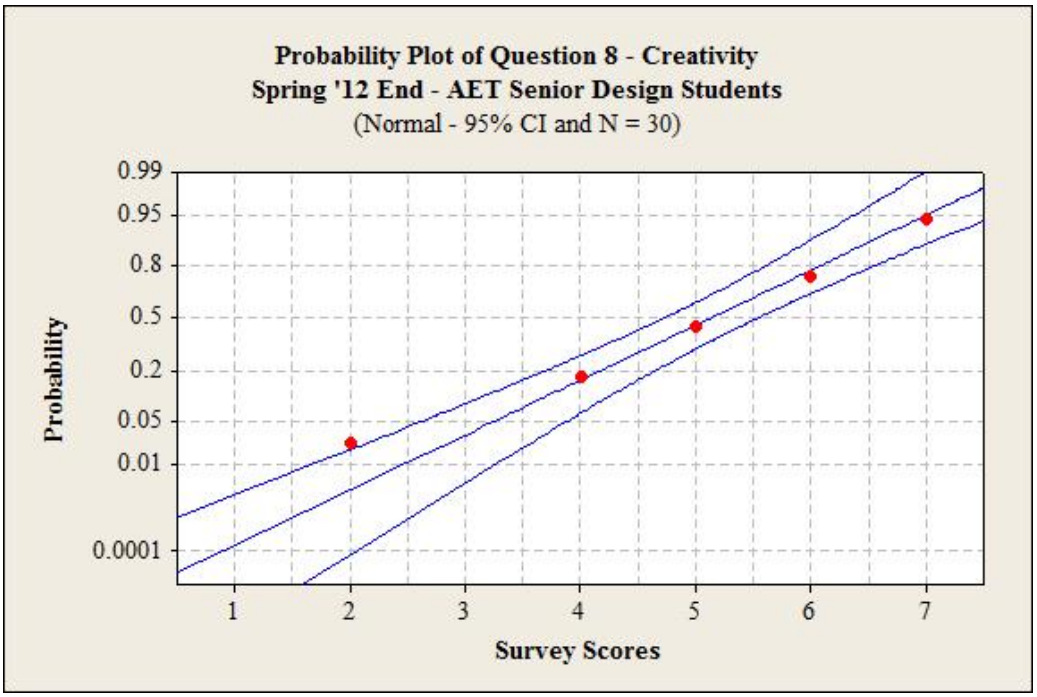


Figure H26. Normal probability plot of Question 8 – Creativity. AET Senior Design students – Spring '12 - End.

Appendix H

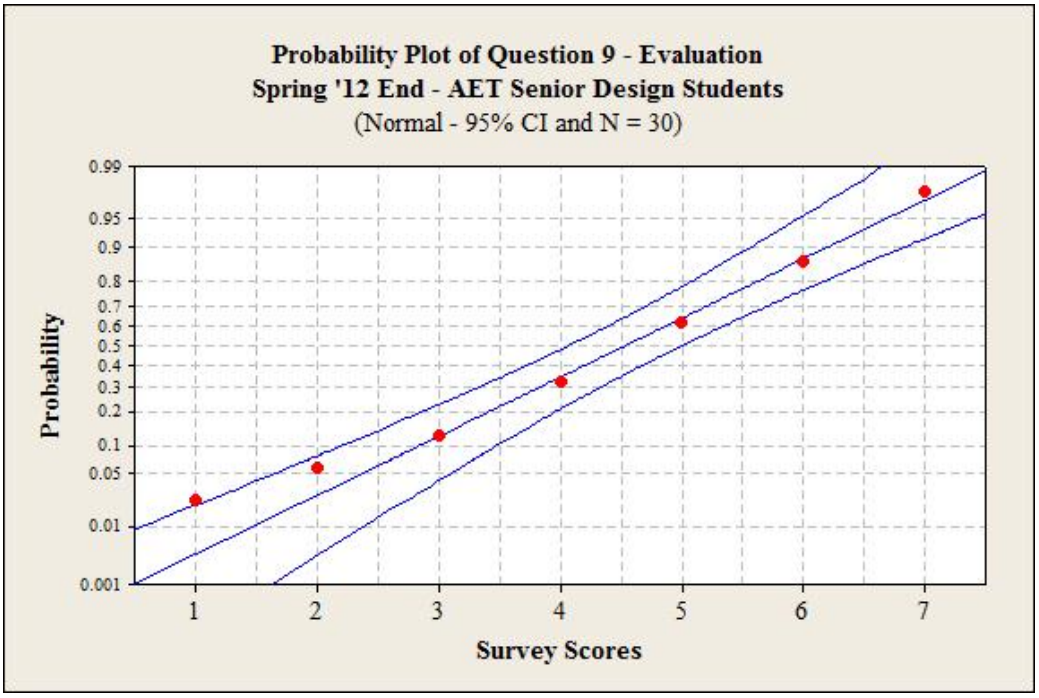


Figure H27. Normal probability plot of Question 9 – Evaluation. AET Senior Design students – Spring ‘12 - End.

Appendix H

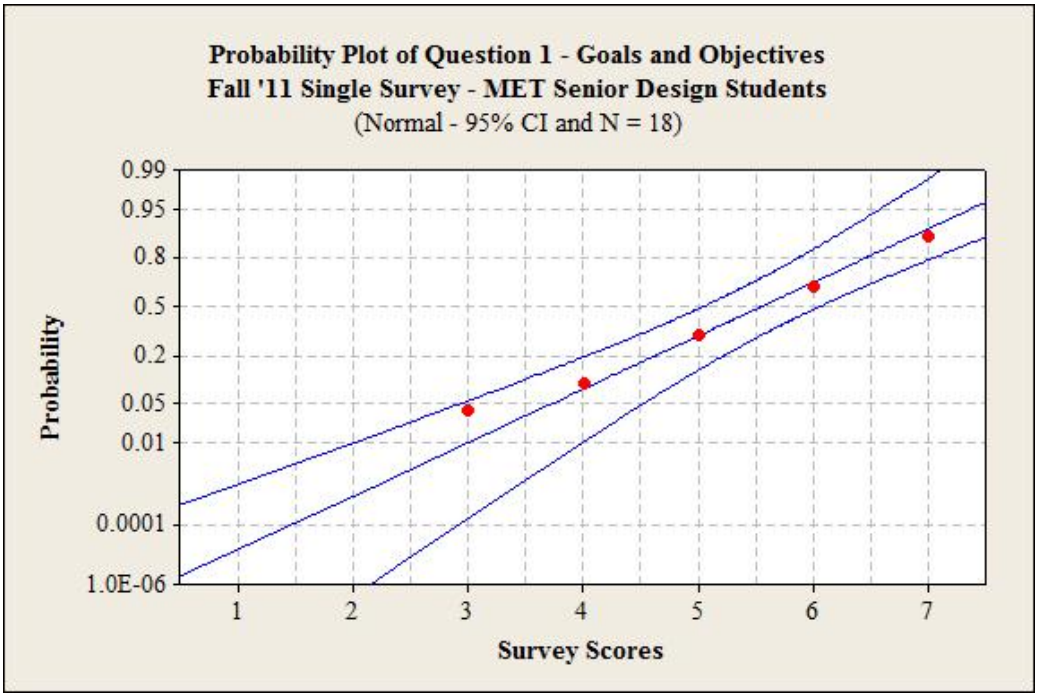


Figure H28. Normal probability plot of Question 1 – Goals and Objectives. MET Senior Design students – Fall ’11 Single Survey.

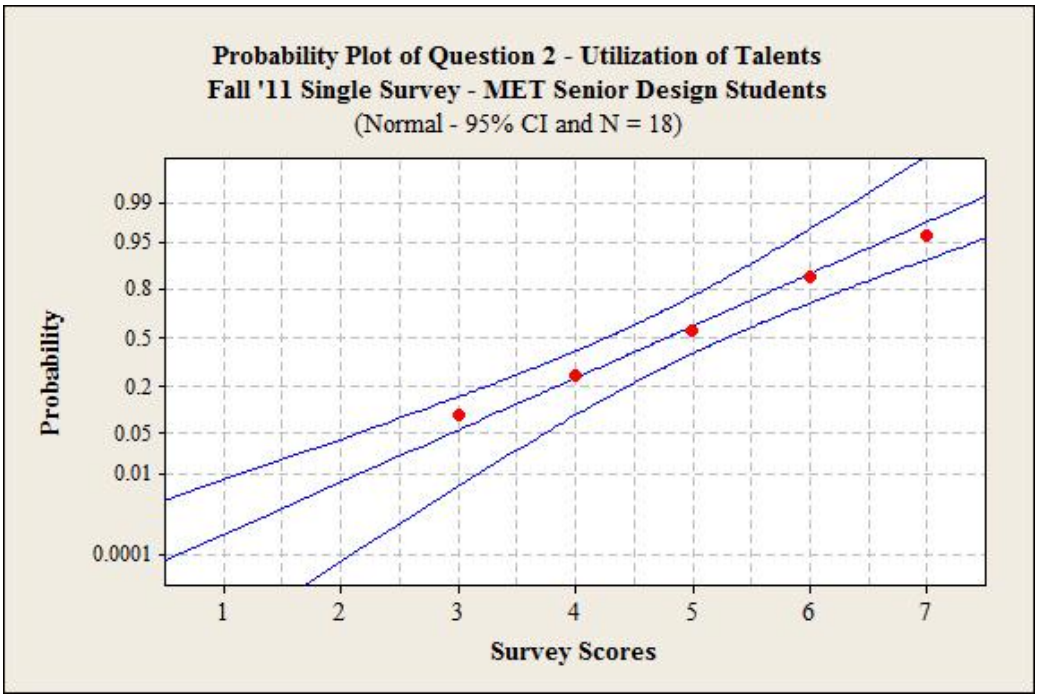


Figure H29. Normal probability plot of Question 2 – Utilization of Talents. MET Senior Design students – Fall ’11 Single Survey.

Appendix H

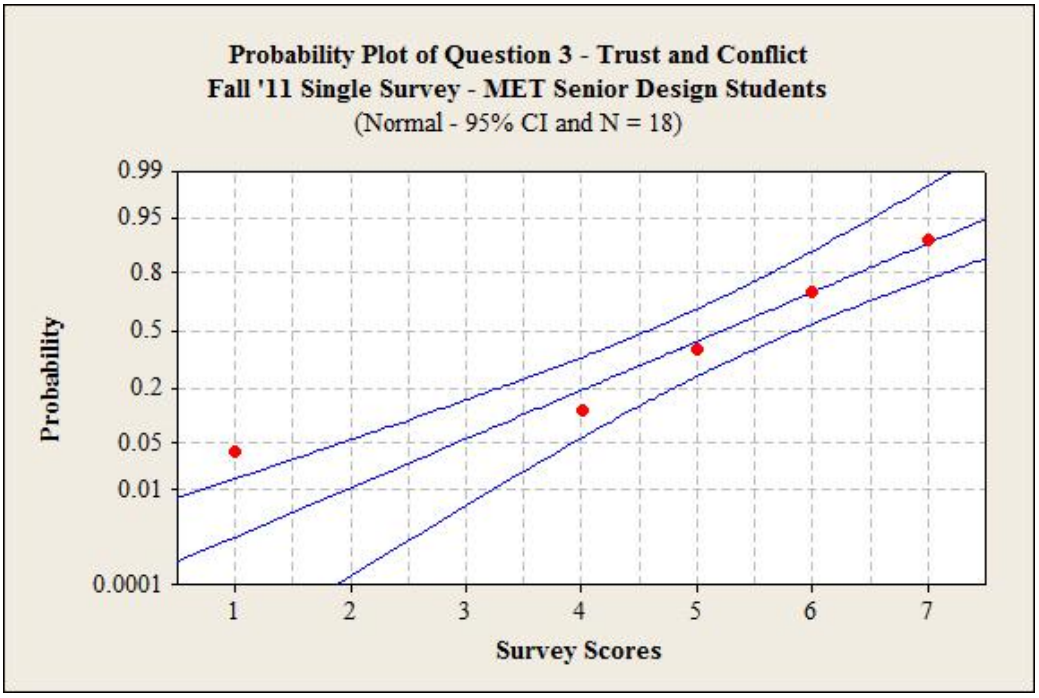


Figure H30. Normal probability plot of Question 3 – Trust and Conflict. MET Senior Design students – Fall ’11 Single Survey.

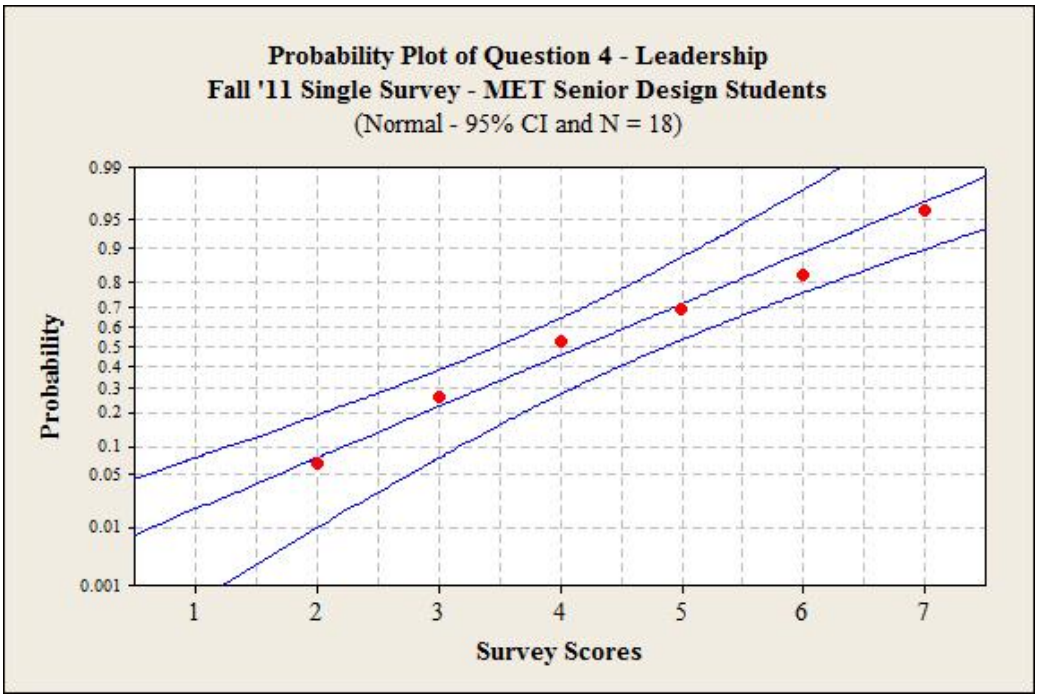


Figure H31. Normal probability plot of Question 4 – Leadership. MET Senior Design students – Fall ’11 Single Survey.

Appendix H

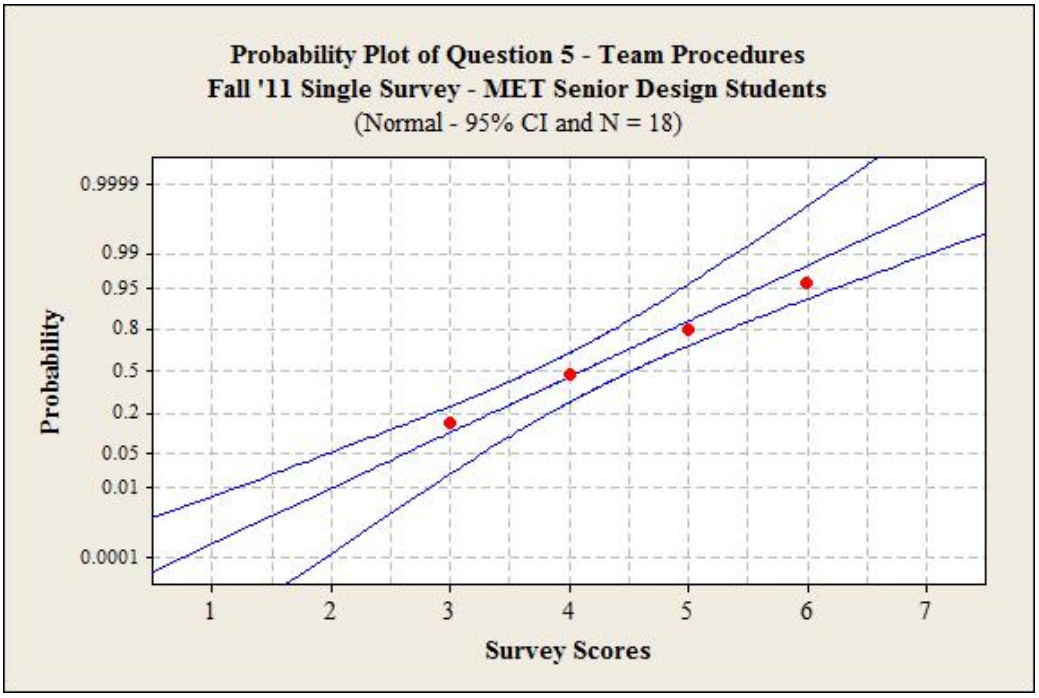


Figure H32. Normal probability plot of Question 5 – Team Procedures. MET Senior Design students – Fall ’11 Single Survey.

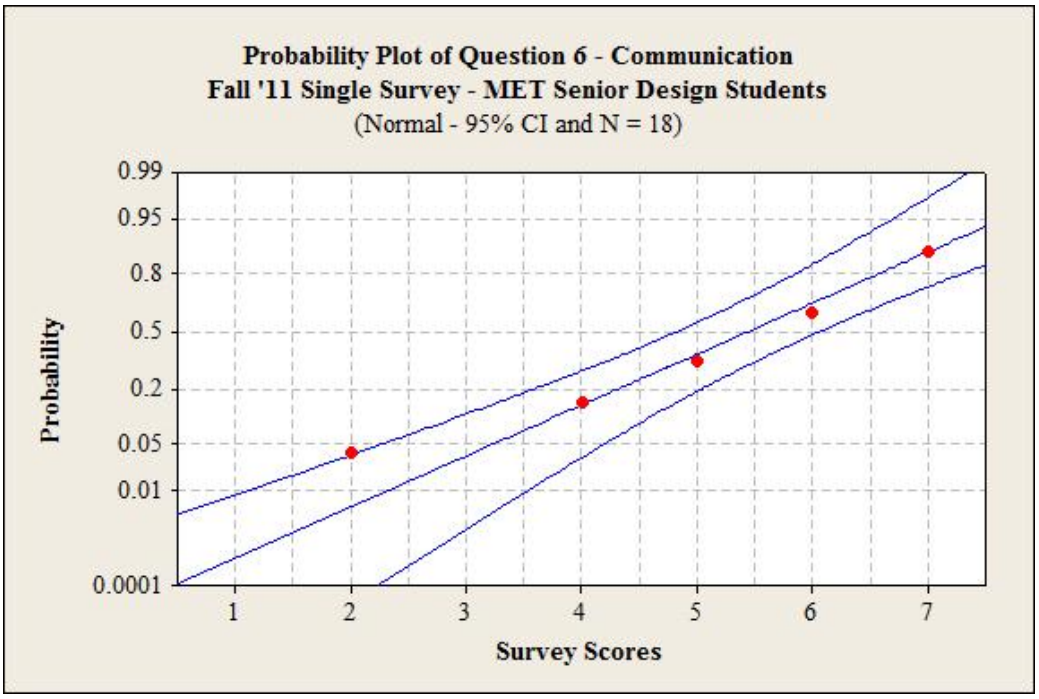


Figure H33. Normal probability plot of Question 6 – Communication. MET Senior Design students – Fall ’11 Single Survey.

Appendix H

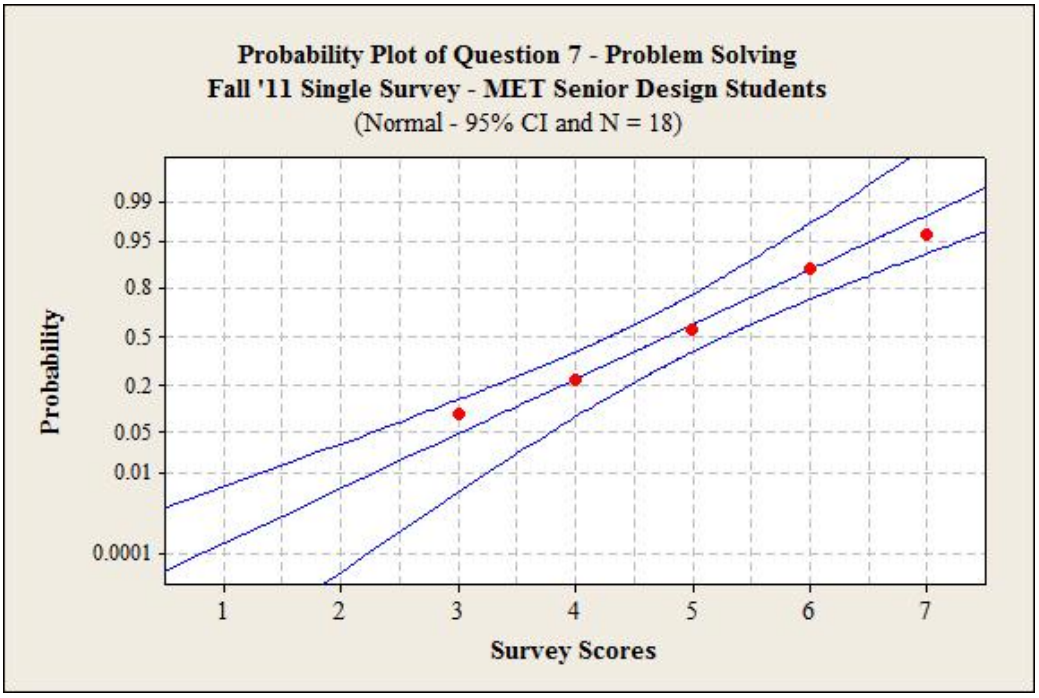


Figure H34. Normal probability plot of Question 7 – Problem Solving. MET Senior Design students – Fall ’11 Single Survey.

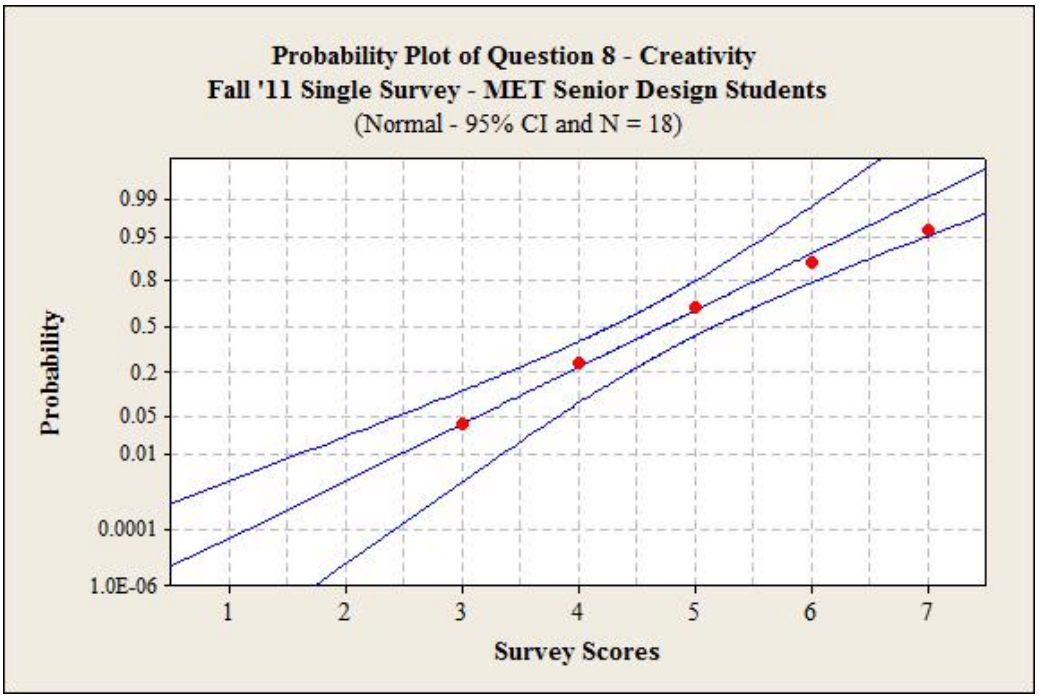


Figure H35. Normal probability plot of Question 8 – Creativity. MET Senior Design students – Fall ’11 Single Survey.

Appendix H

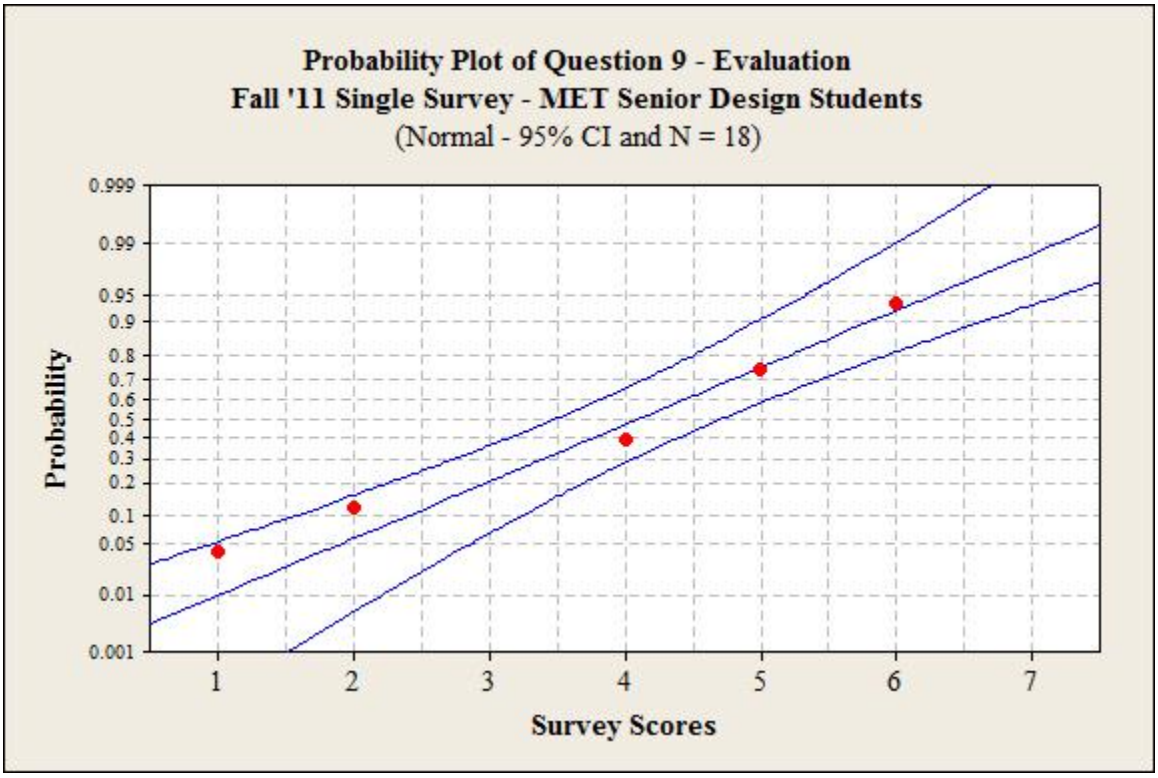


Figure H36. Normal probability plot of Question 9 – Evaluation. MET Senior Design students – Fall ’11 Single Survey.

Appendix H

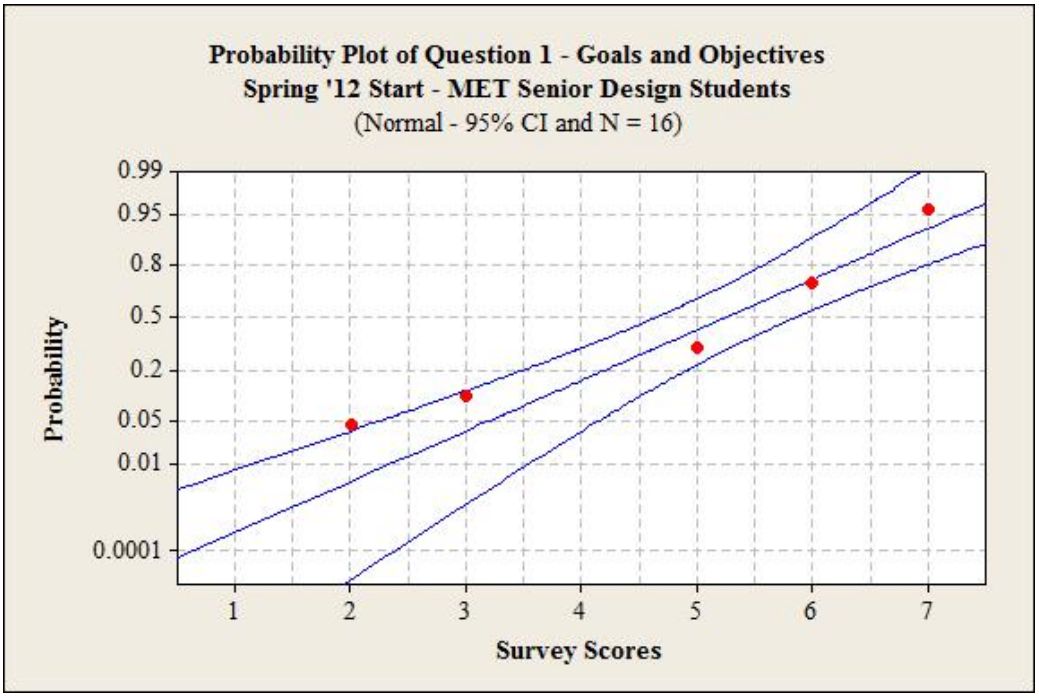


Figure H37. Normal probability plot of Question 1 – Goals and Objectives. MET Senior Design students – Spring '12 - Start.

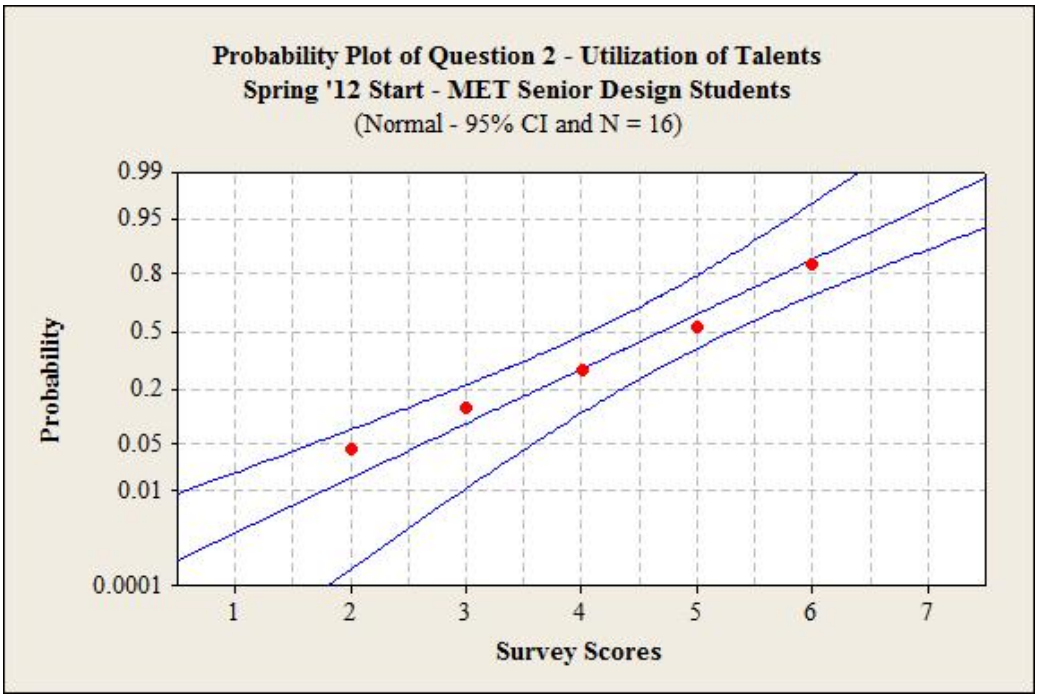


Figure H47. Normal probability plot of Question 2 – Utilization of Talents. MET Senior Design students – Spring '12 - Start.

Appendix H

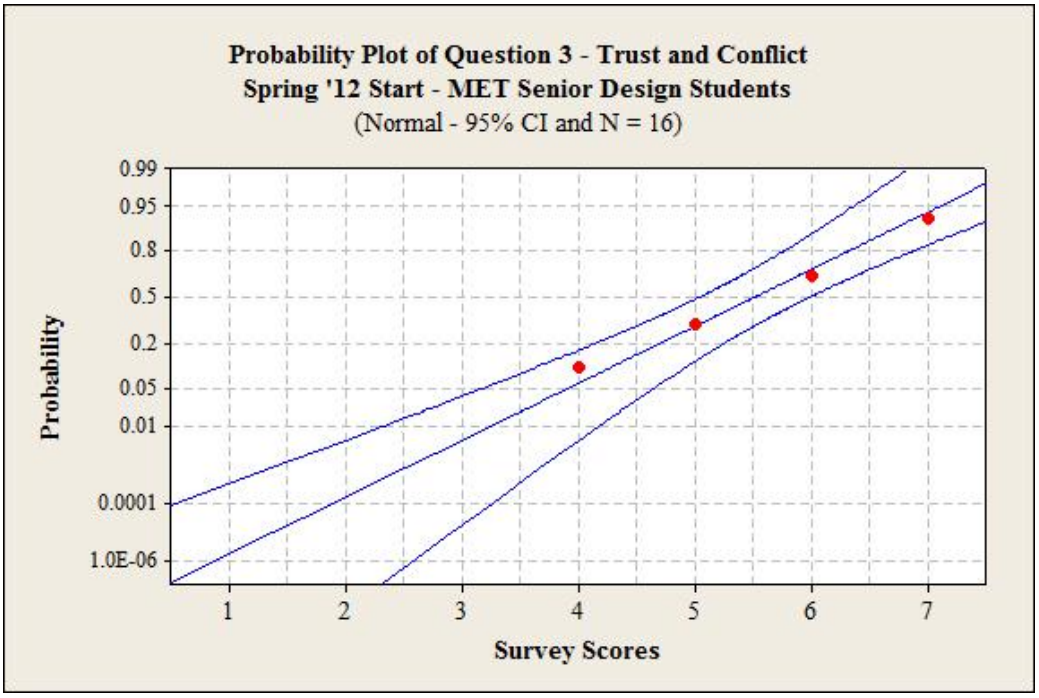


Figure H39. Normal probability plot of Question 3 – Trust and Conflict. MET Senior Design students – Spring '12 - Start.

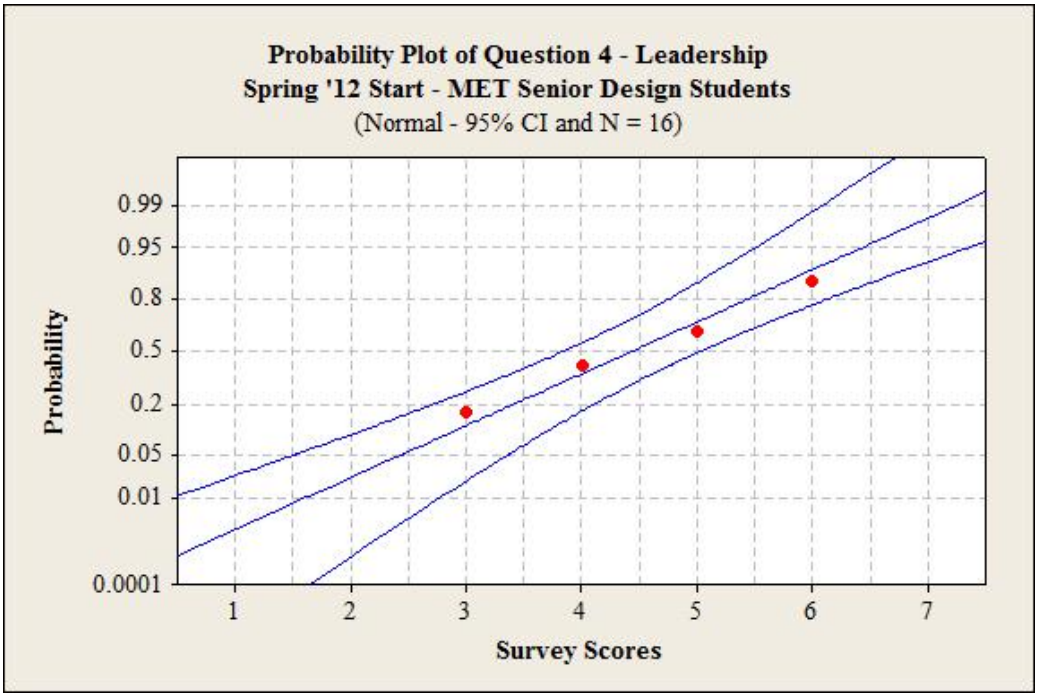


Figure H40. Normal probability plot of Question 4 – Leadership. MET Senior Design students – Spring '12 - Start.

Appendix H

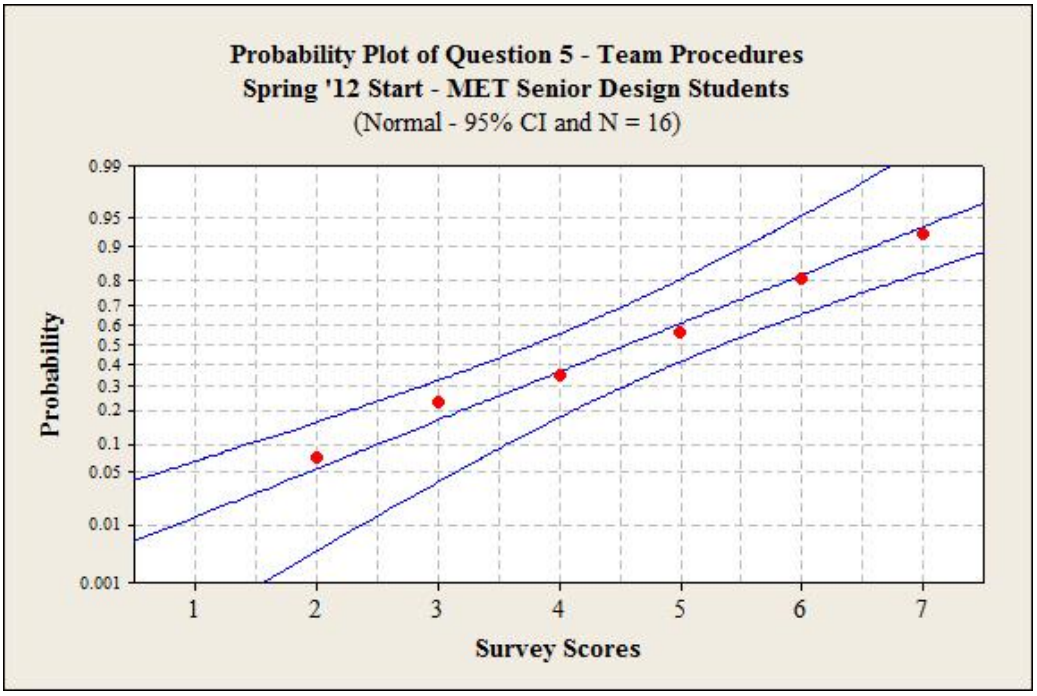


Figure H41. Normal probability plot of Question 5 – Team Procedures. MET Senior Design students – Spring '12 - Start.

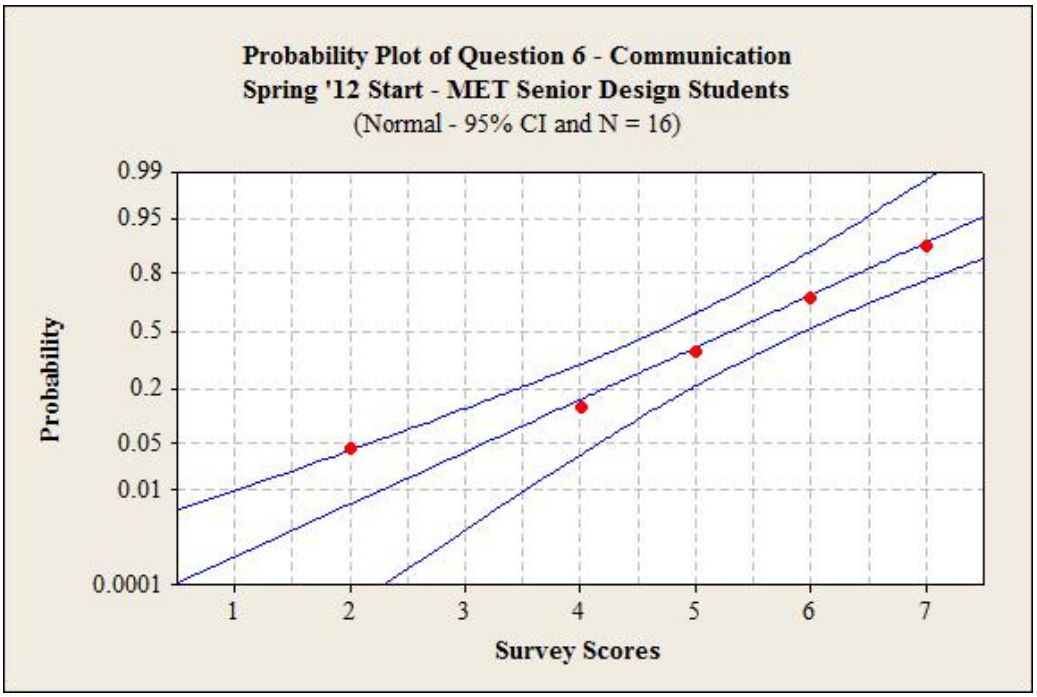


Figure H42. Normal probability plot of Question 6 – Communication. MET Senior Design students – Spring '12 - Start.

Appendix H

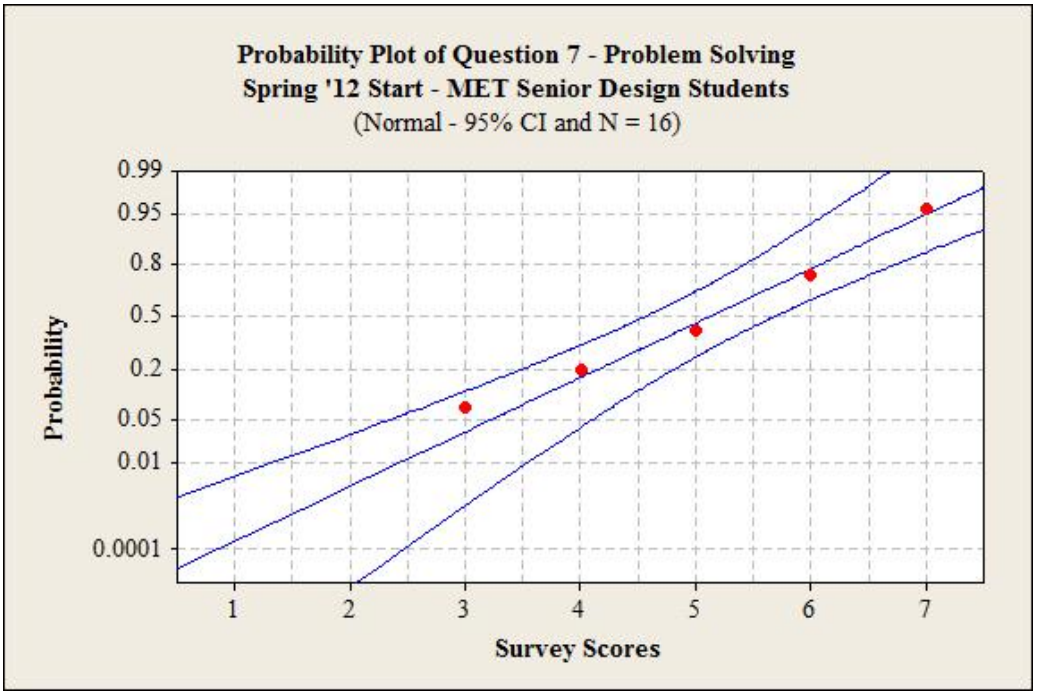


Figure H43. Normal probability plot of Question 7 – Problem Solving. MET Senior Design students – Spring '12 - Start.

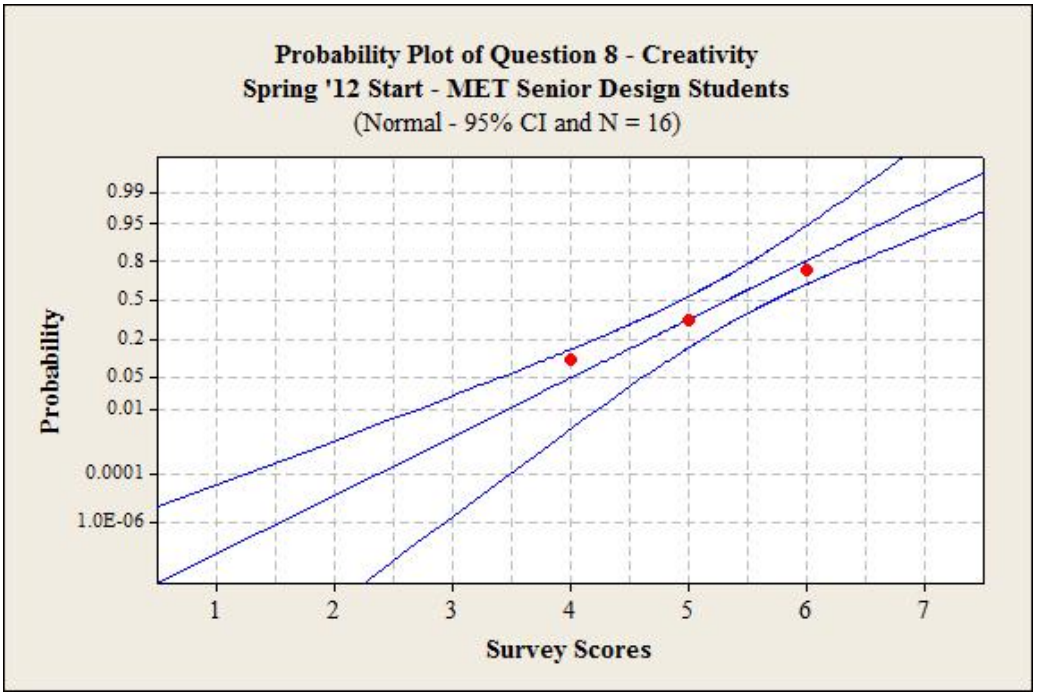


Figure H44. Normal probability plot of Question 8 – Creativity. MET Senior Design students – Spring '12 - Start.

Appendix H

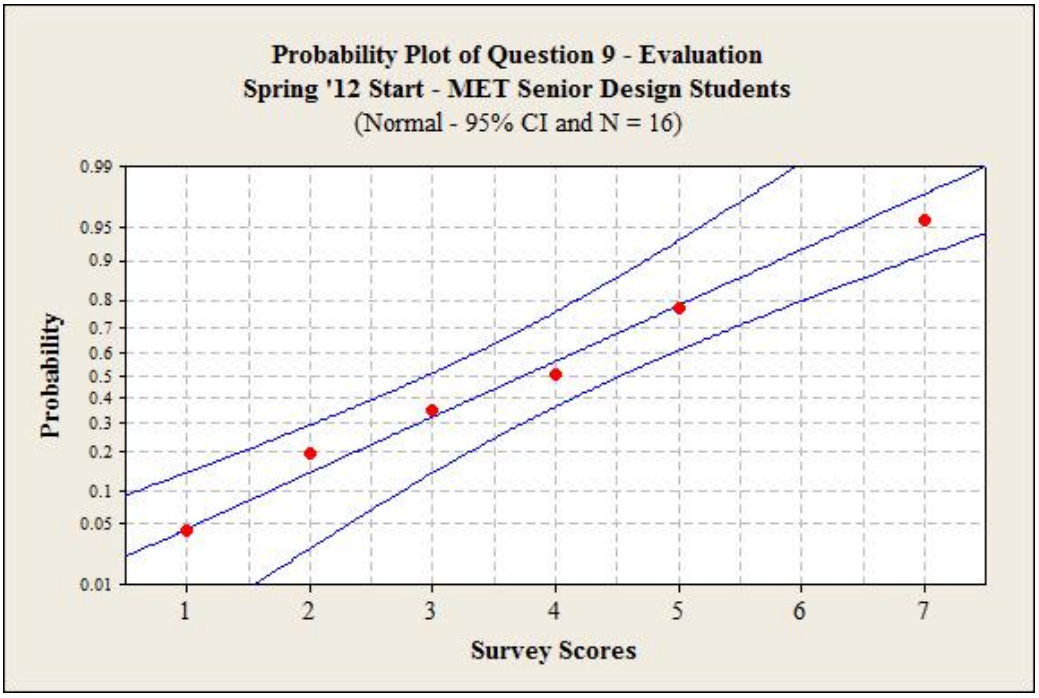


Figure H45. Normal probability plot of Question 9 – Evaluation. MET Senior Design students – Spring ‘12 - Start.

Appendix H

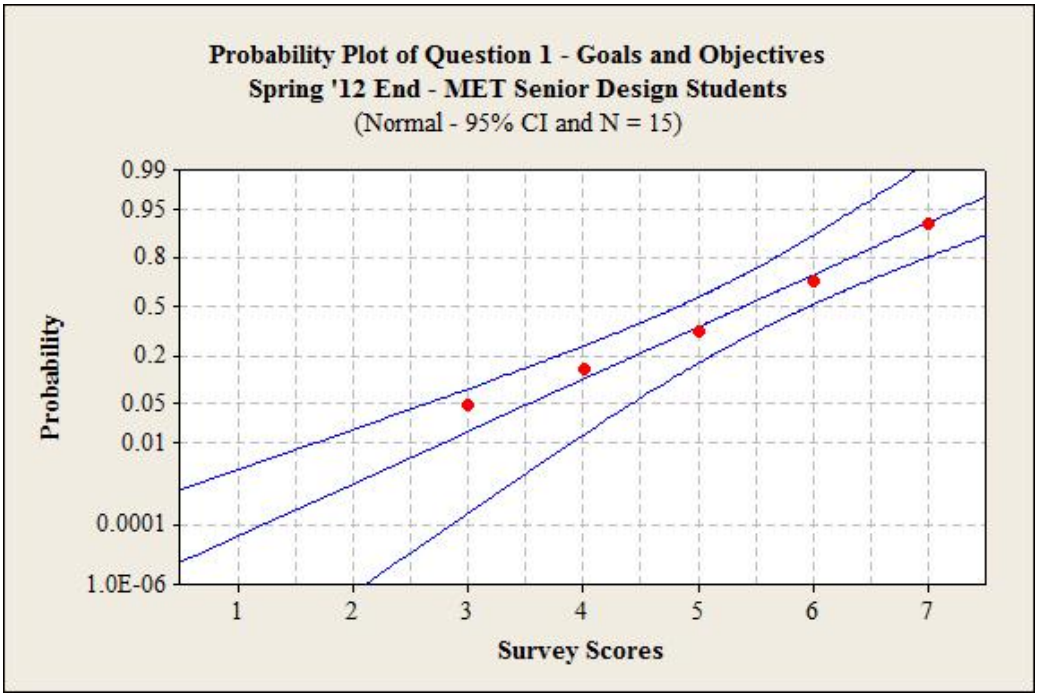


Figure H46. Normal probability plot of Question 1 – Goals and Objectives. MET Senior Design students – Spring '12 - End.

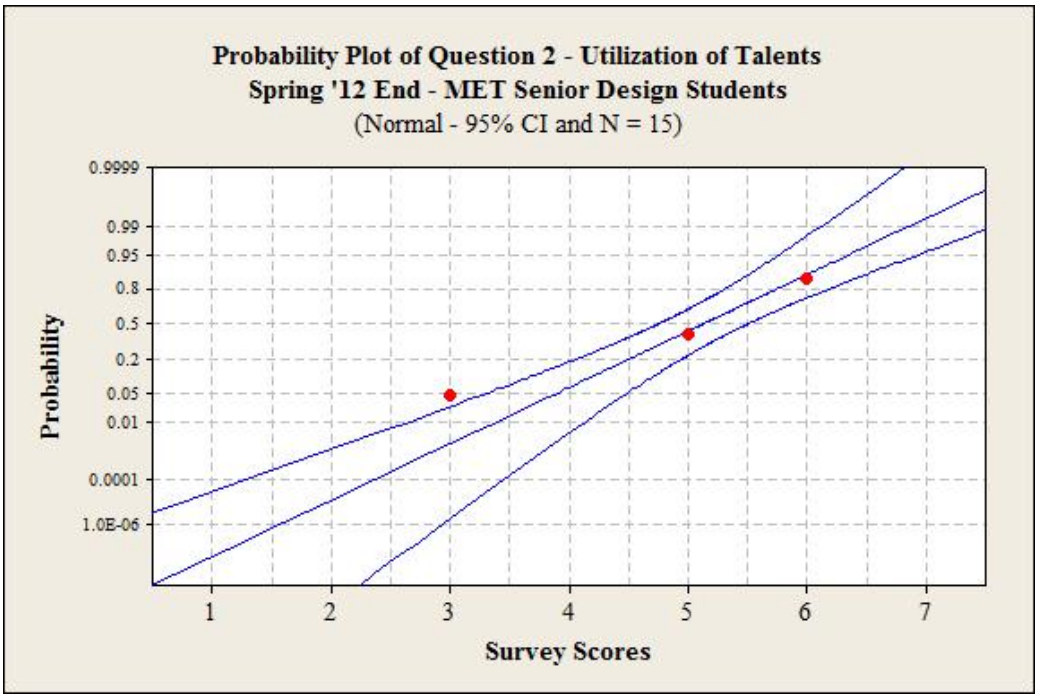


Figure H47. Normal probability plot of Question 2 – Utilization of Talents. MET Senior Design students – Spring '12 - End.

Appendix H

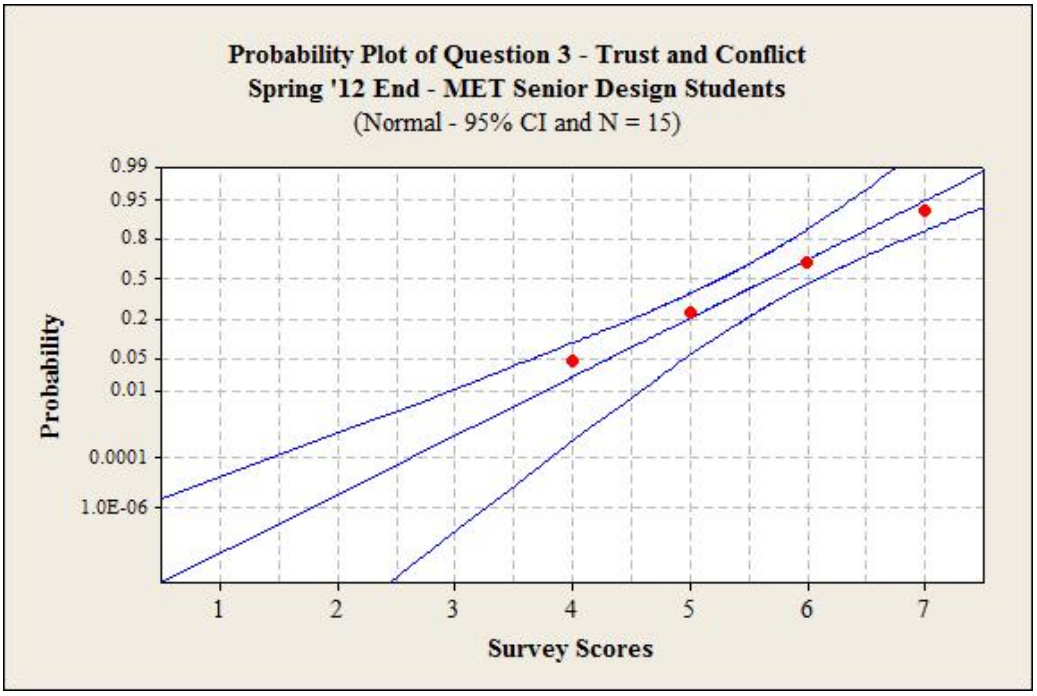


Figure H48. Normal probability plot of Question 3 – Trust and Conflict. MET Senior Design students – Spring '12 - End.

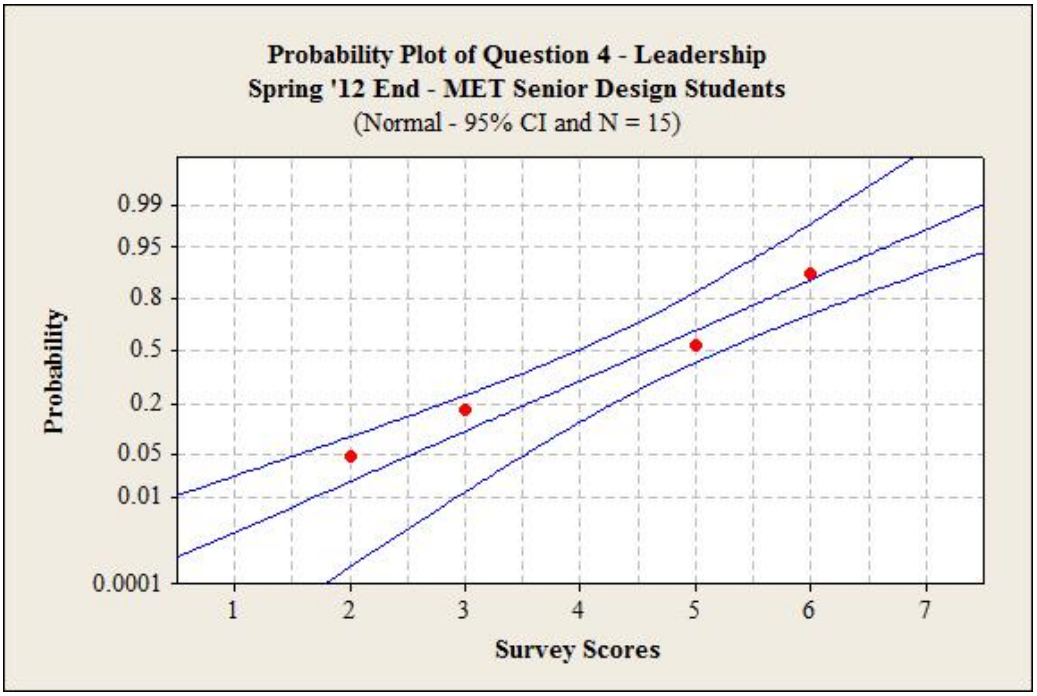


Figure H49. Normal probability plot of Question 4 – Leadership. MET Senior Design students – Spring '12 - End.

Appendix H

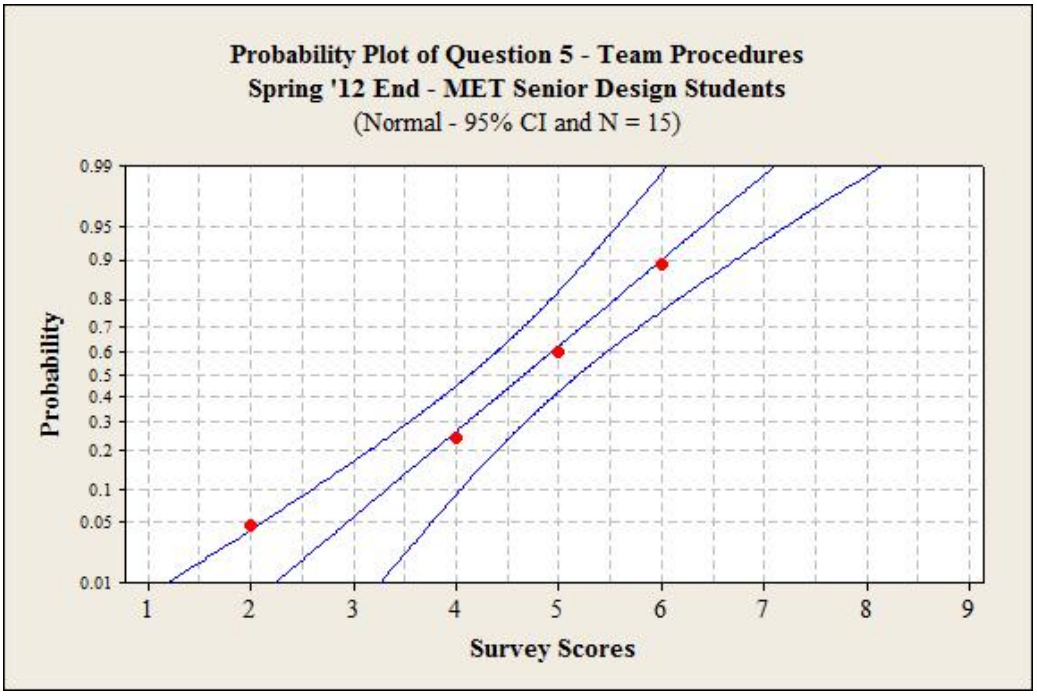


Figure H50. Normal probability plot of Question 5 – Team Procedures. MET Senior Design students – Spring '12 - End.

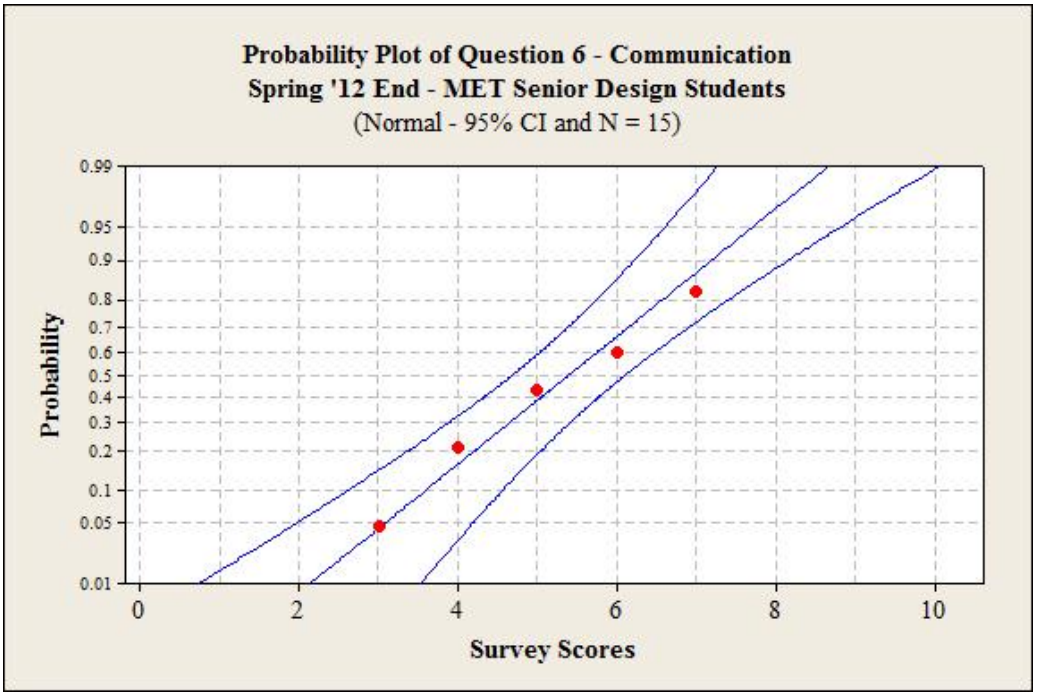


Figure H51. Normal probability plot of Question 6 – Communication. MET Senior Design students – Spring '12 - End.

Appendix H

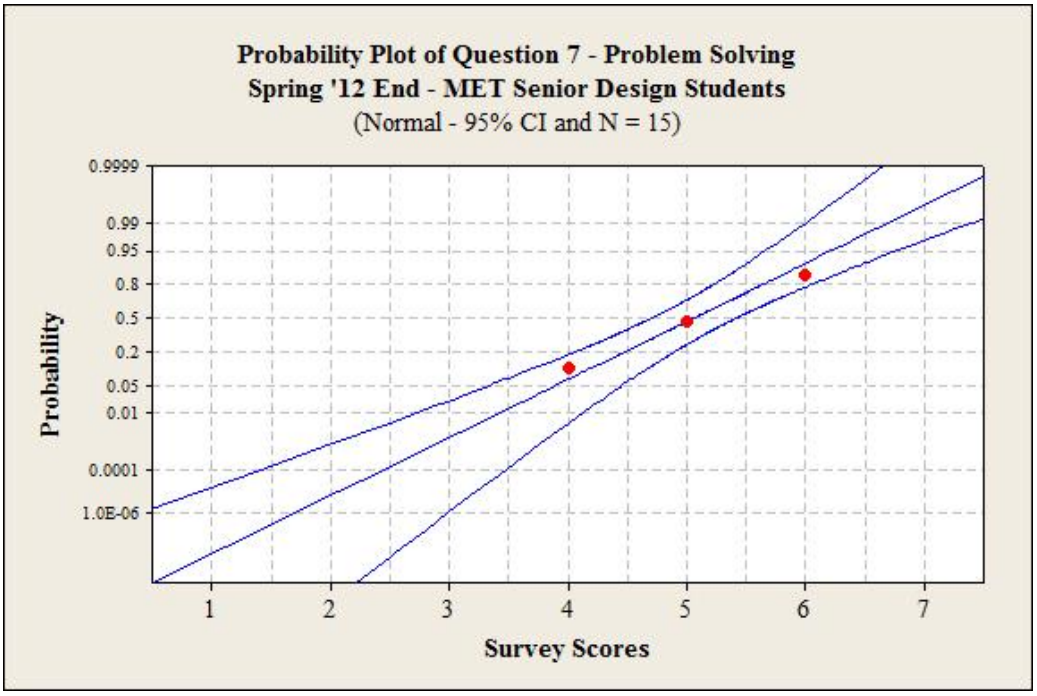


Figure H52. Normal probability plot of Question 7 – Problem Solving. MET Senior Design students – Spring '12 - End.

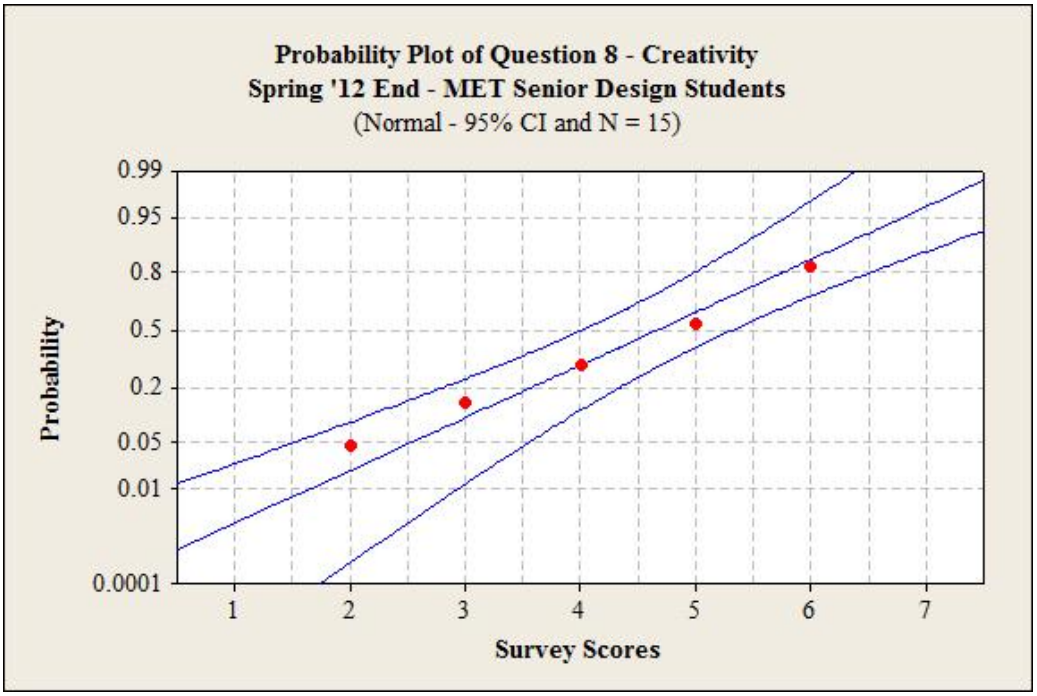


Figure H53. Normal probability plot of Question 8 – Creativity. MET Senior Design students – Spring '12 - End.

Appendix H

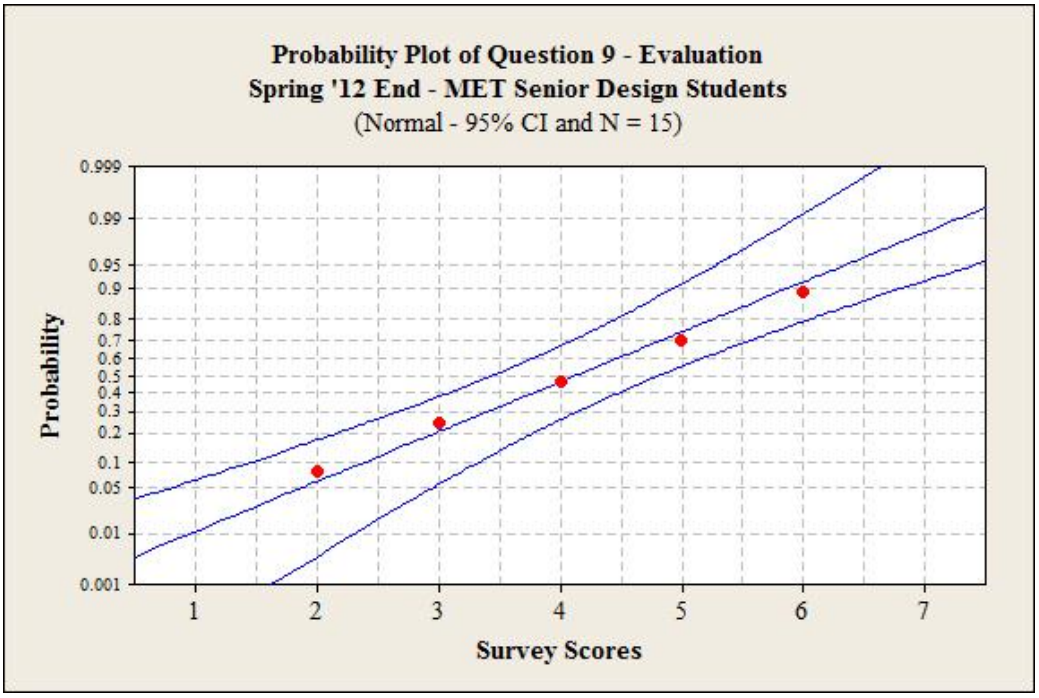


Figure H54. Normal probability plot of Question 9 – Evaluation. MET Senior Design students – Spring ‘12 - End.

Appendix H

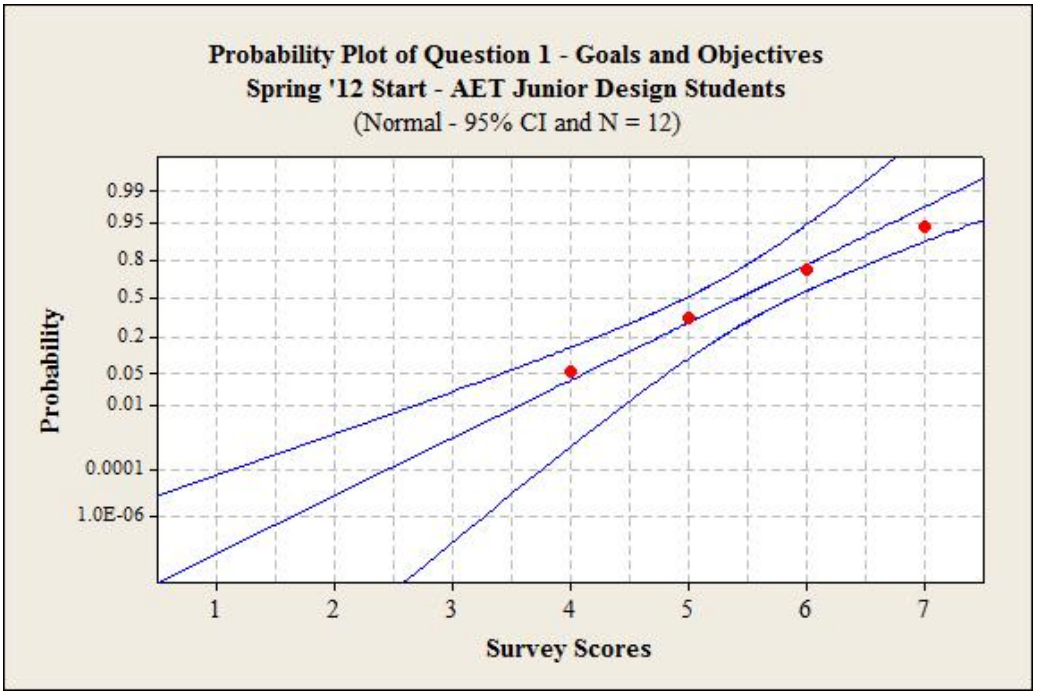


Figure H55. Normal probability plot of Question 1 – Goals and Objectives. AET Junior Design students – Spring '12 - Start.

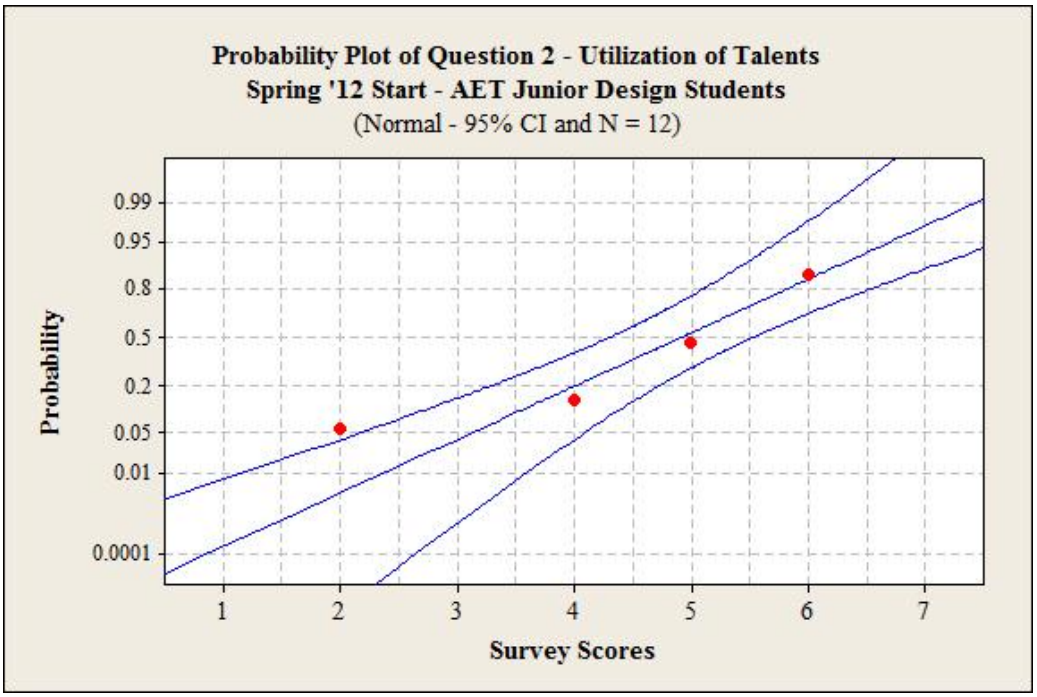


Figure H56. Normal probability plot of Question 2 – Utilization of Talents. AET Junior Design students – Spring '12 - Start.

Appendix H

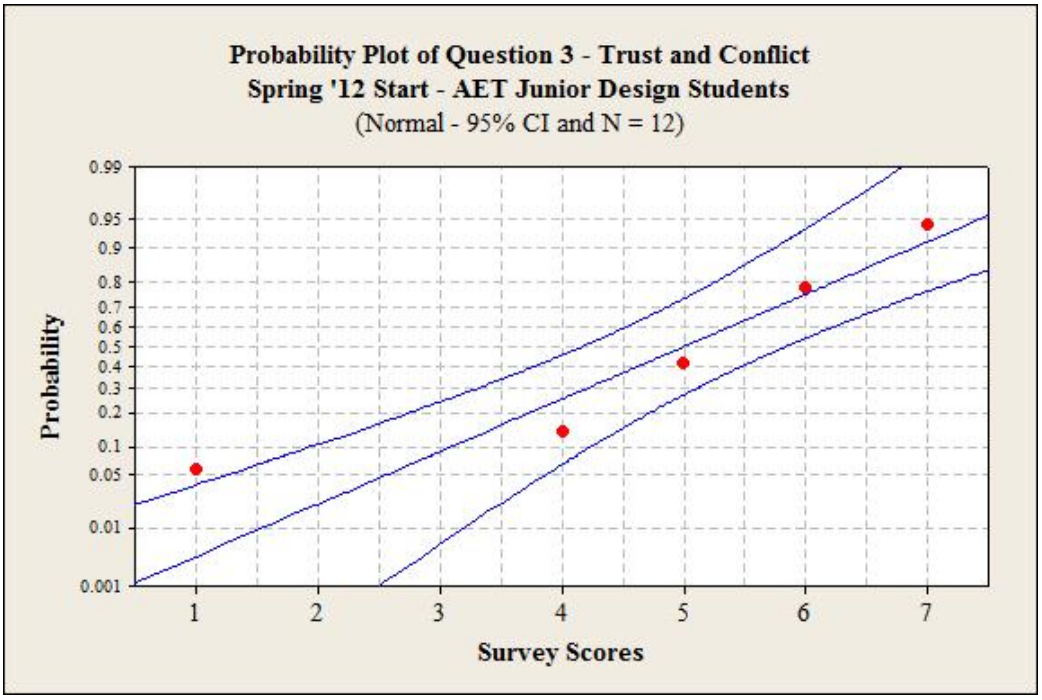


Figure H57. Normal probability plot of Question 3 – Trust and Conflict. AET Junior Design students – Spring '12 - Start.

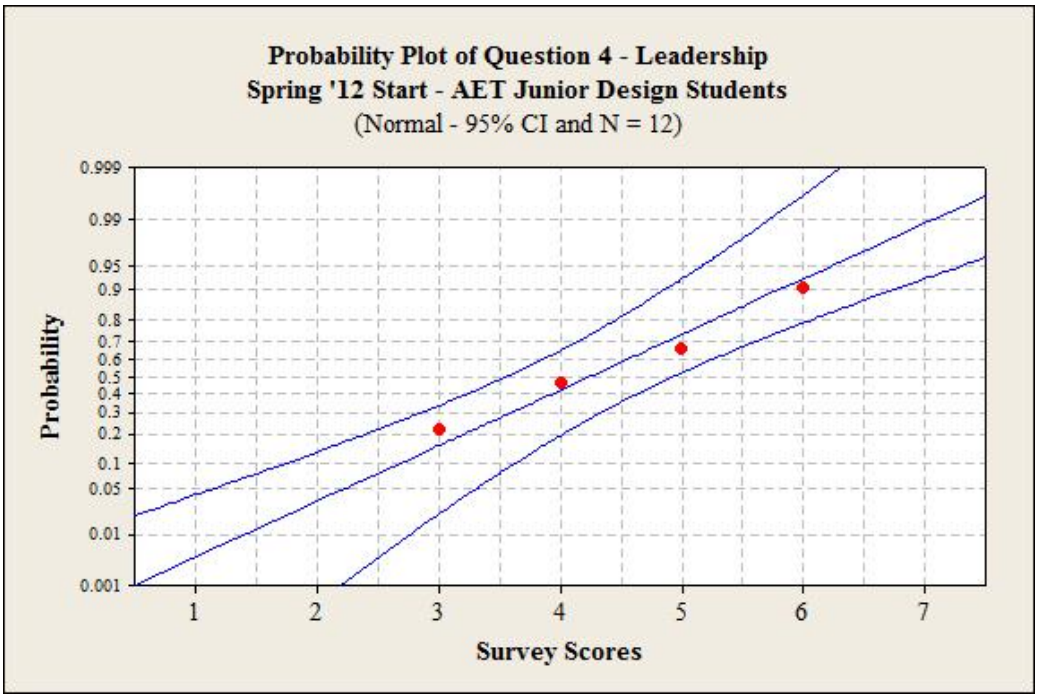


Figure H58. Normal probability plot of Question 4 – Leadership. AET Junior Design students – Spring '12 - Start.

Appendix H

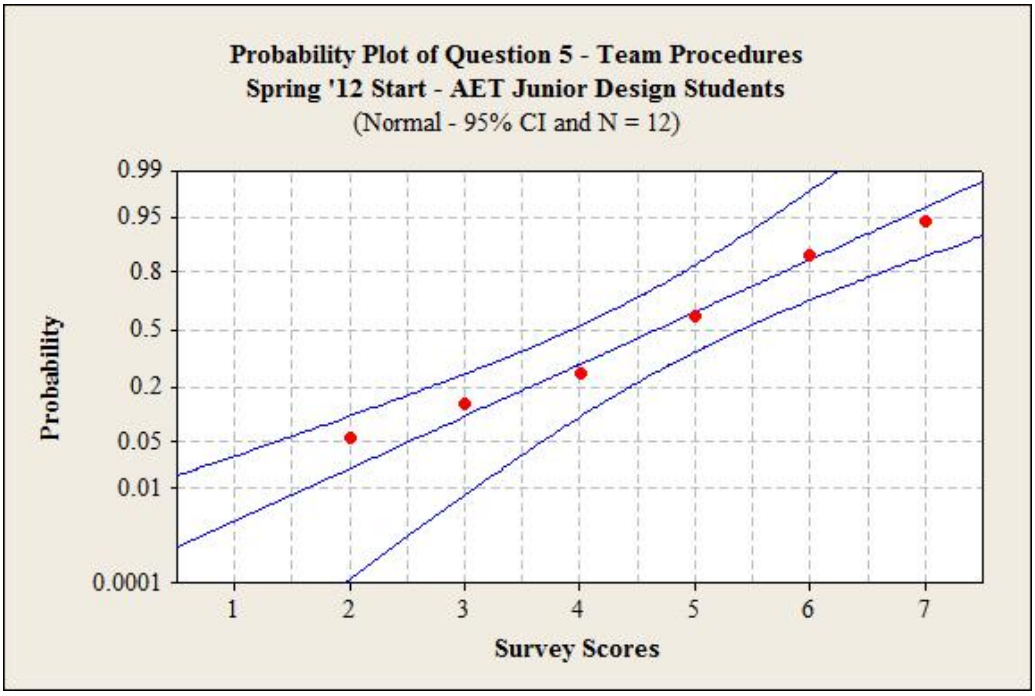


Figure H59. Normal probability plot of Question 5 – Team Procedures. AET Junior Design students – Spring '12 - Start.

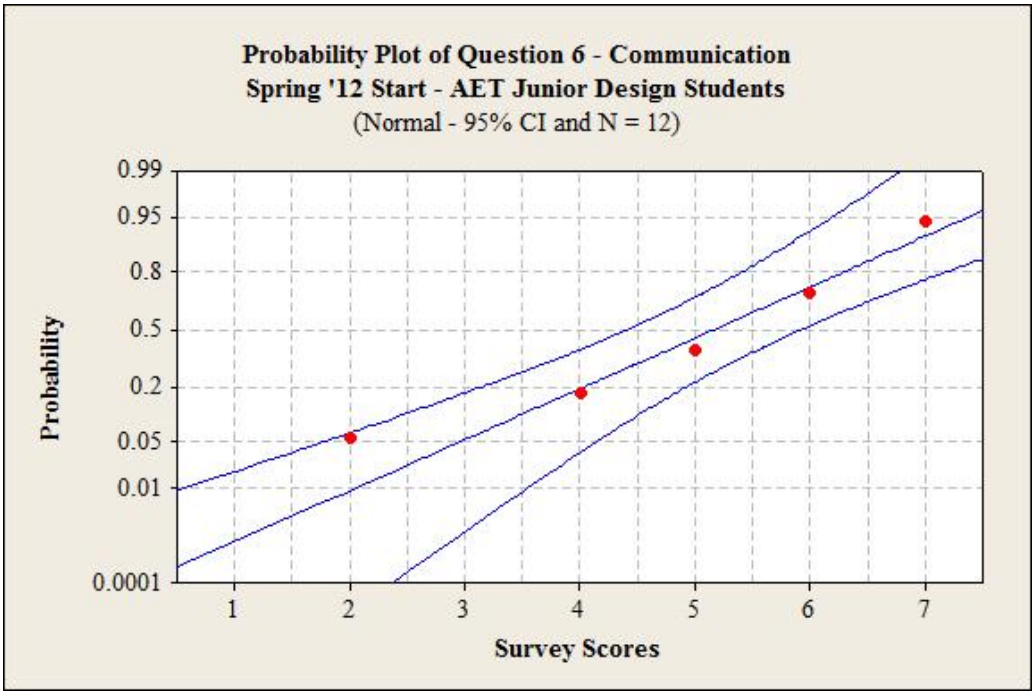


Figure H60. Normal probability plot of Question 6 – Communication. AET Junior Design students – Spring '12 - Start.

Appendix H

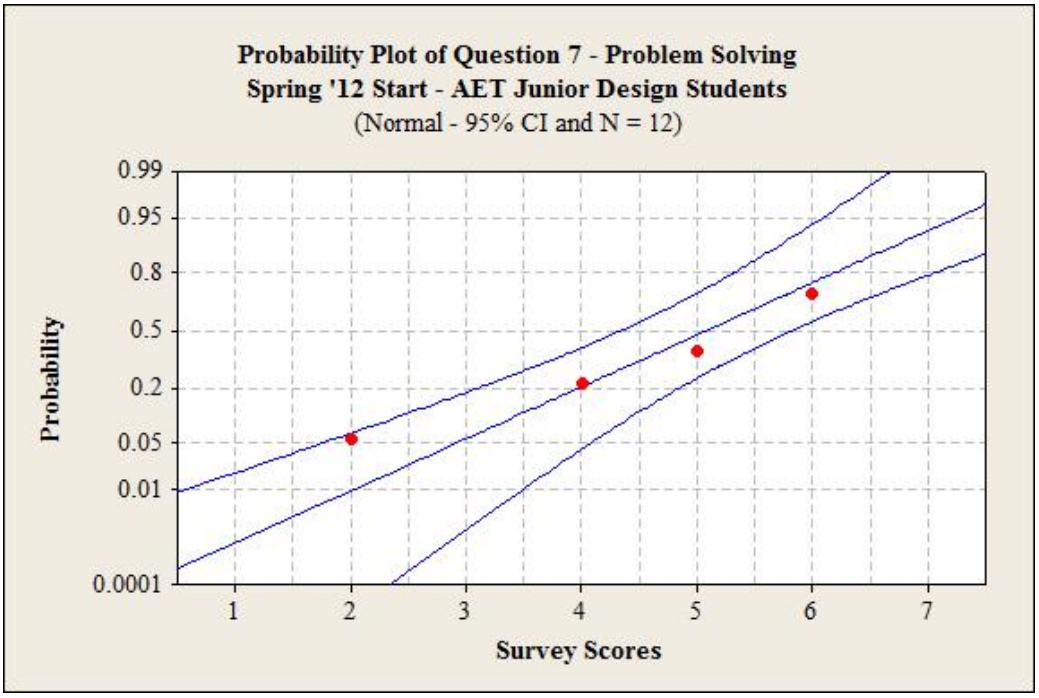


Figure H61. Normal probability plot of Question 7 – Problem Solving. AET Junior Design students – Spring '12 - Start.

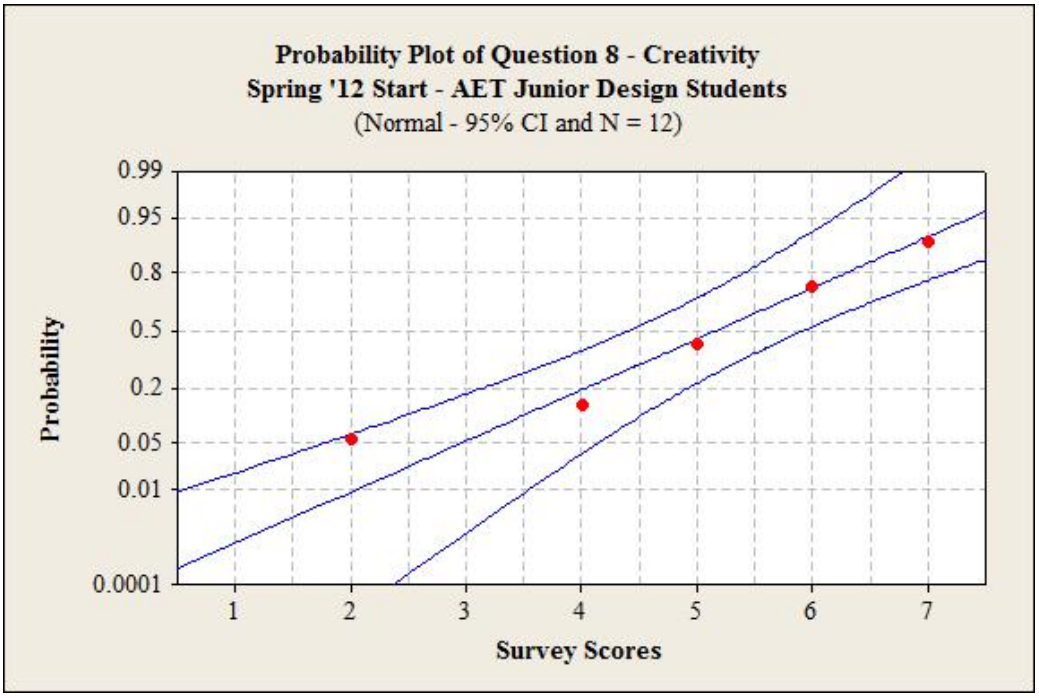


Figure H62. Normal probability plot of Question 8 – Creativity. AET Junior Design students – Spring '12 - Start.

Appendix H

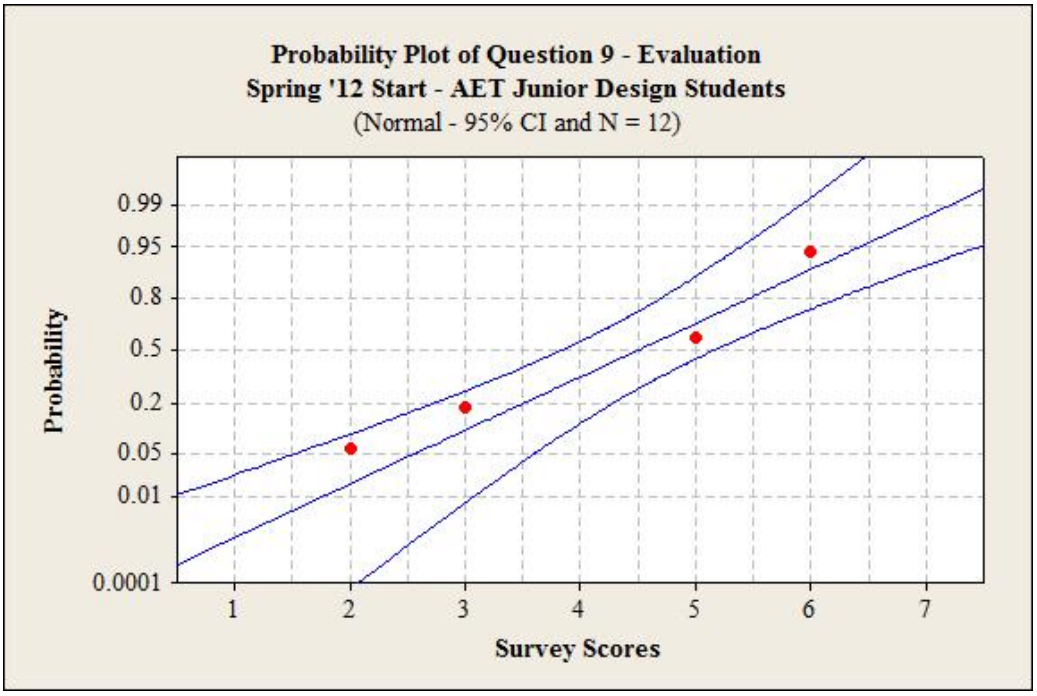


Figure H63. Normal probability plot of Question 9 – Evaluation. AET Junior Design students – Spring ‘12 - Start.

Appendix H

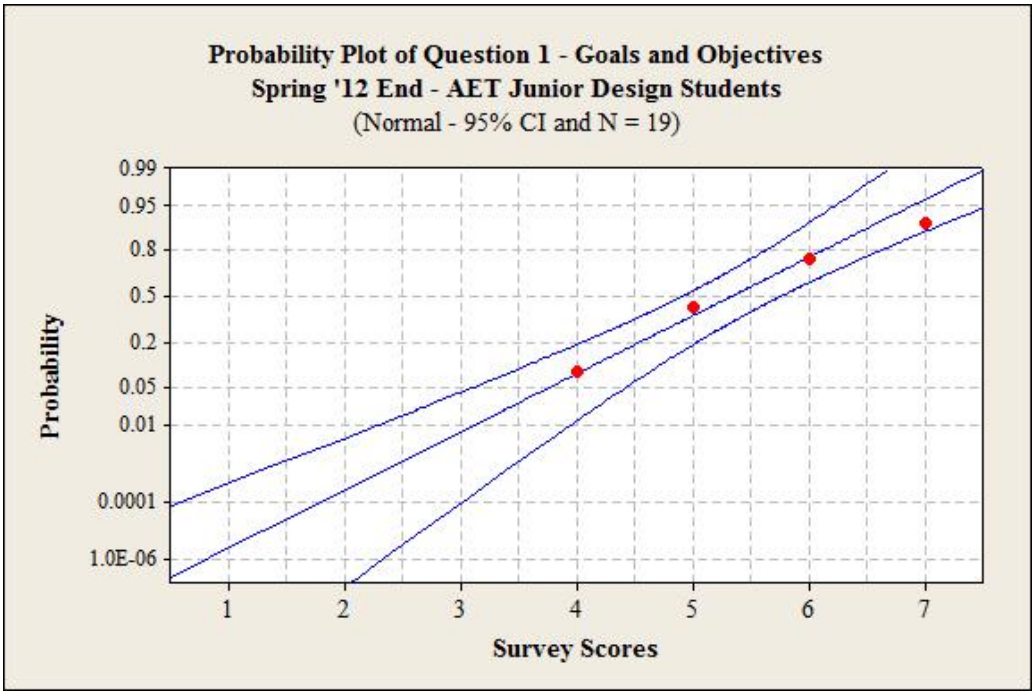


Figure H64. Normal probability plot of Question 1 – Goals and Objectives. AET Junior Design students – Spring '12 - End.

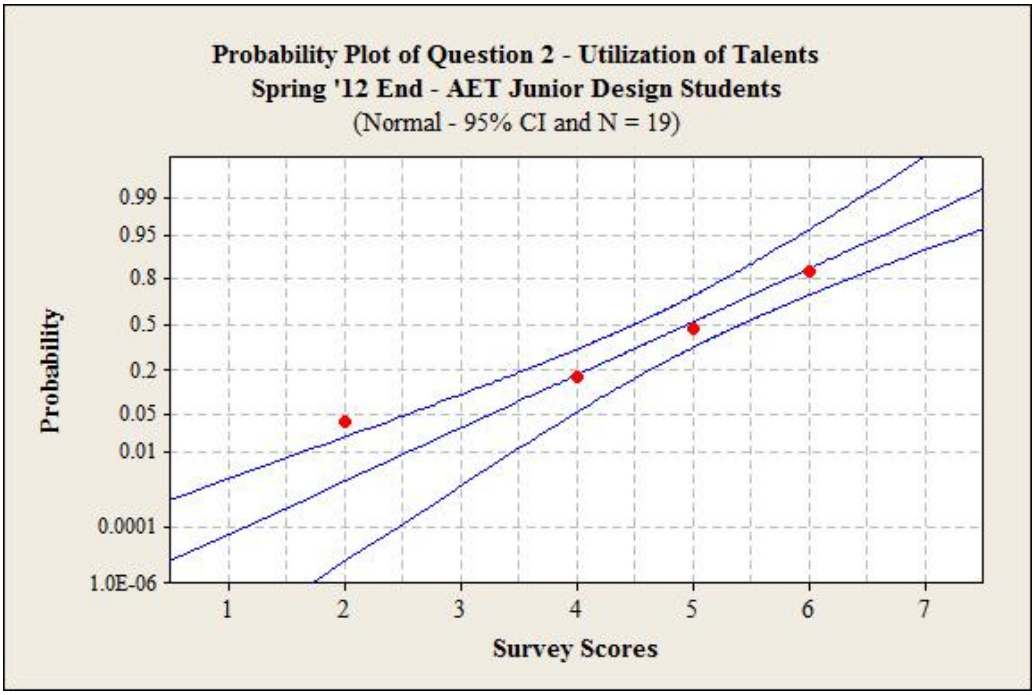


Figure H65. Normal probability plot of Question 2 – Utilization of Talents. AET Junior Design students – Spring '12 - End.

Appendix H

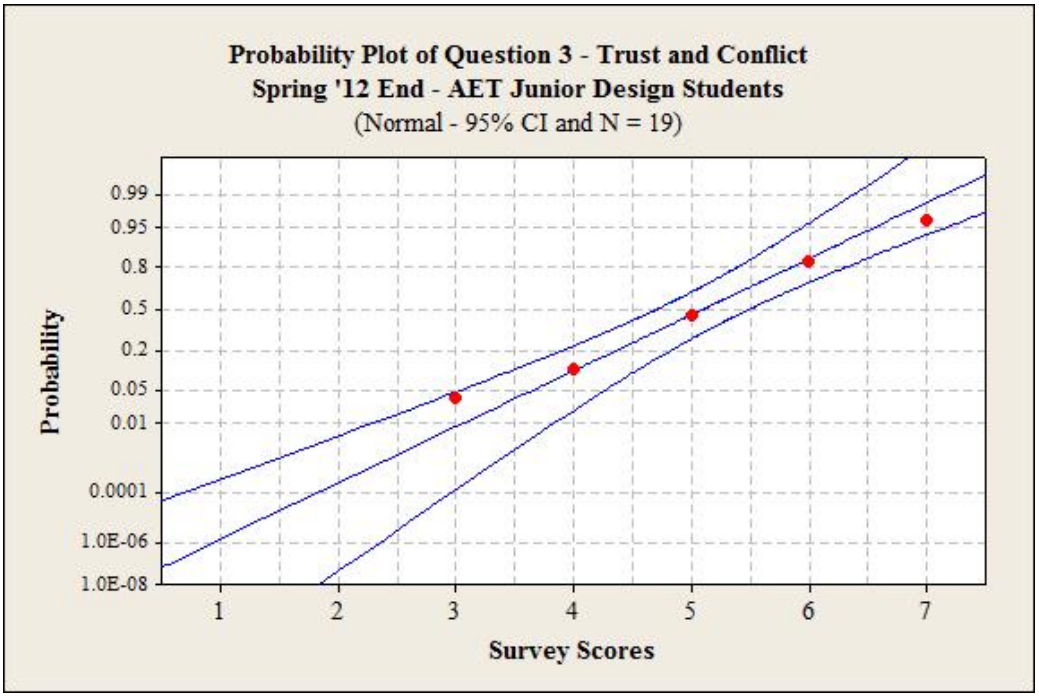


Figure H66. Normal probability plot of Question 3 – Trust and Conflict. AET Junior Design students – Spring '12 - End.

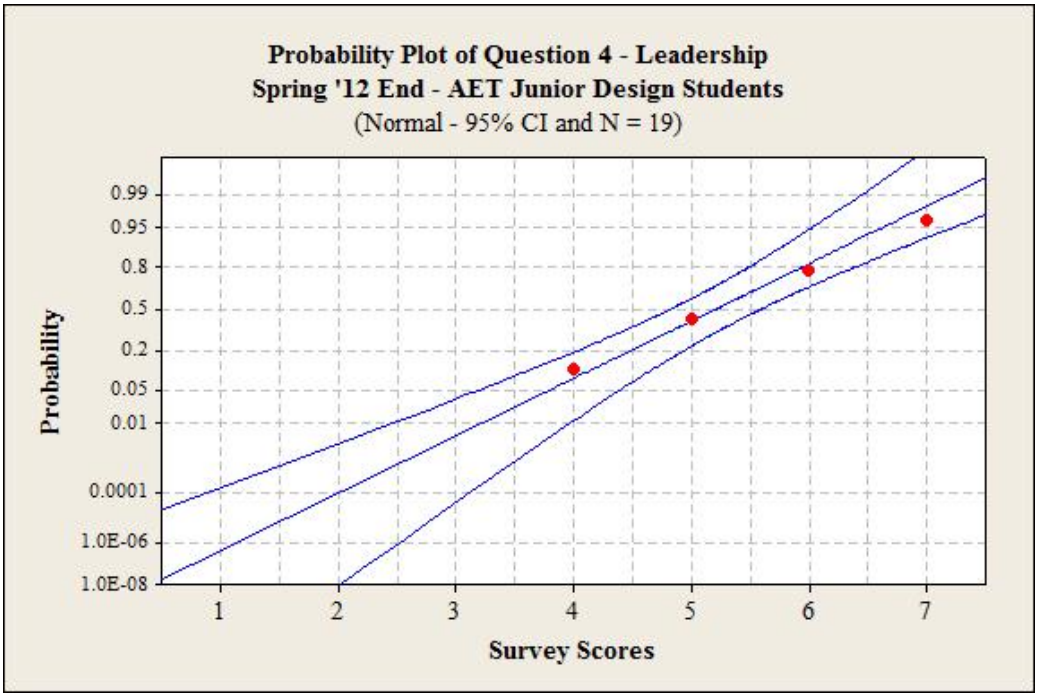


Figure H67. Normal probability plot of Question 4 – Leadership. AET Junior Design students – Spring '12 - End.

Appendix H

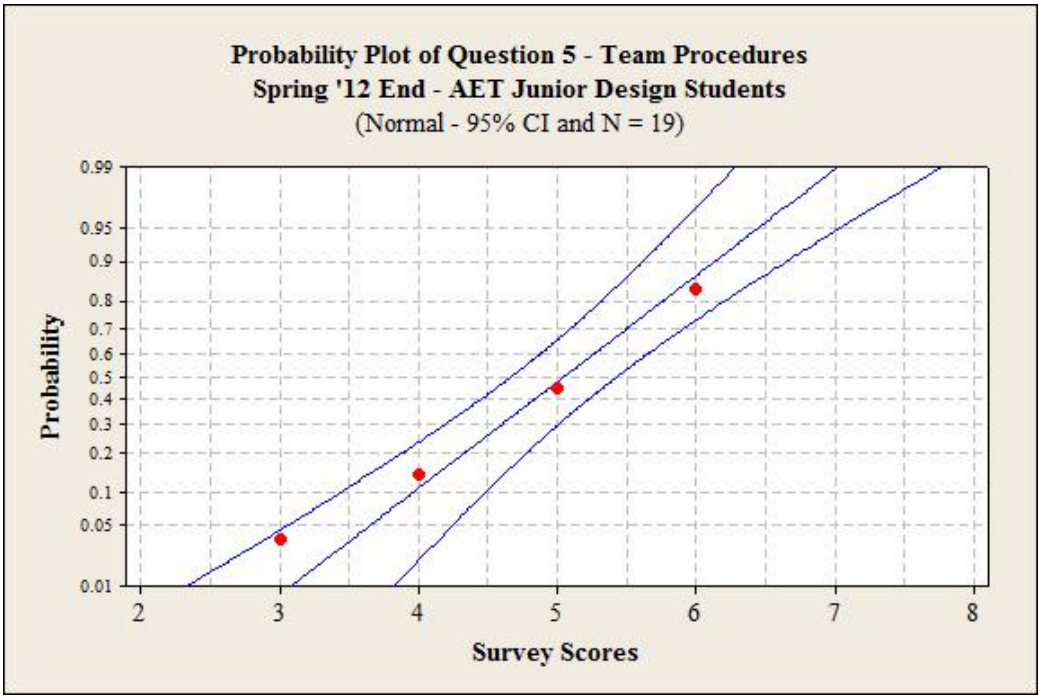


Figure H68. Normal probability plot of Question 5 – Team Procedures. AET Junior Design students – Spring '12 - End.

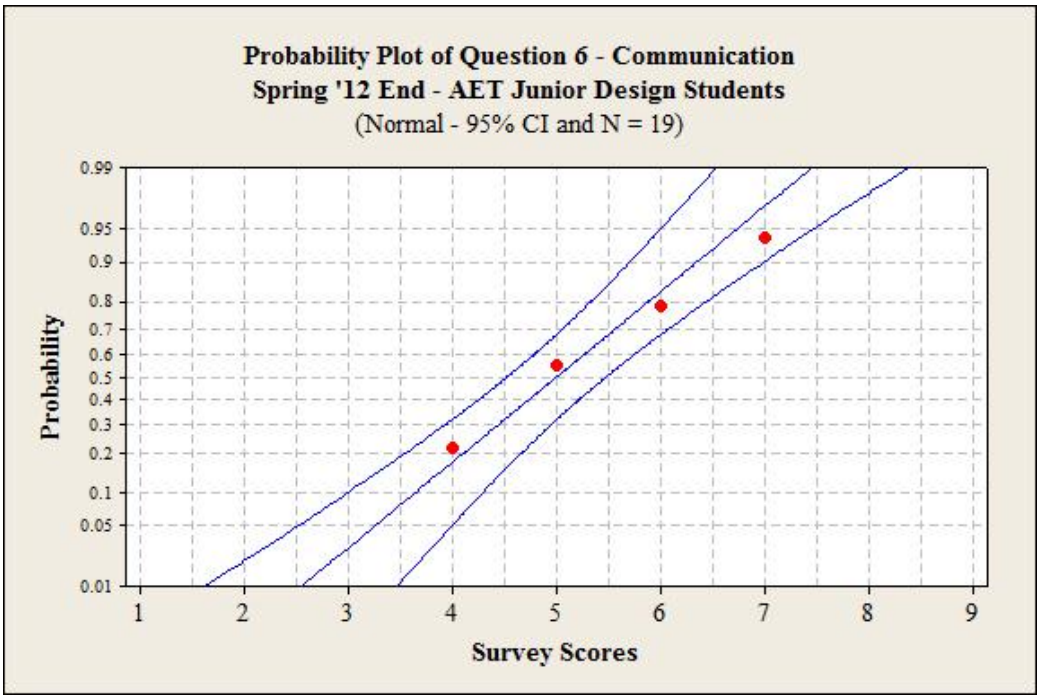


Figure H69. Normal probability plot of Question 6 – Communication. AET Junior Design students – Spring '12 - End.

Appendix H

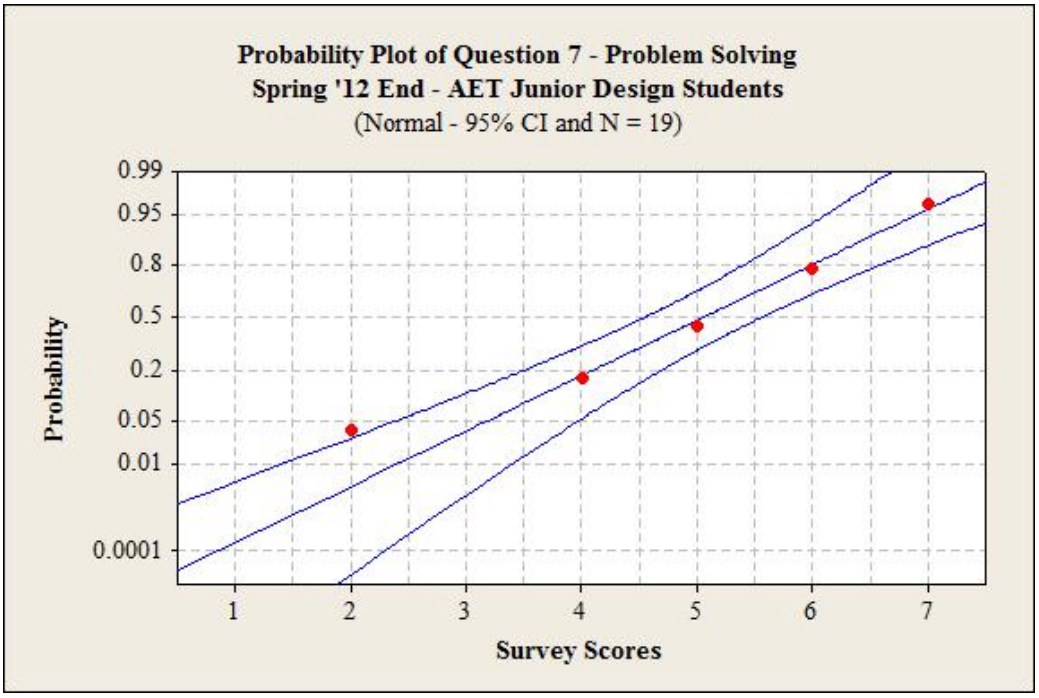


Figure H70. Normal probability plot of Question 7 – Problem Solving. AET Junior Design students – Spring '12 - End.

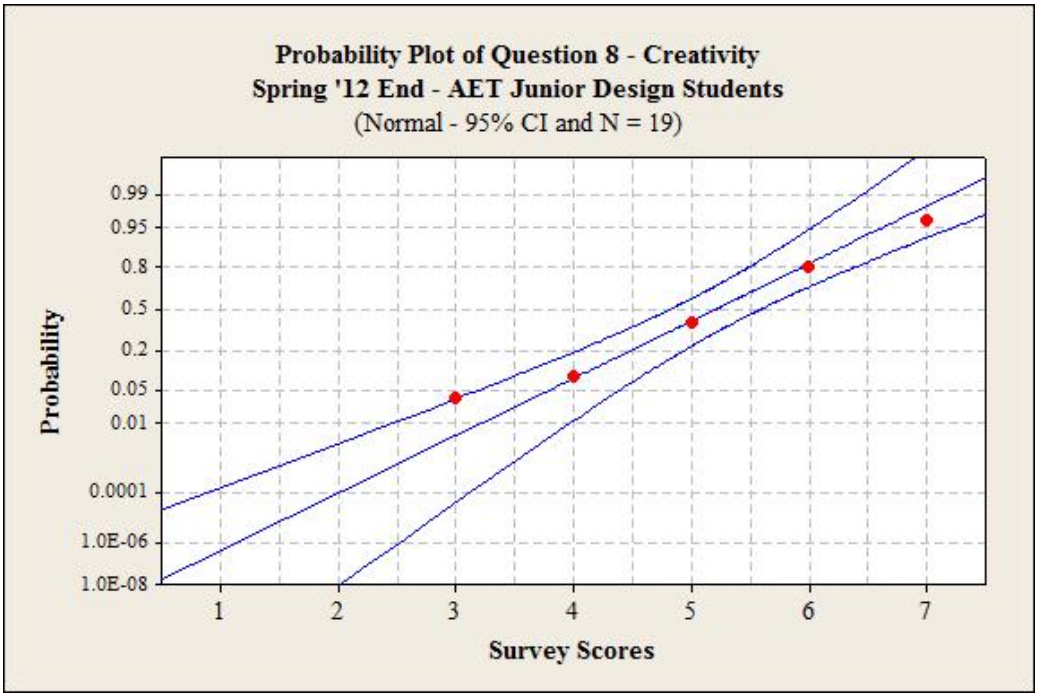


Figure H71. Normal probability plot of Question 8 – Creativity. AET Junior Design students – Spring '12 - End.

Appendix H

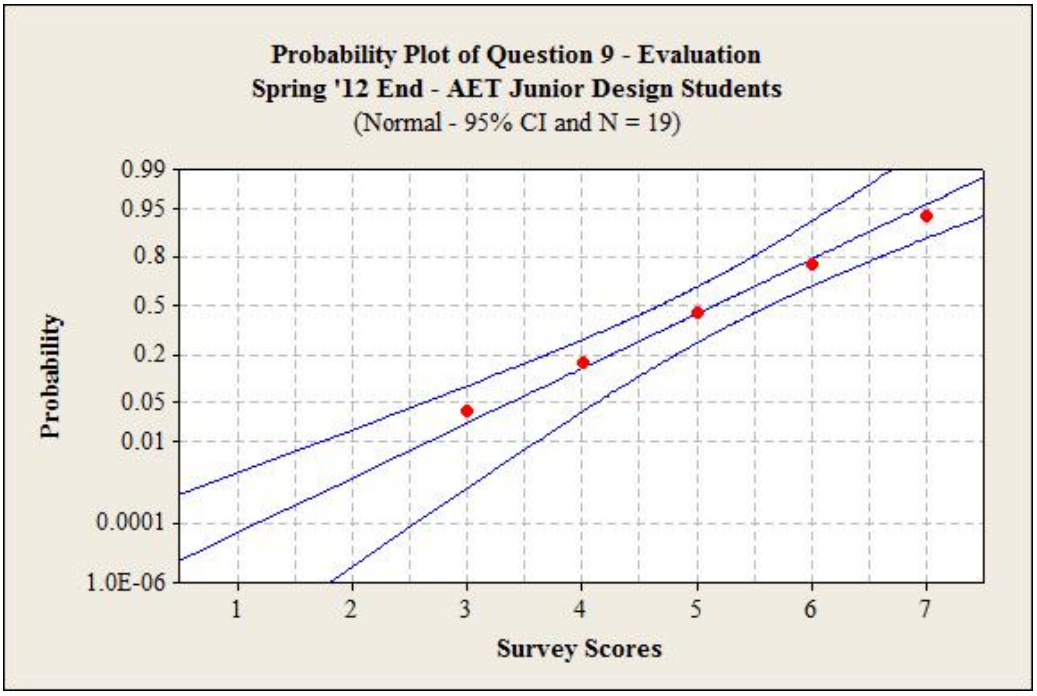


Figure H72. Normal probability plot of Question 9 – Evaluation. AET Junior Design students – Spring ‘12 - End.

Appendix I

Table I1

One Proportion Hypothesis Test of Statistical Significance
AET Senior Design Students – Fall '11 Single Survey ($H_0 \leq 0.50 \mid H_1 > 0.50 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	29	34	0.853	0	Yes	Yes
Q2 - Utilization of Talent	23	34	0.676	0.029	Yes	Yes
Q3 - Trust and Conflict	28	34	0.824	0	Yes	Yes
Q4 - Leadership	19	34	0.559	0.304	No	No
Q5 - Team Procedures	18	34	0.529	0.432	No	No
Q6 - Communication	24	34	0.706	0.012	Yes	Yes
Q7 - Problem Solving	24	34	0.706	0.012	Yes	Yes
Q8 - Creativity	23	34	0.676	0.029	Yes	Yes
Q9 - Evaluation	22	34	0.647	0.061	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 50 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 50 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

Appendix I

Table I2

One Proportion Hypothesis Test of Statistical Significance
AET Senior Design Students – Fall '11 Single Survey ($H_0 \leq 0.48 \mid H_1 > 0.48 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	29	34	0.853	0	Yes	Yes
Q2 - Utilization of Talent	23	34	0.676	0.017	Yes	Yes
Q3 - Trust and Conflict	28	34	0.824	0	Yes	Yes
Q4 - Leadership	19	34	0.559	0.227	No	No
Q5 - Team Procedures	18	34	0.529	0.342	No	No
Q6 - Communication	24	34	0.706	0.006	Yes	Yes
Q7 - Problem Solving	24	34	0.706	0.006	Yes	Yes
Q8 - Creativity	23	34	0.676	0.017	Yes	Yes
Q9 - Evaluation	22	34	0.647	0.037	Yes	Yes

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 48 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 48 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

Appendix I

Table I3

One Proportion Hypothesis Test of Statistical Significance
AET Senior Design Students – Fall '11 Single Survey ($H_0 \leq 0.46 \mid H_1 > 0.46 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	29	34	0.853	0	Yes	Yes
Q2 - Utilization of Talent	23	34	0.676	0.009	Yes	Yes
Q3 - Trust and Conflict	28	34	0.824	0	Yes	Yes
Q4 - Leadership	19	34	0.559	0.163	No	No
Q5 - Team Procedures	18	34	0.529	0.26	No	No
Q6 - Communication	24	34	0.706	0.003	Yes	Yes
Q7 - Problem Solving	24	34	0.706	0.003	Yes	Yes
Q8 - Creativity	23	34	0.676	0.009	Yes	Yes
Q9 - Evaluation	22	34	0.647	0.022	Yes	Yes

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 46 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 46 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

Appendix I

Table I4

One Proportion Hypothesis Test of Statistical Significance
AET Senior Design Students – Spring '12 Start ($H_0 \leq 0.50 \mid H_1 > 0.50 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	30	34	0.882	0.000	Yes	Yes
Q2 - Utilization of Talent	25	34	0.735	0.005	Yes	Yes
Q3 - Trust and Conflict	27	34	0.794	0.000	Yes	Yes
Q4 - Leadership	17	34	0.500	0.568	No	No
Q5 - Team Procedures	24	34	0.706	0.012	Yes	Yes
Q6 - Communication	23	34	0.676	0.029	Yes	Yes
Q7 - Problem Solving	25	34	0.735	0.005	Yes	Yes
Q8 - Creativity	25	34	0.735	0.005	Yes	Yes
Q9 - Evaluation	23	34	0.676	0.029	Yes	Yes

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 50 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 50 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I5

One Proportion Hypothesis Test of Statistical Significance
AET Senior Design Students – Spring '12 Start ($H_0 \leq 0.48 \mid H_1 > 0.48 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	30	34	0.882	0.000	Yes	Yes
Q2 - Utilization of Talent	25	34	0.735	0.002	Yes	Yes
Q3 - Trust and Conflict	27	34	0.794	0.000	Yes	Yes
Q4 - Leadership	17	34	0.500	0.475	No	No
Q5 - Team Procedures	24	34	0.706	0.006	Yes	Yes
Q6 - Communication	23	34	0.676	0.017	Yes	Yes
Q7 - Problem Solving	25	34	0.735	0.002	Yes	Yes
Q8 - Creativity	25	34	0.735	0.002	Yes	Yes
Q9 - Evaluation	23	34	0.676	0.017	Yes	Yes

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 48 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 48 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I6

One Proportion Hypothesis Test of Statistical Significance
AET Senior Design Students – Spring '12 Start ($H_0 \leq 0.46 \mid H_1 > 0.46 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	30	34	0.882	0.000	Yes	Yes
Q2 - Utilization of Talent	25	34	0.735	0.001	Yes	Yes
Q3 - Trust and Conflict	27	34	0.794	0.000	Yes	Yes
Q4 - Leadership	17	34	0.500	0.382	No	No
Q5 - Team Procedures	24	34	0.706	0.003	Yes	Yes
Q6 - Communication	23	34	0.676	0.009	Yes	Yes
Q7 - Problem Solving	25	34	0.735	0.001	Yes	Yes
Q8 - Creativity	25	34	0.735	0.001	Yes	Yes
Q9 - Evaluation	23	34	0.676	0.009	Yes	Yes

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 46 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 46 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I7

One Proportion Hypothesis Test of Statistical Significance
AET Senior Design Students – Spring '12 End ($H_0 \leq 0.50 \mid H_1 > 0.50 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	26	30	0.867	0.000	Yes	Yes
Q2 - Utilization of Talent	24	30	0.800	0.001	Yes	Yes
Q3 - Trust and Conflict	22	30	0.733	0.008	Yes	Yes
Q4 - Leadership	14	30	0.467	0.708	No	No
Q5 - Team Procedures	18	30	0.600	0.181	No	No
Q6 - Communication	22	30	0.733	0.008	Yes	Yes
Q7 - Problem Solving	20	30	0.667	0.049	Yes	Yes
Q8 - Creativity	21	30	0.700	0.021	Yes	Yes
Q9 - Evaluation	16	30	0.533	0.428	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 50 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 50 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I8

One Proportion Hypothesis Test of Statistical Significance
AET Senior Design Students – Spring '12 End ($H_0 \leq 0.48 \mid H_1 > 0.48 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	26	30	0.867	0.000	Yes	Yes
Q2 - Utilization of Talent	24	30	0.800	0.000	Yes	Yes
Q3 - Trust and Conflict	22	30	0.733	0.004	Yes	Yes
Q4 - Leadership	14	30	0.467	0.628	No	No
Q5 - Team Procedures	18	30	0.600	0.129	No	No
Q6 - Communication	22	30	0.733	0.004	Yes	Yes
Q7 - Problem Solving	20	30	0.667	0.031	Yes	Yes
Q8 - Creativity	21	30	0.700	0.012	Yes	Yes
Q9 - Evaluation	16	30	0.533	0.343	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 48 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 48 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I9

One Proportion Hypothesis Test of Statistical Significance
AET Senior Design Students – Spring '12 End ($H_0 \leq 0.46 \mid H_1 > 0.46 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	26	30	0.867	0.000	Yes	Yes
Q2 - Utilization of Talent	24	30	0.800	0.000	Yes	Yes
Q3 - Trust and Conflict	22	30	0.733	0.002	Yes	Yes
Q4 - Leadership	14	30	0.467	0.542	No	No
Q5 - Team Procedures	18	30	0.600	0.088	No	No
Q6 - Communication	22	30	0.733	0.002	Yes	Yes
Q7 - Problem Solving	20	30	0.667	0.018	Yes	Yes
Q8 - Creativity	21	30	0.700	0.007	Yes	Yes
Q9 - Evaluation	16	30	0.533	0.266	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 46 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 46 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I10

One Proportion Hypothesis Test of Statistical Significance
MET Senior Design Students – Fall '11 Single Survey ($H_0 \leq 0.50 \mid H_1 > 0.50 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	16	18	0.889	0.001	Yes	Yes
Q2 - Utilization of Talent	12	18	0.667	0.119	No	No
Q3 - Trust and Conflict	15	18	0.833	0.004	Yes	Yes
Q4 - Leadership	6	18	0.333	0.952	No	No
Q5 - Team Procedures	6	18	0.333	0.952	No	No
Q6 - Communication	14	18	0.778	0.015	Yes	Yes
Q7 - Problem Solving	13	18	0.722	0.048	Yes	Yes
Q8 - Creativity	10	18	0.556	0.407	No	No
Q9 - Evaluation	7	18	0.389	0.881	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 50 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 50 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I11

One Proportion Hypothesis Test of Statistical Significance
MET Senior Design Students – Fall '11 Single Survey ($H_0 \leq 0.48 \mid H_1 > 0.48 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	16	18	0.889	0.000	Yes	Yes
Q2 - Utilization of Talent	12	18	0.667	0.088	No	No
Q3 - Trust and Conflict	15	18	0.833	0.002	Yes	Yes
Q4 - Leadership	6	18	0.333	0.932	No	No
Q5 - Team Procedures	6	18	0.333	0.932	No	No
Q6 - Communication	14	18	0.778	0.010	Yes	Yes
Q7 - Problem Solving	13	18	0.722	0.033	Yes	Yes
Q8 - Creativity	10	18	0.556	0.342	No	No
Q9 - Evaluation	7	18	0.389	0.844	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 48 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 48 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

Appendix I

Table I12

One Proportion Hypothesis Test of Statistical Significance
MET Senior Design Students – Fall '11 Single Survey ($H_0 \leq 0.46 \mid H_1 > 0.46 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	16	18	0.889	0.000	Yes	Yes
Q2 - Utilization of Talent	12	18	0.667	0.064	Yes	Yes
Q3 - Trust and Conflict	15	18	0.833	0.001	Yes	Yes
Q4 - Leadership	6	18	0.333	0.907	No	No
Q5 - Team Procedures	6	18	0.333	0.907	No	No
Q6 - Communication	14	18	0.778	0.006	Yes	Yes
Q7 - Problem Solving	13	18	0.722	0.023	No	No
Q8 - Creativity	10	18	0.556	0.281	Yes	Yes
Q9 - Evaluation	7	18	0.389	0.799	Yes	Yes

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 46 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 46 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I13

One Proportion Hypothesis Test of Statistical Significance
MET Senior Design Students – Spring '12 Start ($H_0 \leq 0.50 \mid H_1 > 0.50 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	14	16	0.875	0.002	Yes	Yes
Q2 - Utilization of Talent	10	16	0.625	0.227	No	No
Q3 - Trust and Conflict	13	16	0.813	0.011	Yes	Yes
Q4 - Leadership	8	16	0.500	0.598	No	No
Q5 - Team Procedures	10	16	0.625	0.227	No	No
Q6 - Communication	13	16	0.813	0.011	Yes	Yes
Q7 - Problem Solving	12	16	0.750	0.038	Yes	Yes
Q8 - Creativity	13	16	0.813	0.011	Yes	Yes
Q9 - Evaluation	6	16	0.375	0.895	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 50 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 50 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I14

One Proportion Hypothesis Test of Statistical Significance
MET Senior Design Students – Spring '12 Start ($H_0 \leq 0.50 \mid H_1 > 0.50 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	14	16	0.875	0.002	Yes	Yes
Q2 - Utilization of Talent	10	16	0.625	0.227	No	No
Q3 - Trust and Conflict	13	16	0.813	0.011	Yes	Yes
Q4 - Leadership	8	16	0.500	0.598	No	No
Q5 - Team Procedures	10	16	0.625	0.227	No	No
Q6 - Communication	13	16	0.813	0.011	Yes	Yes
Q7 - Problem Solving	12	16	0.750	0.038	Yes	Yes
Q8 - Creativity	13	16	0.813	0.011	Yes	Yes
Q9 - Evaluation	6	16	0.375	0.895	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 50 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 50 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

Appendix I

Table I15

One Proportion Hypothesis Test of Statistical Significance
MET Senior Design Students – Spring '12 Start ($H_0 \leq 0.46 \mid H_1 > 0.46 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	14	16	0.875	0.001	Yes	Yes
Q2 - Utilization of Talent	10	16	0.625	0.142	No	No
Q3 - Trust and Conflict	13	16	0.813	0.004	Yes	Yes
Q4 - Leadership	8	16	0.500	0.469	No	No
Q5 - Team Procedures	10	16	0.625	0.142	No	No
Q6 - Communication	13	16	0.813	0.004	Yes	Yes
Q7 - Problem Solving	12	16	0.750	0.018	Yes	Yes
Q8 - Creativity	13	16	0.813	0.004	Yes	Yes
Q9 - Evaluation	6	16	0.375	0.824	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 46 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 46 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I16

One Proportion Hypothesis Test of Statistical Significance
MET Senior Design Students – Spring '12 End ($H_0 \leq 0.50 \mid H_1 > 0.50 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	12	15	0.800	0.018	Yes	Yes
Q2 - Utilization of Talent	14	15	0.933	0.000	Yes	Yes
Q3 - Trust and Conflict	14	15	0.933	0.000	Yes	Yes
Q4 - Leadership	11	15	0.733	0.059	No	No
Q5 - Team Procedures	9	15	0.600	0.304	No	No
Q6 - Communication	10	15	0.667	0.151	No	No
Q7 - Problem Solving	12	15	0.800	0.018	Yes	Yes
Q8 - Creativity	9	15	0.600	0.304	No	No
Q9 - Evaluation	6	15	0.400	0.849	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 50 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 50 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I17

One Proportion Hypothesis Test of Statistical Significance
MET Senior Design Students – Spring '12 End ($H_0 \leq 0.48 \mid H_1 > 0.48 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	12	15	0.800	0.012	Yes	Yes
Q2 - Utilization of Talent	14	15	0.933	0.000	Yes	Yes
Q3 - Trust and Conflict	14	15	0.933	0.000	Yes	Yes
Q4 - Leadership	11	15	0.733	0.043	Yes	Yes
Q5 - Team Procedures	9	15	0.600	0.251	No	No
Q6 - Communication	10	15	0.667	0.117	No	No
Q7 - Problem Solving	12	15	0.800	0.012	Yes	Yes
Q8 - Creativity	9	15	0.600	0.251	No	No
Q9 - Evaluation	6	15	0.400	0.810	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 48 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 48 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I18

One Proportion Hypothesis Test of Statistical Significance
MET Senior Design Students – Spring '12 End ($H_0 \leq 0.46 \mid H_1 > 0.46 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	12	15	0.800	0.008	Yes	Yes
Q2 - Utilization of Talent	14	15	0.933	0.000	Yes	Yes
Q3 - Trust and Conflict	14	15	0.933	0.000	Yes	Yes
Q4 - Leadership	11	15	0.733	0.031	Yes	Yes
Q5 - Team Procedures	9	15	0.600	0.203	No	No
Q6 - Communication	10	15	0.667	0.089	No	No
Q7 - Problem Solving	12	15	0.800	0.008	Yes	Yes
Q8 - Creativity	9	15	0.600	0.203	No	No
Q9 - Evaluation	6	15	0.400	0.764	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 46 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 46 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I19

One Proportion Hypothesis Test of Statistical Significance
AET Junior Design Students – Spring '12 Start ($H_0 \leq 0.50 \mid H_1 > 0.50 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	11	12	0.917	0.003	Yes	Yes
Q2 - Utilization of Talent	10	12	0.833	0.019	Yes	Yes
Q3 - Trust and Conflict	10	12	0.833	0.019	Yes	Yes
Q4 - Leadership	6	12	0.500	0.613	No	No
Q5 - Team Procedures	8	12	0.667	0.194	No	No
Q6 - Communication	9	12	0.750	0.073	No	No
Q7 - Problem Solving	8	12	0.667	0.194	No	No
Q8 - Creativity	10	12	0.833	0.019	Yes	Yes
Q9 - Evaluation	9	12	0.750	0.073	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 50 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 50 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I20

One Proportion Hypothesis Test of Statistical Significance
AET Junior Design Students – Spring '12 Start ($H_0 \leq 0.48 \mid H_1 > 0.48 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	11	12	0.917	0.002	Yes	Yes
Q2 - Utilization of Talent	10	12	0.833	0.014	Yes	Yes
Q3 - Trust and Conflict	10	12	0.833	0.014	Yes	Yes
Q4 - Leadership	6	12	0.500	0.558	No	No
Q5 - Team Procedures	8	12	0.667	0.158	No	No
Q6 - Communication	9	12	0.750	0.056	No	No
Q7 - Problem Solving	8	12	0.667	0.158	No	No
Q8 - Creativity	10	12	0.833	0.014	Yes	Yes
Q9 - Evaluation	9	12	0.750	0.056	No	No

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 48 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 48 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I21

One Proportion Hypothesis Test of Statistical Significance
AET Junior Design Students – Spring '12 Start ($H_0 \leq 0.46 \mid H_1 > 0.46 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	11	12	0.917	0.001	Yes	Yes
Q2 - Utilization of Talent	10	12	0.833	0.010	Yes	Yes
Q3 - Trust and Conflict	10	12	0.833	0.010	Yes	Yes
Q4 - Leadership	6	12	0.500	0.501	No	No
Q5 - Team Procedures	8	12	0.667	0.126	No	No
Q6 - Communication	9	12	0.750	0.041	Yes	Yes
Q7 - Problem Solving	8	12	0.667	0.126	No	No
Q8 - Creativity	10	12	0.833	0.010	Yes	Yes
Q9 - Evaluation	9	12	0.750	0.041	Yes	Yes

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 46 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 46 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I22

One Proportion Hypothesis Test of Statistical Significance
AET Junior Design Students – Spring '12 End ($H_0 \leq 0.50 \mid H_1 > 0.50 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	16	19	0.842	0.002	Yes	Yes
Q2 - Utilization of Talent	14	19	0.737	0.032	Yes	Yes
Q3 - Trust and Conflict	16	19	0.842	0.002	Yes	Yes
Q4 - Leadership	15	19	0.789	0.010	Yes	Yes
Q5 - Team Procedures	15	19	0.789	0.010	Yes	Yes
Q6 - Communication	11	19	0.579	0.324	No	No
Q7 - Problem Solving	14	19	0.737	0.032	Yes	Yes
Q8 - Creativity	17	19	0.895	0.000	Yes	Yes
Q9 - Evaluation	14	19	0.737	0.032	Yes	Yes

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 50 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 50 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I23

One Proportion Hypothesis Test of Statistical Significance
AET Junior Design Students – Spring '12 End ($H_0 \leq 0.50 \mid H_1 > 0.50 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	16	19	0.842	0.002	Yes	Yes
Q2 - Utilization of Talent	14	19	0.737	0.032	Yes	Yes
Q3 - Trust and Conflict	16	19	0.842	0.002	Yes	Yes
Q4 - Leadership	15	19	0.789	0.010	Yes	Yes
Q5 - Team Procedures	15	19	0.789	0.010	Yes	Yes
Q6 - Communication	11	19	0.579	0.324	No	No
Q7 - Problem Solving	14	19	0.737	0.032	Yes	Yes
Q8 - Creativity	17	19	0.895	0.000	Yes	Yes
Q9 - Evaluation	14	19	0.737	0.032	Yes	Yes

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 50 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 50 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

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Table I24

One Proportion Hypothesis Test of Statistical Significance
AET Junior Design Students – Spring '12 End ($H_0 \leq 0.46 \mid H_1 > 0.46 \mid \alpha = 0.05$)

Variable[a]	X	N	Sample p	Exact p-value[b]	Reject Null	Significant
Q1 - Goals and Objectives	16	19	0.842	0.001	Yes	Yes
Q2 - Utilization of Talent	14	19	0.737	0.014	Yes	Yes
Q3 - Trust and Conflict	16	19	0.842	0.001	Yes	Yes
Q4 - Leadership	15	19	0.789	0.004	Yes	Yes
Q5 - Team Procedures	15	19	0.789	0.004	Yes	Yes
Q6 - Communication	11	19	0.579	0.209	No	No
Q7 - Problem Solving	14	19	0.737	0.014	Yes	Yes
Q8 - Creativity	17	19	0.895	0.000	Yes	Yes
Q9 - Evaluation	14	19	0.737	0.014	Yes	Yes

Note. H_0 = Proportion of students who rated the survey question between the scores of 5-7 is less than or equal to 46 %. H_1 = Proportion of students who rated the survey question between the scores of 5-7 is greater than 46 %. Q = Question.
[a]This column represents the 9 survey questions. [b]If the exact p-value was less than the α of 0.05 then H_0 was rejected and the variable was considered significant, but if the exact p-value was more than the α of 0.05 then H_0 was not rejected and the variable was not considered significant.

Appendix J

Table J1

Results for Pearson's Correlation Test – AET Senior Design Students

Pairs of Variables	Results for Fall '11 Single Survey - Trial 1 (N = 34)		Results for Spring '12 Start - Trial 2 (N = 34)		Results for Spring '12 End - Trial 3 (N = 30)	
	r	p-value	r	p-value	r	p-value
Goals and Objectives - Utilization of Talents	0.518	0.002	0.278	0.112	0.522	0.003
Goals and Objectives - Trust and Conflict[a]	0.410	0.016	0.376	0.029	0.602	0.000
Goals and Objectives - Communication	0.314	0.070	0.327	0.059	0.230	0.221
Goals and Objectives - Problem Solving	0.553	0.001	0.231	0.188	0.647	0.000
Goals and Objectives - Creativity	0.576	0.000	0.428	0.012	0.104	0.585
Utilization of Talents - Trust and Conflict[a]	0.558	0.001	0.465	0.006	0.616	0.000
Utilization of Talents - Communication	0.304	0.081	0.404	0.018	0.316	0.088
Utilization of Talents - Problem Solving[a]	0.407	0.017	0.514	0.002	0.656	0.000
Utilization of Talents - Creativity[a]	0.390	0.023	0.363	0.035	0.570	0.001
Trust and Conflict - Communication[a]	0.675	0.000	0.662	0.000	0.582	0.001
Trust and Conflict - Problem Solving	0.537	0.001	0.332	0.055	0.624	0.000
Trust and Conflict - Creativity	0.494	0.003	0.584	0.000	0.224	0.234
Communication - Problem Solving[a]	0.515	0.002	0.519	0.002	0.431	0.017
Communication - Creativity	0.353	0.041	0.492	0.003	0.119	0.530
Problem Solving - Creativity[a]	0.607	0.000	0.376	0.028	0.428	0.018

Note. The correlation analysis was performed using Minitab 15 statistical analysis software. A level of significance $\alpha = 0.05$ was used for this correlation analysis. If the p-value for the pair of variables was greater than 0.05 then the pair was considered statistically significant. If a pair of variables was statistically significant during all three trials then, it was considered a critically significant pair. All the variables shown in this table were considered critically significant via a one proportion hypothesis test of statistical significance.

[a]Represents those pairs of variables which are considered critically significant.

Appendix J

Table J2

Results for Pearson's Correlation Test – MET Senior Design Students

Pairs of Variables	Results for Fall '11		Results for Spring		Results for Spring	
	r	p-value	r	p-value	r	p-value
Goals and Objectives - Trust and Conflict	0.030	0.906	0.669	0.005	0.078	0.468
Goals and Objectives - Problem Solving	0.416	0.086	0.446	0.084	0.054	0.507
Trust and Conflict - Problem Solving	0.314	0.205	0.361	0.170	0.038	0.539

Note. The correlation analysis was performed using Minitab 15 statistical analysis software. A level of significance $\alpha = 0.05$ was used for this correlation analysis.

Appendix K

Definitions of Commonly Used Terms

Variable (y): Dependent Variable (row variable) - Survey scores (1-3 and 5-7)
Variable (x): Independent Variable (column variable) - Project management coursework (MET 325)
Prediction: Those students who have previously taken the MET 325 course have higher survey scores
Pair in Same Direction: MET 325 not taken = Lower survey scores or MET 325 taken = Higher survey scoress
Pair in Opposite Direction: MET 325 not taken = Higher survey scores or MET 325 taken = Lower survey scores

Sample Bi-Variate Frequency Table

Goals and Objectives Fall '11 Single Survey (AET Senior Design Students)

Score	MET 325 Not Taken	MET 325 Taken	Total
5-7	13	16	29
1-3	2	1	3

T_y Calculation Steps

Score	MET 325 Not Taken	MET 325 Taken
5-7	13	16
1-3	2	1

Score	MET 325 Not Taken	MET 325 Taken
5-7	13	16
1-3	2	1

$T_y = [(16*13) + (1*2)] = 210$

Pairs in the Same and Opposite Direction

Score	MET 325 Not Taken	MET 325 Taken
5-7	13	16
1-3	2	1

Score	MET 325 Not Taken	MET 325 Taken
5-7	13	16
1-3	2	1

Same = (2*16) = 32

Opposite = (13*1) = 13

Somers' D_{yx} Formula and Calculation

$$D_{yx} = \frac{\text{Same - Opposite}}{\text{Same + Opposite + } T_y}$$

D_{yx} = 7.5% → D_{yx} value is usually expressed in terms of percentage of cases

Somers' D_{yx} Interpretation

The value for D_{yx} falls between -1.00 to +1.00
A value of -0.075 suggests that 7.5% or more pairs of cases are ordered in the opposite direction
A value of +0.075 suggests that 7.5% or more pairs of cases are ordered in the same direction

Figure K. An example showing how to perform Somers' Dyx analysis. Adapted from "Social Statistics: A Test Using MicroCase," by W. Fox, 2002, pg. 165. Copyright 2002 by the Wadsworth Group.

Appendix L

Table L1

Somers' D_{yx} Analysis for Q1 – Goals and Objectives
AET Senior Design Students – Fall '11 Single Survey

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	13	16
1-3	2	1
Total	15	17
Number of pairs in same direction		32
Number of pairs in opposite direction		13
T_y		210
D_{yx} (%)		7.45

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Table L2

Somers' D_{yx} Analysis for Q2 – Utilization of Talent
AET Senior Design Students – Fall '11 Single Survey

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	13	10
1-3	1	1
Total	14	11
Number of pairs in same direction		10
Number of pairs in opposite direction		13
T_y		131
D_{yx} (%)		-1.95

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix L

Table L3

Somers' D_{yx} Analysis for Q3 – Trust and Conflict
AET Senior Design Students – Fall '11 Single Survey

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	15	13
1-3	1	0
Total	16	13
Number of pairs in same direction		13
Number of pairs in opposite direction		0
T_y		195
D_{yx} (%)		6.25

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Table L4

Somers' D_{yx} Analysis for Q6 – Communication
AET Senior Design Students – Fall '11 Single Survey

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	11	13
1-3	2	1
Total	13	14
Number of pairs in same direction		26
Number of pairs in opposite direction		11
T_y		145
D_{yx} (%)		8.24

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix L

Table L5

Somers' D_{yx} Analysis for Q7 – Problem Solving
AET Senior Design Students – Fall '11 Single Survey

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	11	13
1-3	1	1
Total	12	14
Number of pairs in same direction		13
Number of pairs in opposite direction		11
T_y		144
D_{yx} (%)		1.19

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Table L6

Somers' D_{yx} Analysis for Q8 – Creativity
AET Senior Design Students – Fall '11 Single Survey

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	12	11
1-3	2	0
Total	14	11
Number of pairs in same direction		22
Number of pairs in opposite direction		0
T_y		132
D_{yx} (%)		14.29

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix L

Table L7

Somers' D_{yx} Analysis for Q1 – Goals and Objectives
AET Senior Design Students – Spring '12 Start

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	14	16
1-3	2	0
Total	16	16
Number of pairs in same direction		32
Number of pairs in opposite direction		0
T_y		224
D_{yx} (%)		12.50

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Table L8

Somers' D_{yx} Analysis for Q2 – Utilization of Talent
AET Senior Design Students – Spring '12 Start

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	14	11
1-3	3	1
Total	17	12
Number of pairs in same direction		33
Number of pairs in opposite direction		14
T_y		157
D_{yx} (%)		9.31

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix L

Table L9

Somers' D_{yx} Analysis for Q3 – Trust and Conflict
AET Senior Design Students – Spring '12 Start

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	12	15
1-3	3	0
Total	15	15
Number of pairs in same direction		45
Number of pairs in opposite direction		0
T_y		180
D_{yx} (%)		20.00

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Table L10

Somers' D_{yx} Analysis for Q6 – Communication
AET Senior Design Students – Spring '12 Start

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	10	13
1-3	2	2
Total	12	15
Number of pairs in same direction		26
Number of pairs in opposite direction		20
T_y		134
D_{yx} (%)		3.33

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix L

Table L11

Somers' D_{yx} Analysis for Q7 – Problem Solving
AET Senior Design Students – Spring '12 Start

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	14	11
1-3	1	3
Total	15	14
Number of pairs in same direction		11
Number of pairs in opposite direction		42
T_y		157
D_{yx} (%)		-14.76

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Table L12

Somers' D_{yx} Analysis for Q8 – Creativity
AET Senior Design Students – Spring '12 Start

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	11	14
1-3	2	1
Total	13	15
Number of pairs in same direction		28
Number of pairs in opposite direction		11
T_y		156
D_{yx} (%)		8.72

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix L

Table L13

Somers' D_{yx} Analysis for Q1 – Goals and Objectives
AET Senior Design Students – Spring '12 End

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	11	15
1-3	2	1
Total	13	16
Number of pairs in same direction		30
Number of pairs in opposite direction		11
T_y		167
D_{yx} (%)		9.13

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Table L14

Somers' D_{yx} Analysis for Q2 – Utilization of Talent
AET Senior Design Students – Spring '12 End

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	12	12
1-3	1	1
Total	13	13
Number of pairs in same direction		12
Number of pairs in opposite direction		12
T_y		145
D_{yx} (%)		0.00

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix L

Table L15

Somers' D_{yx} Analysis for Q3 – Trust and Conflict
AET Senior Design Students – Spring '12 End

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	8	14
1-3	1	0
Total	9	14
Number of pairs in same direction		14
Number of pairs in opposite direction		0
T_y		112
D_{yx} (%)		11.11

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Table L16

Somers' D_{yx} Analysis for Q6 – Communication
AET Senior Design Students – Spring '12 End

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	10	12
1-3	1	1
Total	11	13
Number of pairs in same direction		12
Number of pairs in opposite direction		10
T_y		121
D_{yx} (%)		1.40

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix L

Table L17

Somers' D_{yx} Analysis for Q7 – Problem Solving
AET Senior Design Students – Spring '12 End

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	9	11
1-3	1	2
Total	10	13
Number of pairs in same direction		11
Number of pairs in opposite direction		18
T_y		101
D_{yx} (%)		-5.38

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Table L18

Somers' D_{yx} Analysis for Q8 – Creativity
AET Senior Design Students – Spring '12 End

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	10	11
1-3	0	1
Total	10	12
Number of pairs in same direction		0
Number of pairs in opposite direction		10
T_y		110
D_{yx} (%)		-8.33

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix L

Table L19

Somers' D_{yx} Analysis for Q1 – Goals and Objectives
MET Senior Design Students – Fall '11 Single Survey

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	2	14
1-3	0	1
Total	2	15

Number of pairs in same direction	0
Number of pairs in opposite direction	2
T_y	28
D_{yx} (%)	-6.67

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Table L20

Somers' D_{yx} Analysis for Q3 – Trust and Conflict
MET Senior Design Students – Fall '11 Single Survey

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	1	14
1-3	0	1
Total	1	15

Number of pairs in same direction	0
Number of pairs in opposite direction	1
T_y	14
D_{yx} (%)	-6.67

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix L

Table L21

Somers' D_{yx} Analysis for Q7 – Problem Solving
MET Senior Design Students – Fall '11 Single Survey

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	2	11
1-3	0	3
Total	2	14

Number of pairs in same direction	0
Number of pairs in opposite direction	6
T_y	22
D_{yx} (%)	-21.43

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Table L22

Somers' D_{yx} Analysis for Q1 – Goals and Objectives
MET Senior Design Students – Spring '12 Start

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	2	12
1-3	1	1
Total	3	13

Number of pairs in same direction	12
Number of pairs in opposite direction	2
T_y	25
D_{yx} (%)	25.64

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix L

Table L23

Somers' D_{yx} Analysis for Q3 – Trust and Conflict
MET Senior Design Students – Spring '12 Start

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	2	11
1-3	0	0
Total	2	11

Number of pairs in same direction	0
Number of pairs in opposite direction	0
T_y	22
D_{yx} (%)	0.00

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Table L24

Somers' D_{yx} Analysis for Q7 – Problem Solving
MET Senior Design Students – Spring '12 Start

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	2	10
1-3	1	1
Total	3	11

Number of pairs in same direction	10
Number of pairs in opposite direction	2
T_y	21
D_{yx} (%)	24.24

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix L

Table L25

Somers' D_{yx} Analysis for Q1 – Goals and Objectives
MET Senior Design Students – Spring '12 End

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	2	10
1-3	0	1
Total	2	11

Number of pairs in same direction	0
Number of pairs in opposite direction	2
T_y	20
D_{yx} (%)	-9.09

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Table L26

Somers' D_{yx} Analysis for Q3 – Trust and Conflict
MET Senior Design Students – Spring '12 End

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	2	12
1-3	0	0
Total	2	12

Number of pairs in same direction	0
Number of pairs in opposite direction	0
T_y	24
D_{yx} (%)	0.00

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix L

Table L27

Somers' D_{yx} Analysis for Q7 – Problem Solving
MET Senior Design Students – Spring '12 End

Score	MET 325 Not Taken (f)	MET 325 Taken (f)
5-7	1	11
1-3	0	0
Total	1	11

Number of pairs in same direction	0
Number of pairs in opposite direction	0
T_y	11
D_{yx} (%)	0.00

Note. A positive D_{yx} value indicates that more pairs are ordered in the same direction whereas a negative D_{yx} value indicates that more pairs are ordered in the opposite direction.

Appendix M

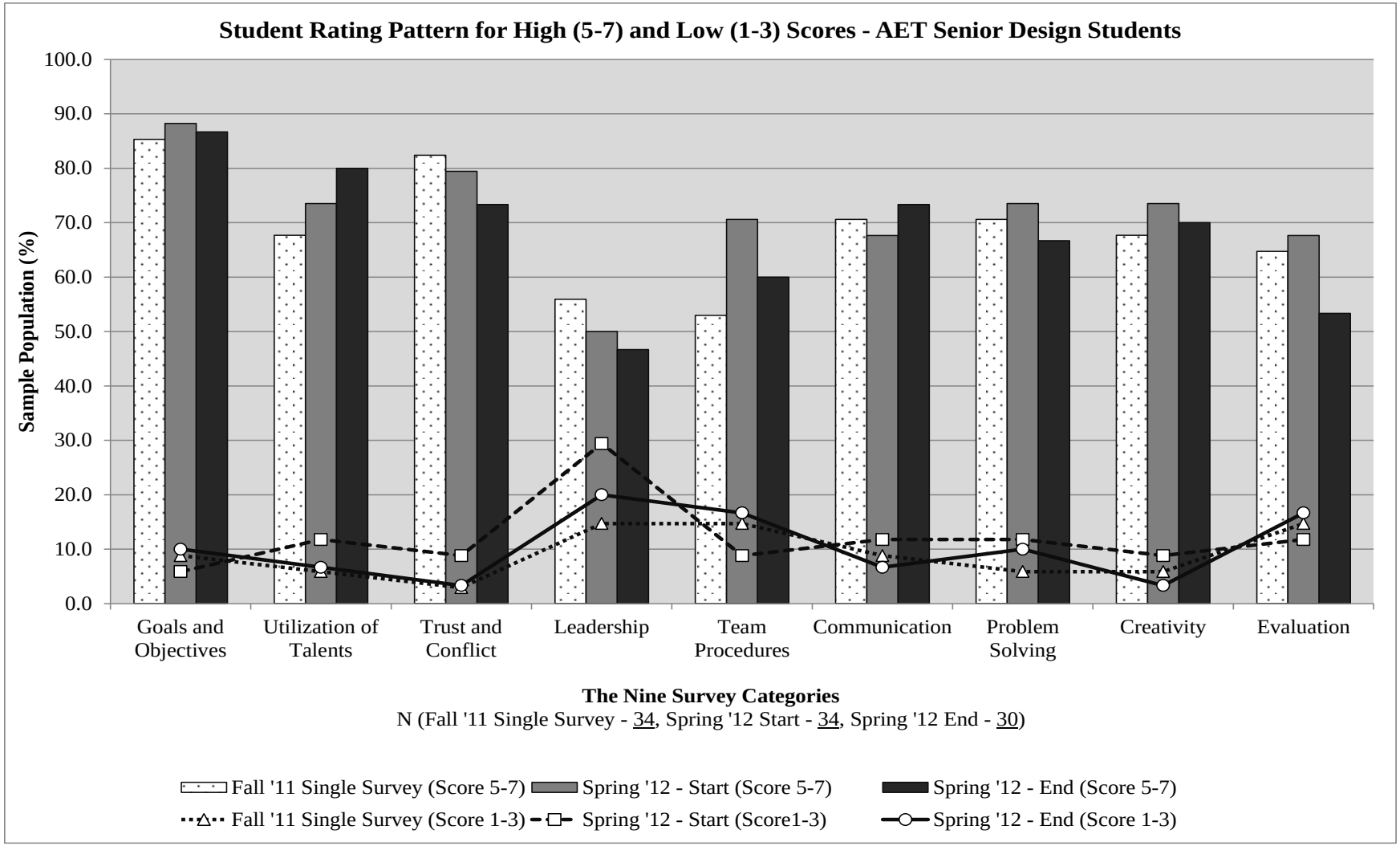

Figure M1. Comparison of Student Rating Pattern for High (5-7) and Low (1-3) Scores Related to the Nine Survey Categories – AET Senior Design Students.

Appendix M

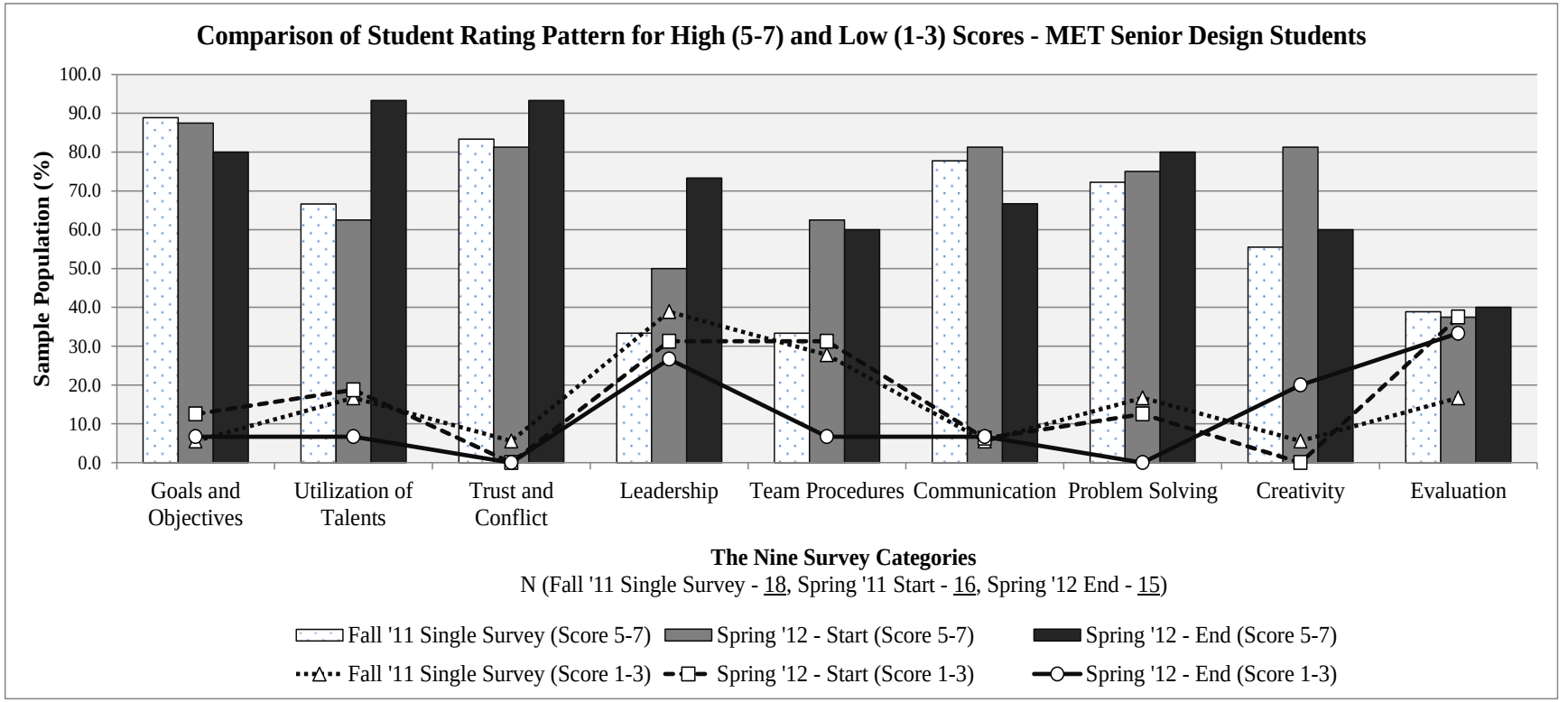

Figure M2. Comparison of Student Rating Pattern for High (5-7) and Low (1-3) Scores Related to the Nine Survey Categories – MET Senior Design Students.

Appendix M

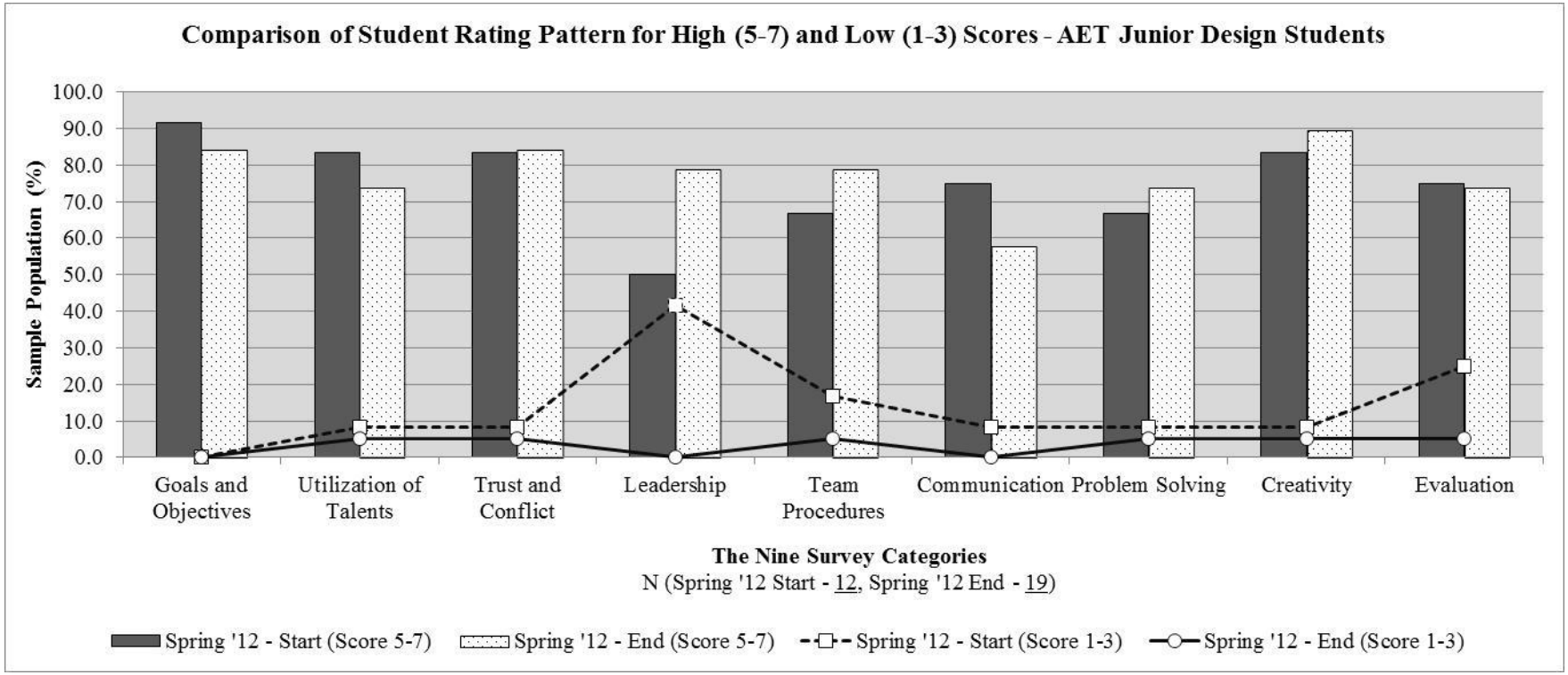

Figure M3. Comparison of Student Rating Pattern for High (5-7) and Low (1-3) Scores Related to the Nine Survey Categories – AET Junior Design Students.

Appendix N

Table N1

Comparison of Scores – Students who Took MET 325 vs. Students who did Not Take MET 325 Prior to the Survey – AET Senior Design Students

Variable	MET 325 Taken		MET 325 Not Taken	
	Scores 1-3	Scores 5-7	Scores 1-3	Scores 5-7
Fall '11 Single Survey	(N) = (17)		(N) = (17)	
Q1 - Goals and Objectives	6	94	12	76
Q2 - Utilization of Talent	6	59	6	76
Q3 - Trust and Conflict	0	76	6	88
Q4 - Leadership	12	59	18	53
Q5 - Team Procedures	6	65	24	41
Q6 - Communication	6	76	12	65
Q7 - Problem Solving	6	76	6	65
Q8 - Creativity	0	65	12	71
Q9 - Evaluation	12	71	18	59
Spring '12 - Start	(N) = (17)		(N) = (17)	
Q1 - Goals and Objectives	0	94	12	82
Q2 - Utilization of Talent	6	65	18	82
Q3 - Trust and Conflict	0	88	18	71
Q4 - Leadership	29	47	29	53
Q5 - Team Procedures	6	65	12	76
Q6 - Communication	12	76	12	59
Q7 - Problem Solving	18	65	6	82
Q8 - Creativity	6	82	12	65
Q9 - Evaluation	12	76	12	59
Spring '12 - End	(N) = (16)		(N) = (14)	
Q1 - Goals and Objectives	6	94	14	79
Q2 - Utilization of Talent	6	75	7	86
Q3 - Trust and Conflict	0	88	7	57
Q4 - Leadership	19	50	21	43
Q5 - Team Procedures	13	69	21	50
Q6 - Communication	6	75	7	71
Q7 - Problem Solving	13	69	7	64
Q8 - Creativity	6	69	0	71
Q9 - Evaluation	6	56	29	50

Note. Q = Question; MET 325 = Project Management.

Appendix N

Table N2

Comparison of Scores – Students who Took MET 325 vs. Students who Did Not Take MET 325 Prior to the Survey – MET Senior Design Students

Variable[a]	MET 325 Taken		MET 325 Not Taken	
	Scores 1-3	Scores 5-7	Scores 1-3	Scores 5-7
Fall '11 Single Survey	(N) = (16)		(N) = (2)	
Q1 - Goals and Objectives	6	88	0	100
Q2 - Utilization of Talent	19	63	0	100
Q3 - Trust and Conflict	6	88	0	50
Q4 - Leadership	44	25	0	100
Q5 - Team Procedures	31	31	0	50
Q6 - Communication	6	75	0	100
Q7 - Problem Solving	19	69	0	100
Q8 - Creativity	6	56	0	50
Q9 - Evaluation	19	31	0	100
Spring '12 - Start	(N) = (13)		(N) = (3)	
Q1 - Goals and Objectives	8	92	33	67
Q2 - Utilization of Talent	23	69	0	33
Q3 - Trust and Conflict	0	85	0	67
Q4 - Leadership	31	46	33	67
Q5 - Team Procedures	31	62	33	67
Q6 - Communication	8	85	0	67
Q7 - Problem Solving	8	77	33	67
Q8 - Creativity	0	85	0	67
Q9 - Evaluation	38	38	33	33
Spring '12 - End	(N) = (13)		(N) = (2)	
Q1 - Goals and Objectives	8	77	0	100
Q2 - Utilization of Talent	8	92	0	100
Q3 - Trust and Conflict	0	92	0	100
Q4 - Leadership	23	77	50	50
Q5 - Team Procedures	8	62	50	50
Q6 - Communication	8	69	0	50
Q7 - Problem Solving	0	85	0	50
Q8 - Creativity	15	62	50	50
Q9 - Evaluation	31	38	50	50

Note. Q = Question; MET 325 = Project Management.

Appendix N

Table N3

Comparison of Scores – Students who Took MET 325 vs. Students who Did Not Take MET 325 Prior to the Survey – AET Junior Design Students

	MET 325 Taken		MET 325 Not Taken	
	Scores 1-3	Scores 5-7	Scores 1-3	Scores 5-7
Spring '12 - Start	(N) = (6)		(N) = (6)	
Q1 - Goals and Objectives	0	83	0	100
Q2 - Utilization of Talent	0	83	17	83
Q3 - Trust and Conflict	0	100	17	67
Q4 - Leadership	50	33	33	67
Q5 - Team Procedures	17	50	17	83
Q6 - Communication	0	100	17	50
Q7 - Problem Solving	0	67	17	67
Q8 - Creativity	0	83	17	83
Q9 - Evaluation	33	67	17	83
Spring '12 - End	(N) = (10)		(N) = (9)	
Q1 - Goals and Objectives	0	100	0	67
Q2 - Utilization of Talent	0	80	11	67
Q3 - Trust and Conflict	0	90	11	78
Q4 - Leadership	0	70	0	89
Q5 - Team Procedures	0	80	11	78
Q6 - Communication	0	50	0	67
Q7 - Problem Solving	0	90	11	56
Q8 - Creativity	0	100	11	78
Q9 - Evaluation	0	60	11	89

Note. The AET Junior Design course is only offered during the Spring semester, as a result no data is available for the Fall '11 semester. Q = Question;
MET 325 = Project Management

Appendix O

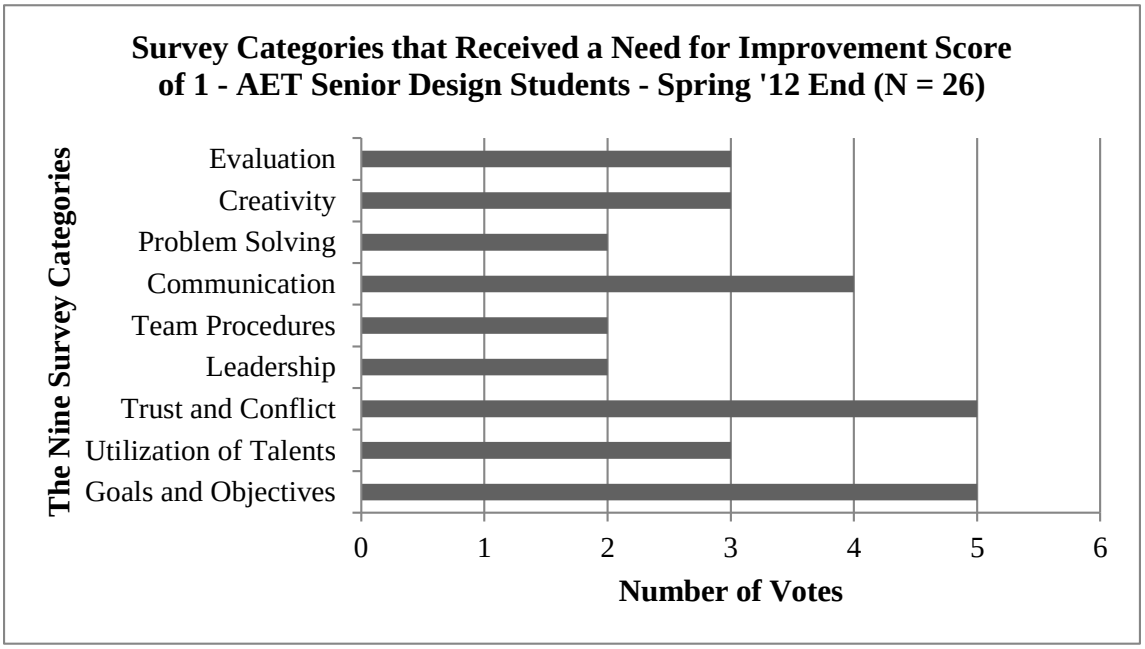

Figure O1. Student Rating Pattern for Survey Question 10 – AET Senior Design Students – Spring ’12 End. N = Number of valid responses.

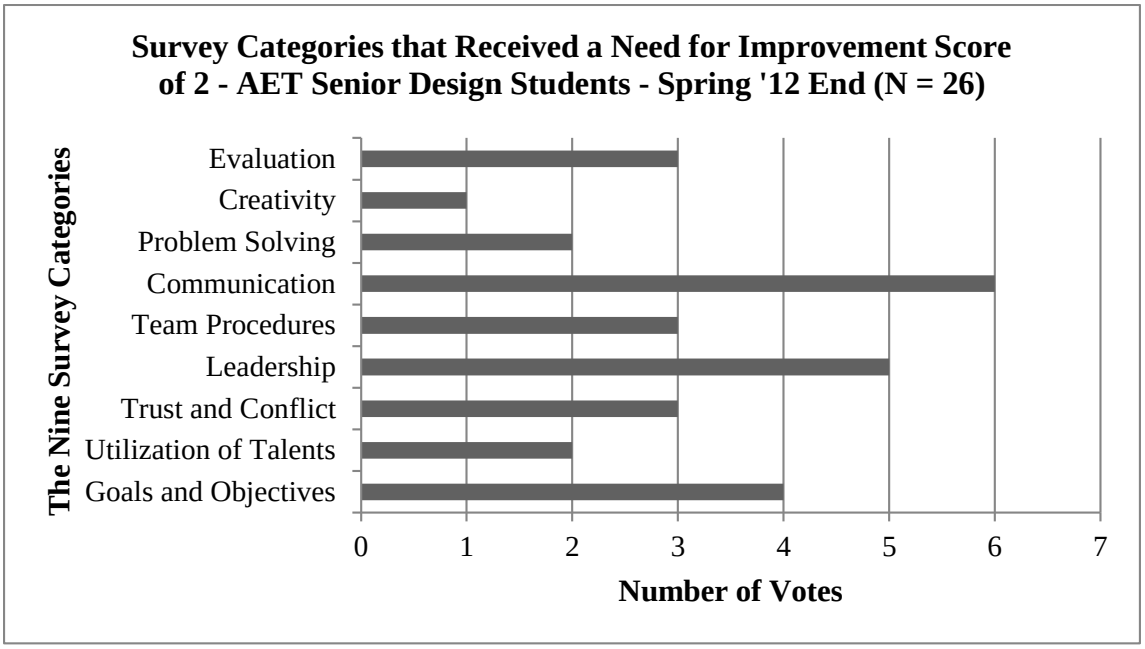

Figure O2. Student Rating Pattern for Survey Question 10 – AET Senior Design Students – Spring ’12 End. N = Number of valid responses.

Appendix O

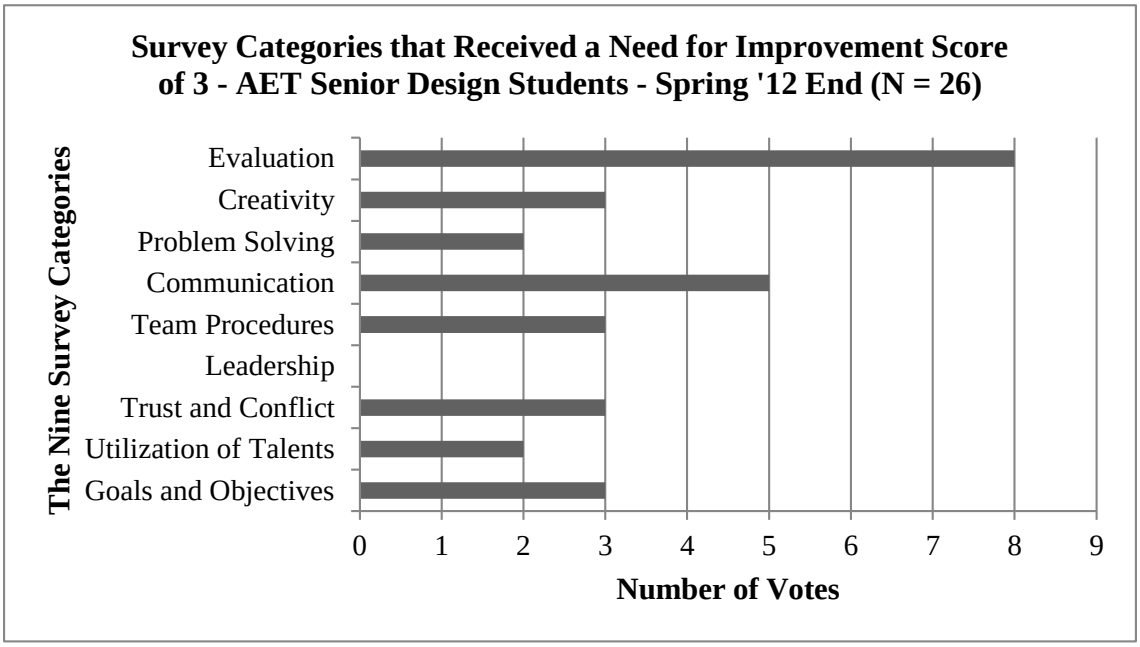

Figure O3. Student Rating Pattern for Survey Question 10 – AET Senior Design Students – Spring ’12 End. N = Number of valid responses.

Appendix O

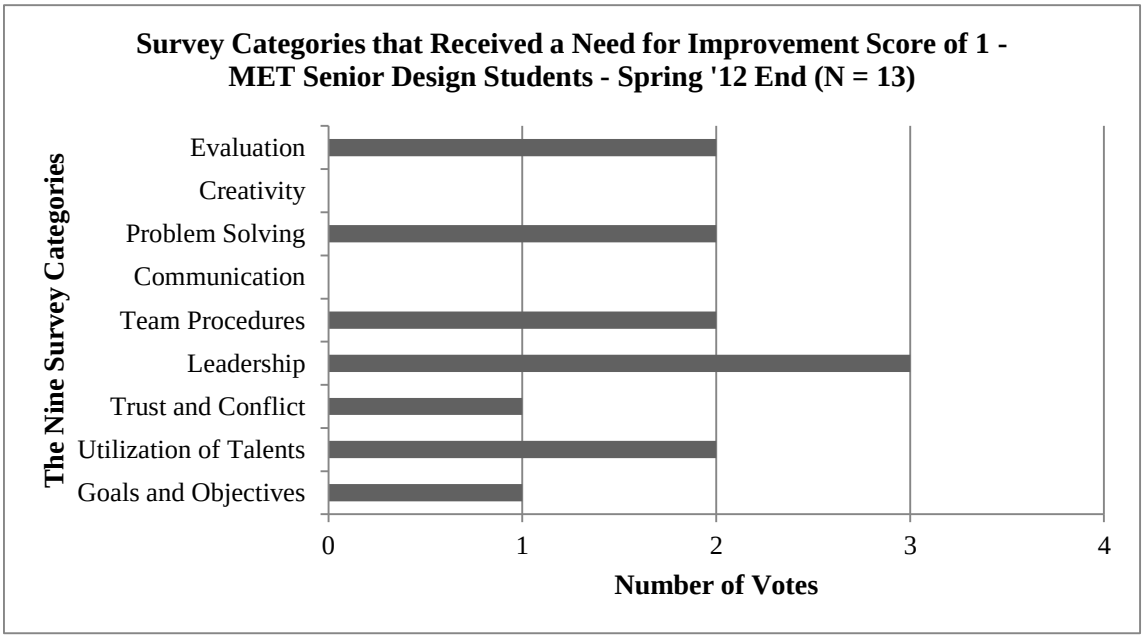

Figure O4. Student Rating Pattern for Survey Question 10 – MET Senior Design Students – Spring ’12 End. N = Number of valid responses.

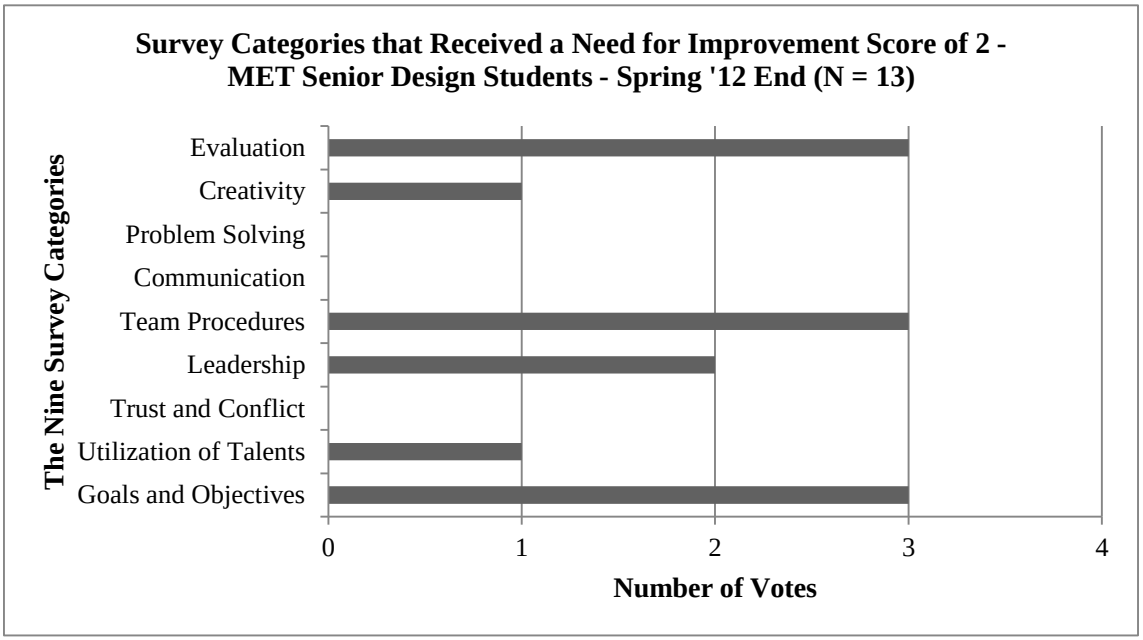

Figure O5. Student Rating Pattern for Survey Question 10 – MET Senior Design Students – Spring ’12 End. N = Number of valid responses.

Appendix O

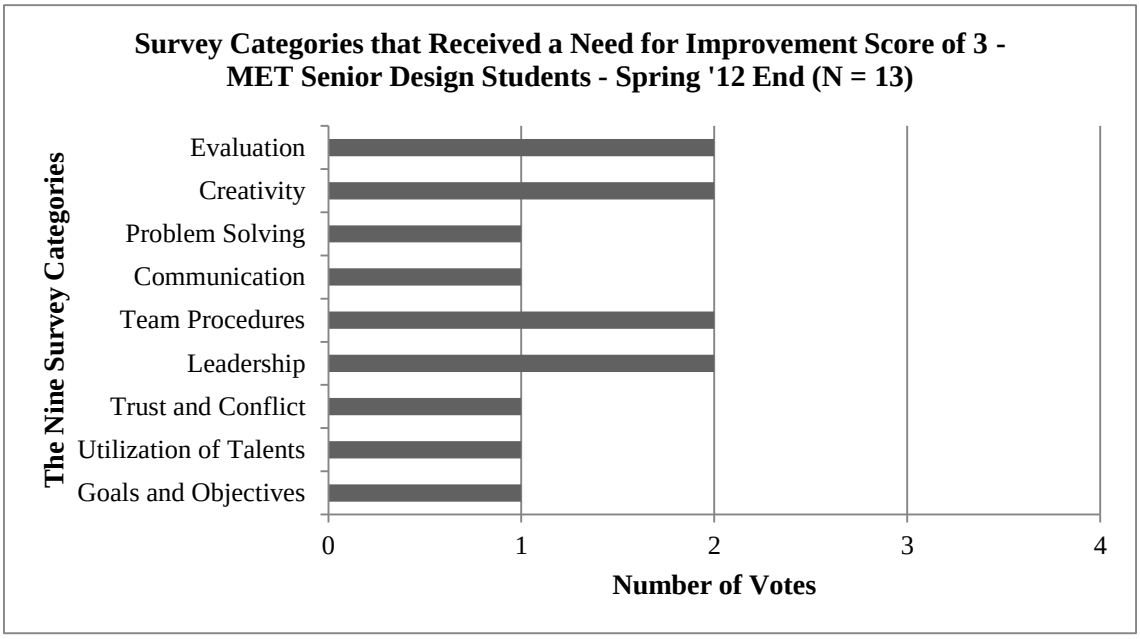

Figure O6. Student Rating Pattern for Survey Question 10 – MET Senior Design Students – Spring ’12 End. N = Number of valid responses.