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Quality System for A Distance Doctoral Consortium: Determination and Analysis of Specific Indicators

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QUALITY SYSTEM FOR A DISTANCE DOCTORAL CONSORTIUM: DETERMINATION AND ANALYSIS OF SPECIFIC INDICATORS

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ABSTRACT

The problem for this research was that there were no identified and confirmed quality system model attributes for a successful online technology management doctoral consortium. The research extended existing research, and utilized a delphi panel to develop the attributes of a quality system model for a successful online doctoral consortium. The attributes of a quality system were developed by a three round delphi procedure and were used to develop a survey to determine perceived quality system differences among faculty, Ph.D. graduates, and current Ph.D. students associated with the Indiana State University (ISU) at Terre Haute Technology Management Ph.D. Consortium program. A proposed graphical quality system model capable of supporting the attributes of an online doctoral consortium was developed and utilized with the study and survey. Hypotheses testing and statistical analysis of the online survey were done to determine perceived quality system differences among faculty, Ph.D. graduates, and current Ph.D. students associated with the ISU Technology Management Ph.D. Consortium program.

The research has indicated that there is a significant difference in the level of agreement the faculty expressed with regards to the ISU Technology Management Ph.D. Consortium in comparison to two other major Ph.D. consortium groups, the graduates and the students. While there was statistical evidence of differences in the three groups of faculty, graduates and students in the ISU Technology Management Ph.D. Consortium program, it was relatively minor. Twelve of the 63 quality indicators from the survey show some type of statistically significant difference in paired combination of faculty-student, faculty-graduate, student-graduate.

DEDICATION

This dissertation is dedicated to my wife, Kathryn Mary Chandler, who has supported me in my lifelong learning and this PhD degree. Oceans of love and thank you for the years you let me stay focused and complete this activity.

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I would like to also acknowledge my appreciation for the courtesy and assistance of the other faculty, Ph.D. graduates and current Ph.D. students who are still in the Indiana State University (Terre Haute) Technology Management PhD Consortium program.

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CHAPTER 1

INTRODUCTION

Overview

This research leads to the development and validation of a quality system model of the existing online Indiana State University (ISU) Technology Management Ph.D. Consortium. This consortium has both a "bricks & mortar" and predominant virtual population of faculty, Ph.D. graduates, and current Ph.D. students. The model system was the associated quality system of a technology management online doctoral consortium.

The research was built on extant literature, including existing research on the ISU Technology Management Ph.D. Consortium (http://technology.indstate.edu/consortphd/). A delphi study was used to develop quality system model attributes for a successful online doctoral consortium. The delphi study was composed of individuals not involved with the ISU Technology Management Ph.D. Consortium. The delphi study generated quality attributes that were used to develop a survey to determine quality system attribute differences between major groups associated with the ISU Technology Management Ph.D. Consortium. The survey focused on three groups, the consortium faculty, Ph.D. graduates, and current Ph.D. students. To confirm the attributes of a quality system model developed by the delphi panel, a survey was made available to faculty, graduates, and students of the ISU Technology Management Ph.D. Consortium program. The survey results were statistically analyzed.

A proposed quality system model capable of supporting the quality attributes of an online doctoral consortium was developed by the researcher. This graphical model was suggested and utilized with the delphi panel. During the survey directed at three groups in the ISU Technology Management Ph.D. Consortium, the proposed graphical quality system model capable of supporting the quality attributes of an online doctoral consortium was again suggested and used.

Background

There is a broad body of knowledge (BOK) associated with educational research. In the area of higher education, this direction of research has progressed from individual courses in undergraduate programs, to graduate programs (such as specific Master's or Ph.D. programs), to domestic single-state (Hendrix, 2005) or multi-state consortia (Peterson, 2002), and finally to international higher education consortia (Anderson, 1999; International Consortium for Educational Development in Higher Education, 2006). Higher education consortia include a wide range of activities for various purposes. There has also been an evolution and migration to Internet-based delivery of higher education, to the point that Epper and Garn (2003, p. 3) suggested that "by the year 2000, almost every state in the nation had created some initiative or entity resembling a virtual university." This situation further developed, and Levy (2003) suggested that six factors can be considered for online distance learning programs in higher education:1) vision and plans, 2) curriculum, 3) staff training and support, 4) student services, 5) student training and support, and 6) copyright and intellectual property. This is similar to the basic components of a model for a successful doctoral program suggested by Wulff and Nerad (2006): 1) program activities; 2) students, faculty, and staff; 3) desired outcomes; 4) and the context of doctoral programs.

There is evidence in the popular and research literature that there is an ongoing interest in higher education from a wide range of stakeholders for a number of purposes. A partial list of stakeholders includes academic researchers, faculty, students, administrators, taxpayers, government officials—local, state and federal levels—alumni, potential students, employers, and others. The various stakeholders can have one or more purposes (Houston, 2008, p. 63; Mariasingam & Hanna, 2006), and typical examples include quality (Haworth & Conrad, 1997, p. 3), research, finances, curriculum, administration, resources, and others. By direct extension, this is true of higher education consortia (Association for Consortium Leadership, 2007; Moore, 1968), and the literature suggests benefits can be found in the areas and functions of enrichment of member institutions, complementarity of offerings, cost savings and/or containment (Peterson, 2002). Of particular interest to this research are the aspects of technology management and quality.

One of the tools available for the application of technology management (Khalil, 2000) to organizations is quality assessment (Banta, 2002; Evans, 2005). There is a broad and well-established body of research associated with quality and assessment in education, including distance (Moore, 2007) and higher education (Miller, 2007). The assessment of doctoral education (Maki & Borkowski, 2006) can be further refined to focus on the assessment of Ph.D. programs (Hendrix, 2005; National Research Council, 2010).

In building on the work of Bilke, Xia, Bailey, Rodchua, and Sinn (2006) and Hendrix (2005), a methodology was proposed to examine the problem for this research. This research problem was to identify and confirm the quality system model attributes for a successful online doctoral consortium. The combined publications include several salient features, including proposing a quality system model, the development of a flowchart of consortium Ph.D. processes

for turning an applicant into a graduate (Bilke et al., 2006, p. 4), and conducting a preliminary analysis of strengths and weaknesses of the quality systems in the ISU Technology Management Ph.D. Consortium.

This research was built on existing research (Mariasingam, 2005), and used the delphi study methodology (Rockwell, Furgason, & Marx, 2000; Skulmoski, Hartman, & Krahn, 2007). A modified delphi study was proposed to first develop a quality system model (Murari, n.d.; Ono & Wedemeyer, 1994; Rogers, 2001; Satterfield, 2007). The delphi study will provide the data used as a basis for the subsequent development of an online survey (Creswell, 2003). This survey allowed for hypotheses testing and statistical analysis (Minium, Clarke, & Coladarci, 1999; Gall, Gall, & Borg, 2003). A graphical model of the ISU Technology Management Ph.D. Consortium quality system was developed and used in the delphi panel and survey research. This incorporated tools such as process mapping (Bruno, 1995; Manos, 2006; Sinn, 2008; Woll, 2003) and gap analysis (Judd, 1998; LaBay & Comm, 2003).

The purpose of this research was to

- develop assessment methodology building on existing research;
- utilize a modified delphi study methodology to develop the attributes of a quality system model attributes for a successful online doctoral consortium;
- develop and administer a survey to determine perceived quality system differences between three groups associated with the online ISU Technology Management Ph.D. Consortium (faculty, graduates, and Ph.D. students) to allow hypotheses testing and statistical analysis; and
- utilize a proposed graphical model of the ISU Technology Management Ph.D. Consortium quality system.

Statement of the Problem

The problem for this research was that there were no identified and confirmed quality system model attributes for a successful online technology management doctoral consortium.

Statement of the Research Questions and Hypotheses

To examine the research questions this researcher utilized a delphi study to develop and/or refine the quality system model attributes of a successful online doctoral consortium. This process was followed by the development and delivery of a survey to confirm the quality system model attributes of the existing online ISU Technology Management Ph.D. Consortium. By applying appropriate statistical techniques to analyze the survey data, this research allowed the following research questions to be answered:

RQ1. What were the expected indicators of quality for a quality system model for a successful online technology management Ph.D. consortium?

RQ2. What were the differences between major groups of the existing online ISU Technology Management Ph.D. Consortium with respect to the expected quality indicators of the quality system model for a successful online technology management Ph.D. consortium?

RQ3. What were the responses to a proposed graphical model of the ISU Technology Management Ph.D. Consortium quality system by the delphi panel and survey respondents?

The first research question was exploratory, and determined the characteristics of a quality system for an online technology management Ph.D. consortium. The research was preceded by vetting of research methodology and the use of a comprehensive literature review to

generate topics for the delphi panel to process, and the results were used to develop a suitable survey.

The second research question determined the quality system attribute differences between three groups associated with the ISU Technology Management Ph.D. Consortium participants program (faculty, graduates, and current Ph.D. students). These differences included those among first-year students and Ph.D. candidates (after passing preliminary exams). This research question allowed for hypotheses testing and statistical analysis.

The third research question was to determine what the responses are to a proposed graphical model of the existing ISU Technology Management Ph.D. Consortium quality system by the delphi panel and survey respondents.

These research questions lead to the following research hypotheses:

H_{01}: There is no significant difference in quality indicators between faculty and students.

H_{02}: There is no significant difference in quality indicators between faculty and graduates.

H_{03}: There is no significant difference in quality indicators between students and graduates.

H_{04}: There is no significant difference in quality indicators between first-year students and Ph.D. candidates (after passing preliminary exams).

H_{05}: There is no significant difference in quality indicators between faculty, students, and graduates.

Statement of the Purpose

The evolution of higher education has progressed to the point where ten years ago the online ISU Technology Management Ph.D. Consortium was organized by (then) six universities. The ranges of forces affecting the spectrum of academic institutions are also affecting the online ISU Technology Management Ph.D. Consortium. A model of the associated quality system of

the successful ISU Technology Management Ph.D. Consortium was used as a framework for assessment (Epper & Garn, 2003; Wulff & Nerad, 2006). Organizational quality was acknowledged as a strategy for academic institutions to survive and improve. This research identified expected and existing indicators of quality for a quality system for an online technology management Ph.D. consortium.

This research resulted in suggested ways to improve the quality system of a technology management Ph.D. consortium. It was anticipated that the results would be transferable to other domestic and international online doctoral consortia and programs.

This research may also be framed in response to the need for improvement of doctoral completion rates, "which now hover around 50% across disciplines for all programs nationally" (Cyr & Muth, 2006, p. 216).

Statement of the Need

The proposed study contributed to the understanding of quality systems of higher education consortium and provided an approach for assessment of higher education doctoral consortium quality systems.

Statement of the Assumptions

There are no outcome differences between "bricks & mortar" and virtual population of Ph.D. students, candidates, and graduates (Jahng, Krug, & Zhang, 2007; Topper, 2007). The delphi panel approach combined with a carefully constructed survey was the most suitable methodology for this study, and results can be generalized. As stated by Funk and Klomparens (2006) "graduate education, especially doctoral education, is a system" (p. 145).

Statement of the Limitations

The primary limitation for this study was that it was based only on a single online technology management Ph.D. consortium.

Statement of the Methodology

Delphi methodology

The delphi methodology is a well-developed and well-established research methodology (Okoli & Pawlowski, 2004; Ono & Wedemeyer, 1994; Skulmoski et al., 2007). This research used a modified delphi methodology with one delphi panel conducted with three rounds. The comprehensive literature review developed quality model attributes used as input into the initial delphi panel with an accept or reject or modify format for consideration of the quality indicators. The initial delphi questionnaire was vetted and tested.

The three round delphi panels were planned to be of 8 to 12 members with the delphi panel of experts selected based on their current involvement with quality and online higher education programs. The delphi panel methodology was used to develop the quality system model attributes of a successful online doctoral consortium.

Survey methodology

The results of the preliminary delphi study were used to develop a survey instrument. This was an online survey sent out via e-mail to the three major groups involved with the ISU Technology Management Ph.D. Consortium. It was estimated that there are approximately 250 survey candidates in the ISU Technology Management Ph.D. Consortium program and anticipated that if 50% responded, there would be about 125 participants for this research. Thirty survey responses were anticipated as a reasonable number for each sample group. Relevant statistical methods used with this research can be used in analyzing a small sample size of 25 -

30 cases or less (Arsham, 2011; Minium et al., 1999, p. 186). Three groups of faculty, Ph.D. graduates, and current Ph.D. students were surveyed, and approximately 90 were needed for the statistical testing. Sample size for groups was calculated at 26, after Minium et al. (p. 316). This researcher resulted in the development of quantitative data, and allowed for hypotheses testing and statistical analysis.

Graphical model/flowcharts

The literature and related ongoing research (Bilke et al., 2006) suggests the use of process mapping, flowcharts, and value stream mapping (Bruno, 1995; Sinn, 2008; Woll, 2003) as effective and complementary activities associated with this research. Relevant to this research are the flowcharts developed by Bilke et al. (2006) for an existing online distance Ph.D. consortium, as well as the Ph.D. in Technology Management Flow Process (2008) from Indiana State University College of Technology Ph.D. in Technology Management program.

Research design

The research design included a typical delphi process (Day & Bobeva, 2005, Skulmoski et al., 2007). Through the comprehensive literature review an initial list of a number of quality system models were examined (Becket & Brookes, 2008; Sorensen, Furst-Bowe, & Moen, 2005; Woolsey & Rodchua, 2004). A set of quality system attributes were developed and used as input into the delphi panel. Each delphi round activity involved a questionnaire based on an Excel spreadsheet. In contrast to the method of Hendrix (2005) utilized an accept or reject or modify scale (Tigelaar, Dolmans, Wolfhagen, & Van der Vleuten, 2004). It was planned that a three-round delphi panel methodology would be utilized, which also considered a graphical model of the quality system attributes of a successful online doctoral consortium. Unlike the methodology

of Hendrix or Tigelaar et al., stability was not used to determine if a subsequent round was needed, and three rounds of the delphi panel were planned.

The results of the delphi study were used to develop a survey instrument which was sent out to all members of the three major groups in the ISU Technology Management Ph.D. Consortium program. It was anticipated that if 50% responded, there would be about 125 participants for this research. Thirty was planned as a reasonable number for each sample group and the sample size for the three groups was calculated at 26. Three groups (faculty, graduates and current Ph.D. students) were investigated, with approximately 90 needed for the statistical testing. This sample size for the research developed quantitative data and allowed utilization of statistical tools. A qualitative graphical model was prepared of the associated processes that were considered and developed by the respective delphi panel and survey groups.

Procedures

The literature review was used to determine a set of quality indicators for a quality system of an online technology management Ph.D. consortium. This activity also allowed for the identification and subsequent selection of expert participants in the delphi panel. The research procedure utilized three successive delphi rounds as the modified delphi methodology (Day & Bobeva, 2005; Skulmoski et al., 2007). The delphi methodology included conducting the first delphi round, processing the first round and proceeding to second delphi round. Then conduct the second round, process the second round, and proceed to third delphi round. Then conduct that final round, process the third round and confirmed termination of the delphi panel. Concurrently, a graphical process model for a successful online doctoral consortium was considered and revised.

The results of the delphi panel were used as input and development of a survey to investigate a set of expected indicators of a quality system for the ISU Technology Management Ph.D. Consortium. This included consideration of a graphic model by the ISU Technology Management Ph.D. Consortium program participants of faculty, graduates and current Ph.D. students. The use of the delphi and survey methodologies by various researchers and authors (Hendrix, 2005; Linstone & Turoff, 1975; Rockwell et al., 2000; Schmidt, 1997; Williams, 2000) has involved both qualitative and quantitative data for subsequent analysis. Statistical techniques have included both parametric techniques and non-parametric techniques (Minium et al., 1999; Gall et al., 2003), and some type of Likert scale (Allen & Seaman, 2007; Clason & Dormody, 1994). Parametric techniques have included *t*-test (Lampley, 2001; Sinn, 1979), *F* test, post hoc test (Sinn, 1979) and factor analysis (Sizer, Felstehausen, Sawyer, Dornier, Matthews, & Cook, 2007; Tigelaar et al., 2004) while non-parametric tests considered included the Mann-Whitney test, Chi-square test, and others (Gall et al., 2003; Minium et al., 1999).

There is significant discussion in the literature and research, suggesting that the delphi methodology produces ordinal data and non-parametric tests should be utilized (Allen & Seaman, 2007; Day and Bobeva, 2005; Schmidt, 1997). However, Zimmerman's study (as cited in Gall, Gall, & Borg, 2003) suggests that there are conditions where a parametric test could result in a better test than a non-parametric test. Relevant to this research, this could be found in situations such as a delphi study or survey utilizing a Likert scale. With similar design the single round delphi study is equivalent to a single round survey. Either methodology could use a Likert scale and have the same statistical analysis. Examples include the survey methodology of Schmidt (2000) and Shelton (2009), or the multi-round delphi methodology of Williams (2000) and Hendrix (2005).

Taking the various comments and analyses found in the literature into account, this research utilized a robust methodology and hypotheses testing, which allowed standard statistical analysis. This included exploratory analysis, one-way ANOVA and post hoc tests to examine research data from online survey and consideration of a graphical model of the existing online multi-university ISU Technology Management Ph.D. Consortium.

Definitions of the Key Terms

The following terms have been defined for the purposes of this study:

1. Analysis of Variance (ANOVA) is a procedure to allow comparison of means of two or more independent groups.
2. Bonferroni post hoc multiple comparison test assumes equal variance and is a multiple comparison procedure to determine where the differences between groups after ANOVA procedures.
3. Brown-Forsythe procedure is a procedure to test equal variance.
4. Cronbach's α is used as a model of internal consistency.
5. Consortia/ Consortium are distributed organizational structures characterized by terms and activities such as partnership, compact, collaborations, between or within institutional cooperation, associations, etc.
6. Delphi panel, study or methodology is a structured research approach using a directed group, frequently experts on the topic of interest.
7. Games-Howell post hoc multiple comparison test not assuming equal variance is a multiple comparison procedure to determine where the differences are between groups after a ANOVA procedures.

8. Doctoral degree is a terminal degree, with similar terms including PhD, Ph.D., or Doctor of Philosophy.
9. Higher Education refers to college and graduate school levels.
10. Imputation is addition of data to an incomplete data set based on a number of statistical or methodological approaches.
11. Kolmogorov-Smirnov statistic is a test for normality.
12. Levene statistic is a test of equal variance.
13. Listwise deletion of data—also known as complete case analysis—is deletion or removal of incomplete data sets with missing data.
14. Online education includes distributed, web-based, Internet-based, virtual, distance, electronic (or e-) learning methodologies.
15. Pairwise deletion of data—in contrast to list-wise deletion—is deletion or removal of incomplete data sets only if a correlation estimated based on the cases having data for both variables does not occur.
16. Ph.D. Consortium in Technology Management at Indiana State University at Terre Haute (http://www.indstate.edu/consortphd/); a five university consortium (Bowling Green State University, Indiana State University, East Carolina University, University of Central Missouri and North Carolina A&T State University).
17. Shapiro-Wilk statistic is a test for normality.
18. Welch procedure is a procedure to test equal variance.

Summary

This chapter provided a basis of relevant research from which to identify a needed extension of research into the quality systems model of higher education. This was further

developed with the examination of the more specific technology management doctoral consortia. A background was provided for an assessment methodology for an online technology management doctoral consortium.

CHAPTER 2

REVIEW OF LITERATURE

Overview

The purpose of this chapter is to review the three main areas within the literature that were relevant to understanding the problem for this research, which was to identify and confirm the quality system model attributes for a successful online technology management doctoral consortium. These major areas were identified broadly as: 1) quality systems, 2) higher education consortia, and 3) assessment approaches. The main topic of higher education consortia has four subtopics: 1) higher education, 2) online education, 3) consortia, and 4) terminology. The main topic of assessment approaches also has four subtopics: 1) assessment, 2) delphi methodology, 3) process and gap analysis, and Value Stream Mapping (VSM), and 4) statistics. Topics and related subtopics basic to the understanding of the problem statement are shown in Appendix C.

Major Topics

In undertaking the initial literature review for this research, there was a focus on those broad topics basic to the understanding of the problem statement. The study contributed to the understanding of quality systems of higher education consortium and provided an approach for assessment of higher education consortium quality systems. The literature review focused on the

major topics, which also lead to relevant and related subtopics, which captured or addressed research and information of importance to this research.

Quality Systems

Specific to this research and from a technology management perspective, it was possible to focus on quality systems associated with an online technology management Ph.D. consortium. There were a number of relevant quality systems identified in the literature (Radziwill, Olson, Vollmar, Lippert, Mattis, Van Dewark, & Sinn, 2008; Shipley, Keller, Bossert, Prevette, Okes, Crownover, & Kubiak, 2003;). Further, there is related quality system research focusing on higher education (Houston, 2008). These quality systems include the Baldrige Criteria (National Institute of Standards and Technology, 2009), systems (Mizikaci, 2006), Total Quality Management (Maughan & Anderson, 2005), the European Foundation for Quality Management model and business process re-engineering (Becket & Brookes, 2008), the Balanced Scorecard (Kaplan & Norton, 1996), ISO 9000 series (American Society for Quality, 2002), frameworks developed by educational organizations (Moore, 2005a), and accreditation (Council for Higher Education Accreditation, 2002). This research builds directly on an inter-related body of research proposing a quality system model for "a consortium of five universities offering a Doctor of Philosophy (Ph.D.) degree through distance learning" (Bilke et al., 2006, p. 6). It also includes the program's Quality System specialization (Carlson, Hayden, Tillelry, Ohrenberg, Sinn, & Zhou, 2000), the work of Olson and colleagues (2006), the work of Sinn, Chandler, Bailey, & Mattis (2008), and others.

Higher Education Consortia

As indicated by Moore (1968, p. 11) the United States higher education consortium movement can be traced back to the 1920s, with published articles and organizational activity in

the 1940s and 1950s. By the 1960s, there was active research and a developing body of literature (Association for Consortium Leadership, n.d.). Higher education consortium related organizations had also developed, providing a range of services for institutional and individual members, such as the Association for Consortium Leadership, the Sloan-C, the Boston Consortium, the Midwestern Higher Education Compact, and others. Relatively recent to this environment was the development of an international higher education consortium.

There were several major subtopics identified in the broad topic of higher education consortium. This included higher education, online education, consortia or consortium, and terminology. Higher education has previously been mentioned as having a broad body of knowledge and a range of stakeholders. Relevant to this research was the extension of the topic of domestic higher education to higher education consortia to the doctoral consortium (Bilke et al., 2006; Hendrix, 2005). Epper and Garn (2003, p. 3) suggested a virtual college and university consortium two-dimensional taxonomy of high or low centralization and high or low business practice resulting in four models: central agency, central enterprise, distributed agency, and distributed enterprise. A synthesis of several authors and the extant literature results in a number of activities or goals of consortia (Epper & Garn, 2003, p. 36). These goals are expand access, increase communication/collaboration, create better educated workforce, serve underserved populations, provide one-stop shopping for higher education courses, improve response to need of the state, foster collaborative course/program development, provide a local Virtual College and University (VCU) online education, lead in new learning technologies, increase economic development, and other considerations.

Higher education consortia or consortium have a number of identified functions, including research collaborations (Cummings & Kiesler, 2005), resource sharing such as library

and information services, faculty and courses (Dotolo & Larrance, 2007), human resources, products and services (Dotolo & Noftsinger, 2002); joint academic programs, collaborative admissions and recruitment, fundraising (Dotolo & Strandness, 1999); and special focus, such as with the American Indian Higher Education Consortium (Boyer, 1998).

Online or distance higher education also has a number of ramifications for this research problem. The beginning of domestic online education delivery can be traced to the mid-1980s (Matthews, 1999). Online higher education is now the accepted complement of the classic face-to-face higher education institution. As stated by Black (2007, p. 4), "by the beginning of the 21st century, the "no significant difference" phenomenon had been firmly and repeatedly substantiated (Saba, 2003, pp. 6, 18)". Similarly, Rovai, Ponton, and Baker (2008, p. 62) stated that based on extensive research, distance education is as effective as face-to-face education (with appropriate qualification). There is currently almost complete equivalency in designing education programs and courses for virtual and face-to-face programs, colleges and universities, as well as blended programs in a "continuum anchored at opposite ends by fully traditional and fully distance learning environments" (Rovai et al., 2008, p. 69).

In the review of literature for this research, one constant background activity was the understanding and acquisition of terminology by different academic and industry sectors. This was necessary and related to the validation of the quality system model attributes for a successful online technology management doctoral consortium. The importance of terminology can be appreciated by the existence of 1) the Definition of the Key Terms, and 2) the List of Acronyms in this dissertation. This lead to a number of resources (Council for Higher Education Accreditation, 2001; Vlăsceanu, Grünberg, & Pârlea, 2007; Wolf & Johnstone, 1999), as well as glossaries in several research-related texts (Allen, 2004, pp. 165-173; Miller, 2007, pp. 239-247;

Rovai et al., 2008, pp. 173-178; Ruhe & Zumbo, 2009, pp. 251-259). One observation from the literature review was that there did not appear to be a coherent or centralized body of knowledge associated with higher education. Examples are found to exist for what appears to be the significantly smaller body of knowledge (BoK) of the American Society for Quality for the somewhat similar Certified Quality Engineer or the American Society for Quality (n.d.a) Manager of Quality/Organizational Excellence Certification (n.d.c).

An Approach for Assessment

There were several major subtopics identified in the broad topic of an approach for assessment. This included assessment, delphi methodology, gap analysis, and statistics. The topic of assessment was approached from several perspectives, such as inputs and outputs, graduate program quality (Funk & Klomparens, 2006, p. 145), online education program quality (Shelton, 2010) and have different motivations, such as from internal and external forces, as suggested by Brooks and Heiland (2007, p. 351). The dominant approach from the education perspective is assessment of student learning, with both direct and indirect methods (Funk & Klomparens, 2006, pp. 153-154). However, there can be multiple purposes for assessment in higher education (Banta, 2002; Miller, 2007), as well as higher education programs (Allen, 2004), and even more specifically in the assessment of doctoral programs (Maki & Borkowski, 2006) or consortia (Association for Consortium Leadership, 2007). Other related assessment approaches include accreditation (Accrediting Council for Independent Colleges and Schools, 2009; Association of Technology, Management, and Applied Engineering, 2009;W. K. Kellogg Foundation, 1998;), organizational quality assessments (NIST, 2009), and organizational improvement activities (Sorensen et al., 2005). Relevant to this research was the use of indirect

assessment—in the case of this research, using one delphi panel followed by a survey—as opposed to direct assessment (Allen, 2004, p. 103).

Delphi Methodology

The original delphi methodology was developed at the Rand Corporation in the 1950s (Yousuf, 2007) and referred to as classical delphi (Skulmoski et al., 2007). With continuous use this procedure has developed into the well-established delphi research methodology (Clayton, 1997; Linstone & Turoff, 1975). Okoli and Pawlowski (2004, p. 16) suggested the delphi methodology can be applied "to a wide variety of situations as a tool for expert problem solving". Skulmoski et al. (2007) stated that under appropriate circumstances the delphi method is considered a flexible research procedure:

> The Delphi method is an iterative process to collect and distill the anonymous judgments of experts using a series of data collection and analysis techniques interspersed with feedback. The Delphi method is well suited as a research instrument when there is incomplete knowledge about a problem or phenomenon; however it is not a method for all types of (…) research questions. The Delphi method works especially well when the goal is to improve our understanding of problems, opportunities, solutions, or to develop forecasts. (p. 1)

The classic delphi methodology has evolved with the development of modified—or hybrid—delphi methodologies with methodological alternatives. This includes ranking-type Delphi, issue identification/prioritization, concept/framework development, and specific/special applications (Okoli & Pawlowski, 2004, pp. 16-17), single or double (Mariasingam, 2005) to multiple rounds and sample size of panel experts (Skulmoski et al., p. 5), to number of delphi panels (Okoli & Pawlowski, 2004, p. 18; Ono & Wedemeyer, 1994; Rockwell et al., 2000). Hsu and Sandford (2007) suggested that "other notable characteristics inherent with using the Delphi technique are the ability to provide anonymity to respondents, a controlled feedback process, and the suitability of a variety of statistical analysis techniques to interpret the data" (p. 2).

The topics, questions or items that compose the initial and follow-up documents submitted to the delphi panel can come from many sources, including a literature review. Tigelaar et al. (2004, p. 257) utilized existing frameworks for developing a framework to use as input into the delphi panel. The development of the survey submitted to the delphi panel can be evaluated by experts associated with the topic, or by conducting a pilot the survey with a small group (Day & Bobeva, 2005, p. 107; Tigelaar et al., 2004, p. 258). Several researchers used some form of delphi electronic survey with five-point (or more) Likert scale (Albaum, 1997; Allen & Seaman, 2007) used for panelist responses. This research benefited from the work of Hendrix (2005, pp. 43-48) with associated use of the delphi technique. The rules of thumb for the size of a panel varies, with Clayton (1997, p. 378) suggesting 5 to 10 members for a homogeneous panel and 15 – 30 participants for a heterogeneous panel. This relates to the power consideration of statistical analysis, and Okoli and Pawlowski (2004, p. 19) stated, "because the goal is to generalize results to a larger population, the researchers need to select a sample size that is large enough to detect statistically significant effects in the population."

Survey research (Gall et al., 2003, p. 223) refers to research that involves utilization of questionnaires or interviews, with current research typically being an online extension of this activity. Creswell (2003, p. 153) states that appropriate survey design will allow for collection of quantative data of a sample to be used to describe a population. A general methodology for constructing and administering a research survey or questionnaire was suggested by Gall et al. (2003, p. 224) to include the following major steps: 1) define research objectives, 2) select sample, 3) design the survey, 4) pretest the survey, 5) pre-contact the sample, 6) write cover letter (or e-mail or web-based introduction), 7) distribute the survey, 8) follow-up with non-respondents, and 9) analyze the survey data.

Brown and Swartz (1989) used several statistical techniques in analyzing responses to the same survey by different groups. This included principal components analyses to identify factors, and subsequent reliability analysis to refine the factors further. Pearson's correlation was used as well as regression analysis. Headley and Choi (1992, pp. 10-11) provided a somewhat similar example where "mean scores on a four-point agree/disagree scale were compared for both the customer and employee groups using a *t*-test of the group means on each statement."

For developing the quality system model the quality literature (ASQ, [n.d.b]; Juran, Gryna, & Bingham, 1974) and related ongoing research (Bilke et al., 2006; Radziwill et al., 2008) suggested the use of process flowcharts (ReVelle, 2004; Woll, 2003, pp. 36-37) and value stream mapping (Woll, 2003, p. 40). Relevant to this research were the flowcharts developed by Bilke et al. (2006) for an existing online distance Ph.D. consortium, the quality system development application by Radziwill et al. (2008), as well as the Ph.D. in Technology Management Flow Process (2008) from Indiana State University College of Technology Ph.D. in Technology Management program.

ReVelle (2004, pp. 137-141) suggested development of a process flowchart is the first phase of a process analysis, which is followed by the development of a process map. Grewal (2008, p. 406) stated that value stream mapping (VSM) was initially developed in 1995 as a graphical tool and focused on identification and removal of value stream waste. However, there has been an evolution in VSM, from "pencil and paper" to a standardized graphical analysis methodology (Lasa, Laburu, & Vila, 2008)—or mapping tool (Braglia, Carmignani & Zammori, 2006, p. 3930)—to VSM software and applications with a number of related benefits (Manos, 2006; Woll, 2003). Skulmoski et al. (2007, p. 4) discuss the use of reality maps to provide graphical representations for consideration by the delphi panel participants.

Day and Bobeva (2005, p. 112) stated that "at the moment there are few tools available for processing a large number of non-numerical, unstructured and rich data sets that can be captured in Delphi studies." This is reflected in the significant discussion found in the literature and research. Relevant to this research were the conclusions that the delphi methodology produces ordinal data and non-parametric tests should be utilized (Allen & Seaman, 2007; Day & Bobeva, 2005, p. 112; Schmidt, 1997). There is a significant amount of literature and research that challenges these research recommendations. For example, Zimmerman's study (as cited in Gall, Gall, & Borg, 2003, p. 315) suggested that there are conditions where a parametric test could result in a better test than a non-parametric test.

Taking the various comments and analysis found in the literature into account, this researcher benefited from a relevant literature review, developed research questions and hypotheses for research, utilized a robust methodology and, allowed standard statistical analysis. This included exploratory analysis, one-way ANOVA and post hoc tests, to examine research data from online questionnaire.

Summary

The purpose of this chapter was to review the three main areas within the literature that were relevant to understanding the problem for this research. These areas were identified broadly as: 1) quality systems, 2) higher education consortia, and 3) assessment approaches. These topics allowed identification and confirmation of the quality system model attributes for a successful online technology management doctoral consortium.

CHAPTER 3

METHODOLOGY

Overview

This chapter details the methods that were used to identify and confirm the quality system model attributes for a successful online technology management doctoral consortium. The research questions were developed after significant coursework, literature review, and consultation with faculty and advisors. This included an analysis from the macro to micro perspective, and consideration of qualitative and quantative research methods (Creswell, 2003; Gall et al., 2003; Minium et al., 1999), which led to a selection of a combined delphi and survey methodology to investigate the research problem. The broad literature review provided the initial input for the initial delphi, which determined expected indicators of quality for a quality system as well as the major categories of this quality system for an online technology management Ph.D. consortium. Related to this was the development of a graphical model of the existing online ISU Technology Management Ph.D. Consortium.

The quality indicators from the delphi panel became the input for development of a survey which determined indicators of quality for three major groups of the existing online ISU Technology Management Ph.D. Consortium. This activity also involved utilization of a graphical model of the quality system for the existing online ISU Technology Management Ph.D. Consortium. The delphi panel was anticipated to be 8 to 12 members, and the delphi panel

worked with e-mail based documentation and delphi procedures. The panel was comprised of experts in higher education, quality systems, and consortia, and it was not related to the ISU Technology Management Ph.D. Consortium from which the survey groups were drawn. There was no delphi pilot study, and the initial delphi questionnaire and research procedure was reviewed by professionals in higher education and quality systems. Three rounds of a "typical Delphi process" (Skulmoski et al., 2007, p. 3) were completed by the delphi panel with no termination decision made through a stopping criteria (Schmidt, 1997, p. 771; Hendrix, 2005, pp. 52-53).

The research questions that were investigated were the following:

RQ1: What would be the expected indicators of quality for a quality system model for a successful online technology management Ph.D. consortium?

RQ2: What would be the differences between major groups of the existing online ISU Technology Management Ph.D. Consortium with respect to the expected quality indicators of the quality system model for a successful online technology management Ph.D. consortium?

RQ3: What are the responses to a proposed graphical model of the ISU Technology Management Ph.D. Consortium quality system by the delphi panel and survey respondents?

This led to the following research hypotheses:

H_{01}: There is no significant difference in quality indicators between faculty and students.

H_{02}: There is no significant difference in quality indicators between faculty and graduates.

H_{03}: There is no significant difference in quality indicators between students and graduates.

H_{04}: There is no significant difference in quality indicators between first-year students and Ph.D. candidates (after passing preliminary exams).

H_{05}: There is no significant difference in quality indicators between faculty, students, and graduates.

Assessment

The assessment methodology involved the use of delphi and survey methodologies, which were utilized to first develop and then confirm a quality system model for the ISU Technology Management Ph.D. Consortium. This validation along with consideration of a related graphical quality system model that would support the attributes of an online doctoral consortium allowed for an assessment methodology of a technology management Ph.D. consortium.

Research Design

The literature review for this research identified probable quality system model attributes for a successful online doctoral consortium, which were used by a delphi panel to develop quality system model attributes for a successful online doctoral consortium. A number of researchers have identified or developed quality attributes relevant to higher education, quality systems, and consortia, as indicated in Appendix D. This research included the 24 indicators of quality or outcomes for an online doctoral program developed by Hendrix (2005, p. 92) to provide a reasonable starting point for the delphi panel questionnaire (listed in Appendix E). These activities related to research question RQ1. For research question RQ2 the results of the delphi panel were used to develop a suitable survey which was administered to three groups of

the existing online ISU Technology Management Ph.D. Consortium. A related graphical quality system model was considered for an online technology management Ph.D. consortium and for the existing ISU Technology Management Ph.D. Consortium.

Delphi Methodology

The broad literature review for this research provided the initial input for the first round of the delphi panel, which began with the procedure to determine indicators of quality for an online technology management Ph.D. consortium. This data and delphi panel scores and comments became the input for a second delphi panel that followed the same procedures to determine indicators of quality for a quality system. Similarly the third round consolidated the delphi panel scores and comments and became the input for a web-based survey. Three rounds of a "typical Delphi process" (Skulmoski et al., 2007, p. 3) were completed by the delphi panel. There was no termination decision made using a stopping criteria (Hendrix, 2005, pp. 52-53; Schmidt, 1997, p. 771).

Selection for the delphi panel and survey group members had different criteria. The delphi panel was anticipated to include 8 to 12 members and work with web-based delphi procedures. The delphi panel were experts in higher education, quality systems and consortia, and not related to the ISU Technology Management Ph.D. Consortium from which the survey groups were drawn. The literature review also identified possible delphi panel participants, as well as lead to discussions with participants of organizations involved with higher education, quality and/or consortia.

Participants for the survey were from the ISU Technology Management Ph.D. Consortium and were identified in three ways; the faculty through the Consortium website, the Ph.D. graduates through their dissertations, and the current Ph.D. students through the listserv for

ISU Technology Management Ph.D. Consortium students. While all faculty were identified, it was not possible to identify all Ph.D. graduates or current Ph.D. students. The first round delphi document and the web-based survey were both vetted by two Ph.D. professionals, one working in higher education and the other in quality management. The reviewer from higher education is a Director of the University Counseling Center at a major Midwestern U.S. university. The reviewer involved with quality management background is a recognized quality expert, researcher and writer. After vetting of the web-based survey, a test run of the web-based survey was conducted by approximately five students of a quality-related Master's program class.

Survey Methodology

Survey research (Gall et al., 2003, p. 223) suggested utilization of questionnaires or interviews, with current research typically being an online extension of this activity. Creswell (2003, p. 153) stated that appropriate survey design will allow for collection of quantative data of a sample to be used to describe a population. A general methodology for constructing and administering a research survey or questionnaire was suggested by Gall et al. (2003, p. 224) to include the following major steps: 1) define research objectives, 2) select sample, 3) design the survey, 4) pretest the survey, 5) pre-contact the sample, 6) write cover letter (or e-mail or web-based introduction), 7) distribute the survey, 8) follow-up with nonrespondents, and 9) analyze the survey data.

Graphical model/flowcharts

Research question RQ3 involved the delphi panel and major groups of the existing online ISU Technology Management Ph.D. Consortium considering a graphical model that would support indicators of quality for a quality system for an online technology management Ph.D. consortium. As with the development of indicators of quality for a quality system for an online

technology management Ph.D. consortium by the delphi panel a preliminary flowchart was suggested. This preliminary flowchart of an online technology management Ph.D. consortium was synthesized from two related and existing flowcharts, Figure 2 by Bilke et al. (2006) and the Ph.D. in Technology Management Flow Process (2008) from Indiana State University College of Technology Ph.D. in Technology Management program. A website Universal Resource Locator (URL) to the proposed Ph.D. Consortium flowchart is located in Appendix F.

Data Description

The quantative data was developed from both a delphi panel and later survey. The delphi panel utilized e-mail with an Excel spreadsheet that use an accept or reject or modify scale. Qualitative data was provided by participant comments, including the consortium process graphical model. A spreadsheet questionnaire was returned from each of the three delphi rounds. The ISU Technology Management Ph.D. Consortium data was in the form of integers from one to six found in the typical structure of a Likert scale. Data from both the delphi panel and the subsequent survey was available for analysis. This was a procedure similar to what several researchers utilized (Hendrix, 2005; Rockwell et al., 2000; Schmidt, 1997; Sinn, 1979; Williams, 2000). The data from the graphical model provided an evolving graphical representation of a doctorial consortium.

Data Collection and Data Reduction

The delphi panel date was collected by Excel spreadsheet attachments from delphi panel participants, and a larger Excel spreadsheet was used to collect, track and aggregate the delphi panel responses. The ISU Technology Management Ph.D. Consortium data was collected by an online survey provider, SurveyMonkey. After the online survey was closed, the data was available to the researcher in several forms, including a vendor-specific data summary. This

researcher received the survey results as an Excel spreadsheet of integers from one to six found in the typical structure of a Likert scale associated with the initially proposed indicators. The survey data also had zero as a not applicable response that the survey respondent could select, and there was missing data.

Missing Data

Missing data in research has been addressed by many authors (Gall, et al., 2003, p. 154; Howell, 2009; Norusis, 2004, p. 522). Norusis (2004, p. 50) suggested that in dealing with missing data you should report the percentage of missing cases. Both authors (Norusis and Howell) also suggested the use of listwise deletion in SPSS statistical software procedures, which eliminates incomplete cases. This is done to avoid the possibility of correlation coefficients based on different groups of data, as can occur with the pairwise deletion of missing data. Gall et al. (2003, p. 154) suggested adding group means to fill the missing data, or a more statistically sophisticated method of regression analysis to fill in the missing data. Gall et al. (2003) further offered the observations that the best solution is to avoid missing data and that if too much data is missing the research will be compromised and "the only alternatives are to abandon the study or collect a new set of data." Howell (2009) and Graham (2009) suggested several methods for addressing missing data, including multiple imputation using NORM and an SPSS missing values analysis procedure (IBM, 2010). These missing value analysis techniques were utilized with the survey data, in order to take advantage of all the data in the survey responses. Given the nature of the research data and associated statistical techniques selected, there was not adequate pervasiveness of the imputed data procedures throughout IBM SPSS 19 to allow further use of multiple imputation, in particular with the one-way ANOVA and post-hoc

procedures. Alternatively, the IBM SPSS Amos software (Arbuckle, 2010), a general approach to structural equation modeling, was used for data imputation.

Procedures for Data Analysis

Given the nature of this research, the discussion by Minium et al. (1999) related to statistical inference and nonstatistical generalizations was relevant:

> Statistical inference procedures can account for chance sampling variation in the particular sample results. They do not provide any mathematically based way to generalizing from or making inference beyond the type of research participants used and the exact set of conditions at the time. (p. 269)

Broad generalizations were suggested as appropriate, but were to be made without statistics providing a direct basis. Generalizations would need to be based in the researcher's knowledge and understanding of the substantive area and resulting research.

The research proceeded with hypotheses testing and statistical analysis. This included consideration of the use of standard *t*-test, regressions, and ANOVA in testing the research data from the online questionnaire. A one-way ANOVA with post hoc procedures was selected and utilized.

The associated null hypothesis assumed there would be no significant difference at $\alpha = .05$ and after Minium et al. (1999, p. 410):

H_{01}: There is no significant difference in quality indicators between faculty and students.

H_{02}: There is no significant difference in quality indicators between faculty and graduates.

H_{03}: There is no significant difference in quality indicators between students in QSS and students in manufacturing.

H_{04}: There is no significant difference in quality indicators between first-year students and Ph.D. candidates (after passing preliminary exams).

H_{05}: There is no significant difference in quality indicators between faculty, graduates and current Ph.D. students.

This level of significance of $\alpha = .05$ was selected because there was no serious consequence or risk in this research related to rejecting or retaining H_0 (Minium et al., 1999, p. 207).

The hypotheses testing involved calculating and comparing the mean of the survey quality indicators. In the statistical analysis, attention was paid to statistical power (Minium et al., 1999, pp. 309, 329) related to the concepts of effect size and sample size (pp. 314, 317), and level of significance.

The analysis of variance (ANOVA) statistical technique was selected to allow for the purpose of testing the various hypotheses of no difference between the means of independent samples (Minium et al., 1999, p. 323). More specifically the one-way analysis of variance was used to allow comparison of means of two or more independent groups—in this case three groups, the consortium faculty, consortium Ph.D. students and consortium Ph.D. graduates—with the associated *F* ratio (p. 328, 334) and the SPSS level of significance, Sig. There are several ANOVA assumptions and other considerations that were considered with this study (Minium et al., 1999, p. 345): 1) the samples are independent; 2) each of the populations is normally distributed, 3) each population of observations are equally variable and 4) caution needed with interpretation of "results when subjects have not been randomly assigned to treatment conditions" (p. 346; see also Section 14.9).

For analysis of data normality, skewness and kurtosis were examined. As indicated in the NIST/SEMATECH e-Handbook of Statistical Methods "skewness for a normal distribution is zero, and any symmetric data should have a skewness near zero. Negative values for the skewness indicate data that are skewed left and positive values for the skewness indicate data

that are skewed right." With the symmetry of a normal distribution the skewness value is zero. The related measure of kurtosis occurs and complements the symmetry of a normal distribution that has a value of zero. The NIST/SEMATECH e-Handbook of Statistical Methods states "positive kurtosis indicates that the observations cluster more and have longer tails than those in the normal distribution, and negative kurtosis indicates that the observations cluster less and have shorter tails."

In this research small sample size was a concern (Minimum et al., 1999, Chapter 17 Statistical "Power" (and How to Increase It)). Following the procedure suggested by Minium et al. (p. 317), for this research a population difference, $d = 0.80$, power 0.80 and $\alpha = 0.05$ (two-tailed) and using Table 17d, an anticipated 26 participants from each group would be needed. These criteria resulted in a probability of at least .80 of detecting a difference of $d = 0.80$ (a large difference) with a 5% level of significance (two-tailed). Smaller group sizes would be considered effective if the criteria were relaxed further.

Related procedures were run to determine the differences between the three groups, and provided a post hoc multiple comparisons to protect against an inflated Type 1 error probability if a significant overall F was found. The use of post hoc procedures with IBM SPSS Version 19 Graduate Pack includes options for various assumptions related to the data for post hoc procedures. This includes numerous procedures with equal variance assumed such as the Bonferroni procedure or unequal variance assumed such as with the Games-Howell procedure. The homogeneity of variance assumption was tested with the Levene test. The Welch procedure and the Brown-Forsythe procedure were used to test equal variance and the equality of means. Statistical determination of normality was made with the Shapiro-Wilk and Kolmogorov-Smirnov procedures. Related means procedures and exploratory analysis in SPSS also allowed

for graphical analysis of the data. This included a suite of graphics including box plots, histograms, and normal curves superimposed over the histograms.

Summary

This chapter explained the basis for the method of delphi study and survey of the ISU Technology Management Ph.D. Consortium groups. In this chapter, the collection of the research data was described and the approach that was used to collect, reduce, and statistically examine the delphi panel and survey data was presented.

CHAPTER 4

RESULTS

Introduction

The methodology for this research was the utilization of a three-round delphi panel to develop and or expand the quality indicators of a quality system model of an existing online ISU Technology Management Ph.D. Consortium. The three-round delphi panel took the initial basis of 33 quality indicators and developed 63 quality indicators. These expanded quality indicators were then used as the basis of a web-based six-point Likert survey of participants of the existing online ISU Technology Management Ph.D. Consortium.

From the survey data results the issue of missing data in the survey responses were addressed. The survey responses were analyzed with two one-way ANOVA procedures to determine if there were statistical differences between three major groups of the existing online ISU Technology Management Ph.D. Consortium. The results from the supporting university staff were too minor to consider. The use of the one-way ANOVA procedures included:

- conditioned missing data;
- data excluded listwise;
- the level of significance probability, $p \geq 0.05$ (or Sig. in SPSS nomenclature) on the three groups of faculty, graduates and students;
- post hoc multiple comparison tests.

Twenty-six invitations were sent out to potential delphi panel members, as shown in Appendix G. In round one, there were nine responses, for a 35% response rate. For round two, there were eight responses, for a 31% response rate. For round three, there were seven responses, for a 27% response rate. The delphi panel summary data is available in Appendix H.

For the survey 257 invitations were sent to the ISU consortium-related faculty, grads, and university staff with individual e-mails. Invitations were sent via listserv to current ISU Technology Management Ph.D. Consortium program students. See Appendix I for the survey and Appendix K for the survey results. Within this number of 257 there were 74 faculty, 51 graduates, 125 current Ph.D. students, and 7 university staff, for a total of 257. The survey was closed out with 103 responses recorded by the SurveyMonkey service provider. A forced response was not used with the survey responses and there were a significant number of incomplete responses. The faculty response was significantly lower than the anticipated minimum threshold of 30, but it was still useful. The subgroup of current Ph.D. students was also investigated for differences between the five specializations, but the small response sizes made this examination unsuccessful. Further, there was an interest in examining the Ph.D. students from the groups of 12 first-year students and the 22 students that had passed the Ph.D. preliminary exams. These sample sizes were also significantly lower than the anticipated minimum threshold of 30, but they were still useful.

The six-item Likert scale survey response also had a 7^{th} item, not applicable (N/A), to provide survey respondents a way to move on through the survey (Gall et al, 2003, p. 229). All survey responses had at least one N/A response (1 out of the 63 quality indicator responses) and ranged up to a maximum of 15 N/A responses (see Table 3). In the resulting data analysis, the N/A responses were dropped from further consideration by classifying this condition as missing

data for statistical purposes. This missing data was examined in Excel with the use of the COUNTBLANK function. This approach allowed the ranking of the data cases from least missing data cells to most missing data cells in each survey case. In determining what threshold to use to remove survey cases based on percent of missing data, there were 8 survey cases with 25% to 50% missing data, and 13 survey cases with 50% to 99% missing data. The decision was made to drop the survey cases with 50% or more missing data, which was 13 survey cases, reducing the number of survey cases from 103 to 90. Two other cases, the university staff, were also removed, leaving 88 cases from the groups of faculty, graduates and students.

Delphi Panel

The intention of the delphi panel was to provide expert opinion and to allow the development of a survey instrument that could then be utilized by the three remaining groups in the ISU Technology Management Ph.D. Consortium. The three groups were the faculty, Ph.D. graduates, and current Ph.D. students. The university staff was no longer considered in the data analysis. From the literature it was determined that three rounds would be sufficient to gather delphi panel opinions. It was not the intention to rigorously reduce the number of quality indicators, although an effort was made to consolidate a limited number that were quite similar. The first-round delphi started with 33 suggested quality indicators, of which 24 were taken from the research results of Dr. Mary Hendrix (2005, p. 93), and 9 others were added from the initial literature review identification of relevant quality indicators, as found in Appendix H. The first-round delphi ended with nine modifications and thirty-seven additional added quality indicators. After consolidation of similar comments a total of 63 quality indicators were then taken into the second-round delphi. The second-round delphi added 17 modifications to the 63 quality indicators. The third-round delphi started and ended with 63 quality indicators, with no further

modifications. The delphi panel summary date is presented in Table 1, which also has a column indicating the corresponding survey question.

Table 1

Delphi 3rd and Final Round Results

Delphi Item #	Quality Indicator	Accepted	Rejected	Survey Question #
1	Percentage of students who pass comprehensive exams on first attempt.	7	0	V6H1
2	(Original) Quality of dissertations.	6	1	V7H2
3	(Original) Student placement rates.	7	0	V8H3
4	(Original) Professional examination/credentialing of graduates (if applicable).	5	2	V9H4
5	(Original) Number of presentations made by students at professional conferences.	5	1	V10H8
6	Original) Employers' satisfaction with graduates of online program.	7	0	V11H5
7	(Original) Percentage of students who indicate they would not have been able to complete a doctoral program if it were not available online.	3	4	V12H16
8	(Original) Student enrollment.	4	3	V13H20
9	#1 (Original) Number of students who apply to program.	0	5	V14H23
10	(Original) Alumni/graduates satisfaction with their educational experience.	7	0	V15
11	(Original) Availability 24x7.	3	4	V16
12	(New) Student to faculty ratio (or average class size).	6	1	V17

Table 1 (continued)

Delphi Item #	Quality Indicator	Accepted	Rejected	Survey Question #
13	(New) Percentage of students satisfied with the quality of Faculty advice and support.	7	0	V18
14	(New) Percentage of students satisfied with the quality of Online teaching/learning process (including technology and other resources, curriculum, course syllabi, exams, etc.).	7	0	V19
15	(Original) Student satisfaction with online program.	5	2	V20H13
16	(Original) Student satisfaction with technology.	6	1	V21H17
17	(Original) Student satisfaction with student support service.	6	1	V22H18
18	(New) Percentage of students satisfied with the quality of Academic/student support services.	7	0	V23
19	(Original) Feedback to student assignments and questions is constructive and provided in a timely manner.	6	1	V24
20	(Original) Cost effectiveness.	1	6	V25H6
21	(Original) Total amount of funding from grants secured by faculty and students.	2	5	V26H9
22	(New) Average instructional cost per student enrolled in the program.	3	3	V27
23	#1 Tuition and fees generated by the program as a percentage of total program expenditures.	6	1	V28
24	#2 (New) Tuition and fees generated by the program at each institution as a percentage of total program expenditures at each institution.	4	2	V29

Table 1 (continued)

Delphi Item #	Quality Indicator	Accepted	Rejected	Survey Question #
25	#1 Course credits and student credit hours generated per teaching faculty FTE.	5	2	V30
26	#2 (New) Course credits and student credit hours generated per teaching faculty FTE per institution.	3	3	V31
27	(New) Total instructional costs as a percentage of total expenditures.	5	2	V32
28	(New) Total dollars generated from grants and contracts as a percentage of total revenues.	3	4	V33
29	(New) Number of jobs supported by external (grants and contracts) dollars.	3	4	V34
30	(Original) Number of students who are accepted to online program.	1	6	V35H21
31	(New) Yield rate between accepted and enrolled students.	6	1	V36
32	(New) Percentage of students who drop out due to unmet financial needs.	3	4	V37
33	(Original) Quality and number of peer-reviewed publications produced by students.	5	2	V38H7
34	(Original) Number of peer-reviewed publications produced by faculty.	6	1	V39H12
35	#1 (Original) Student-to-faculty ratio.	5	2	V40H15
38	New) Quality of faculty academic credentials, etc.	6	1	V43
39	(New) Number of faculty presentations at professional meetings and conferences.	6	1	V44
40	#2 Percentage of program faculty satisfied with the quality of faculty compensation and benefits.	4	2	V45
36	#2 Faculty satisfaction with student to faculty ratio.	5	1	V41

Table 1 (continued)

Delphi Item #	Quality Indicator	Accepted	Rejected	Survey Question #
37	(Original) Number of grants secured by faculty and students.	2	5	V42H19
41	(New) Percentage of program faculty satisfied with the quality of new students.	6	0	V46
42	(New) Percentage of program faculty satisfied with the quality of Program leadership, organizational structure, and curriculum.	6	1	V47
43	(New) Percentage of program faculty satisfied with the quality of Online teaching/learning processes and resources.	7	0	V48H14
44	(Original) Faculty satisfaction with delivery method.	5	2	V49H22
45	(New) Consistency among and compliance with program and consortium policies, procedures and rules.	7	0	V50
46	#2 Quality of communications among institutions in the consortium.	3	3	V51
47	(Original) Consortium governance.	2	5	V52
51	(New) Quality (currency) of program curriculum.	5	2	V56
52	(New) Quality of online teaching processes such as quality of course organization and syllabi, constructiveness and timeliness of faculty feedback to students regarding assignments, questions, grades, and quality of exams, etc.	7	0	V57
53	(New) Quality (age, currency, cost, location) of teaching/research equipment, supplies, etc.	6	1	V58
48	(New) Quality of incoming students (academic qualifications, prior experience, credentials, etc.).	6	1	V53

Table 1 (continued)

Delphi Item #	Quality Indicator	Accepted	Rejected	Survey Question #
49	(New) Program accreditation status.	6	1	V54
50	(New) Program national ranking.	6	1	V55
54	(New) Student retention rates, by course or faculty, and by academic year.	7	0	V59
55	#2 Percentage of students who complete their degree within seven years.	5	0	V60H10
56	#2: Average time to degree completion.	6	0	V61H11
57	(New) Alignment of official and published program outcomes with individual course outcomes and content of comprehensive exams.	5	1	V62
58	(Original) There is a recognizable mission (and/or vision) of the Consortium.	6	1	V63
59	(New) Quality of continuous improvement practices in recruitment (students and faculty), curriculum review, equipment acquisitions and upgrades, teaching and learning processes, etc.	7	0	V64
60	#1 (Original) Student and faculty assessment of whether the student identified with the institution.	1	6	V65H24
61	#1 (Original) Student and faculty assessment of whether the student identified with the program.	2	4	V66
62	(New) Measurable Learning Outcomes for the PhD program that are annually assessed and used as a feedback loop for continuous improvement.	7	0	V67
63	The Flowchart: three major parts is suitable for utilization of all - or almost all - of the previously identified quality indicators.	2	0	V68

It was also of interest to determine how the delphi panelists responded to the 24 quality indicators from Hendrix (2005) that were used as part of the basis of quality indicators for the first round of the delphi panel. In the exploratory data analysis, these specific items were difficult to unbundle from the surrounding data. One way to represent the data analysis was consideration that the delphi panelists had 168 opportunities to consider the 24 Hendrix quality indicators in the three delphi rounds. In the third and final delphi round, the 24 Hendrix quality indicators were accepted 107 times and rejected 55 times, for a total of 162 considerations of the Hendrix quality indicators. The acceptance rate was 66%.

Along with the delphi panel accept, reject, modify, and comment responses, there were also comments by the delphi panelists that were sometimes directed to the researcher, and sometimes directed to the other panelists. This feedback is a major strategy of the delphi panel structure and process, and was used in this delphi. Though the data was qualitative, the comments provided some interesting insights, and showed both alignment and diversion of the delphi panelists.

After the three delphi rounds, there were 13 quality indicators where all panelists only accepted the quality indicator. This was interpreted as a strong indication of agreement by a diverse panel. To show the least disagreement, centrally located pairs of acceptance and rejections were examined. In the final delphi panel, the configurations of pairs there were eight 3 and 4 pairs, and seven 4 and 3 pairs. To show the most disagreement by the panel members, there were three pairs of 1 and 6 pairs. There were no quality indicators where all panelists only rejected the quality indicator, which was interpreted as a strong indication of agreement by a diverse panel. Given the direction of the research to identify quality indicators, and the use of

the literature to provide a previously researched basis of quality indicators, it was noted there were so many quality indicators that were rejected.

A related aspect of evidence of agreement or disagreement were the comments by the panelists that other panelists would see and consider in rounds two and three. One example to make this point was a proposed quality indicator for quality and number of peer-reviewed publications produced by students. This quality indicator generated one comment in the first delphi round: "Don't see how this is a good metric for students while they are in school." There were two follow-up comments generated in the second delphi round: 1) "This is more important after graduation." 2) "I think this is an excellent criterion. One that serious faculty at research universities look at as a quality metric." A second example of delphi panel commentary was the proposed quality indicator of student enrollment. This quality indicator generated one comment in the first delphi round: "Yield rate is better because it controls for qualified students." There were two comments generated in the second delphi round: 1) "This is OK if the intent is to follow enrollment statistics over time and compare them with strategic goals--by itself it is not a measure of anything related to program quality." 2) "MEASURING STUDENT ENROLLMENT IS AN IMPORTANT METRIC BECAUSE WITHOUT STUDENTS YOU HAVE NO PROGRAM.[*sic*]"

Survey

The survey response was not as great as anticipated and the researcher gathered the data and proceeded with the analysis. The survey instrument was developed for and administered to the three groups in the ISU Technology Management Ph.D. Consortium, the faculty, graduates, and current Ph.D. students.

Survey Data Analysis

The statistical analysis of the initial survey results was done with SPSS 14.0 and IBM SPSS 19 Graduate Pack for Windows. Exploratory data analysis, the one-way ANOVA (analysis of variance), means comparison and post hoc procedures, and graphics were used to investigate the hypotheses of this research. The level of significance, Sig., for SPSS is equivalent to the probability, p, of a statistically significant difference and was set equal to 0.05. The hypotheses were stated in terms of the means of the three major groups in the ISU Technology Management Ph.D. Consortium—the faculty, Ph.D. graduates, and current Ph.D. students—not being statistically significantly different. The response by the current Ph.D. students by specialization was not sufficient to allow analysis of H_{03}. This was initially stated that there is no significant difference in quality indicators between students in QSS and students in manufacturing. The university staff group was removed and the initial H_{03} was replaced. The resulting hypotheses were:

H_{01}: There is no significant difference in quality indicators between faculty and students.

H_{02}: There is no significant difference in quality indicators between faculty and graduates.

H_{03}: There is no significant difference in quality indicators between students and graduates.

H_{04}: There is no significant difference in quality indicators between first-year students and Ph.D. candidates (after passing preliminary exams).

H_{05}: There is no significant difference in quality indicators between faculty, students, and graduates.

Results for H_{01}, H_{02} and H_{03}, and H_{04}

The statistical investigation and the research results had two statistical approaches. The first approach was a one-way ANOVA of the ISU Technology Management Ph.D. Consortium group responses for quality indicators for H_{01}, H_{02} and H_{03}, and H_{04}. The second statistical approach utilized data from the data analysis of the first approach and was the one-way ANOVA of the group means of each of the quality indicators for each ISU Technology Management Ph.D. Consortium program groups for determination of H_{05}.

A significant consideration in the analysis of variance was establishing the validity of the one-way Analysis of Variance (ANOVA) assumptions. This includes (Minium, et al., 1999, p. 345) the samples are independent, the populations of observations are normally distributed, and the populations of observations are equally variable. Another consideration for the research results was small sample sizes that tend to give non-significant results leading to Type 2 errors.

Use of the one-way ANOVA of the ISU Technology Management Ph.D. Consortium group responses allowed for examination of the related but slightly different structures of research questions 1 and 2 that referred respectively to H_{01}, H_{02}, H_{03}, and H_{04}. The hypotheses of H_{01}, H_{02} and H_{03} were investigated directly with SPSS with the one-way ANOVA. For investigation of H_{04} with the one-way ANOVA, the data was pre-conditioned by the filter Data/If V1 = 4 to get only students with the V4 independent variable that would allow comparison of first-year students and Ph.D. candidates.

For determination of H_{05}, the means of each quality indicator within each of the three groups in the ISU Technology Management Ph.D. Consortium faculty, graduates, and students was determined from the data analysis that was used to examine H_{01}, H_{02} and H_{03} and H_{04}. The analysis for H_{05} was a one-way ANOVA analysis of the summary mean data from the first

survey data with the independent variable being the ISU Technology Management Ph.D. Consortium group membership type of faculty, graduate, or student. This required a reformatting of the data to provide the necessary independent variable of ISU Technology Management Ph.D. Consortium group membership type for faculty, graduates or students. The summary mean data from the survey data quality indicators were the dependent variables.

From SPSS 14.0 and IBM SPSS 19 software, the data factor variable values should be integers, and the dependent variable should be quantitative (interval level of measurement). Assumptions included that each group is an independent random sample from a normal population. Analysis of variance is robust to departures from normality, although the data should be symmetric. The Shapiro-Wilk and Kolmogorov-Smirnov statistics were calculated as a test for normality, with consideration of Sig. ≥ 0.05. The groups should come from populations with equal variances. To test this assumption, Levene's homogeneity-of-variance test was used, again with Sig. ≥ 0.05. The groups were considered independent as well as relatively small size.

Missing Values Analysis

As previously mentioned in the Chapter 4 Introduction, the initial 103 survey responses were reduced to 88 based on incomplete responses, still with noticeable missing responses in the remaining data. There are a number of statistical considerations related to the appropriate statistical methodology to use in dealing with the missing data. With this research data this includes a related focus on small sample size and loss of statistical power. In the initial exploratory data analysis the diminishing data was made worse using listwise deletion to manage missing data. The size of the three groups with sufficient responses for statistical analysis decreased to eight faculty, 21 graduates, 26 Ph.D. students, for a total of 55 complete survey responses. The 26 Ph.D. students were also differentiated by the five specializations: four

Quality Systems, six Manufacturing Systems, five Digital Communications Systems, and seven HRD and Industrial Training, and four Construction Management students.

From the researcher's perspective, there were equally significant operational considerations and a significant level of effort needed to increase the sample size of the three groups. These issues included re-engagement with Institutional Review Boards at two universities, difficulty in contacting the participants in the three groups (faculty, graduates, and students), and the anonymous survey responses, which would result in re-contacting the faculty in the ISU Technology Management Ph.D. Consortium. This lead to the decision to use data imputation to extract the maximum information from the survey data, and develop a data set that would have realistic value. Howell (2009) suggested the simplest approach—previously mentioned—is listwise deletion, in contrast to the poorly regarded approach of pairwise deletion. Both Howell and Graham (2009) also discuss other older techniques, as well as what Graham refers to as modern missing data analysis methods.

The IBM SPSS Version 19 Graduate Pack Missing Values Analysis procedure (IBM, 2010) was utilized to further examine and potentially condition the complete 103 survey data sets, and take advantage of more recently available statistical tools that would provide maximum utilization of the survey data. Previously, the missing data techniques of listwise data deletion was discussed, which, due to the less than anticipated response rates, resulted in small groups with negative ramifications to the data and resulting analysis.

Listwise deletion will eliminate incomplete cases and pairwise deletion will typically retain the incomplete cases but leads to the possibility of correlation coefficients based on different groups of data. The use of IBM SPSS Version 19 Missing Values statistics module allowed for missing value analysis and multiple imputation was utilized. Little's Chi-square

statistic (IBM, 2010, p. 8) with null hypothesis that the data are missing completely at random with p value significant at the 0.05 level returned a value of Sig. = 0.042, indicating the data are not missing completely at random. A relate graphic is found in Figure 1. The middle figure focused on the individual survey responses, which are referred to as cases. The missing value analysis procedure supported the previously discussed reduction of cases missing greater than 50% survey responses. The related analysis of patterns was done, where it was possible to note that the data is still relatively more random (IBM, 2010, p. 49).

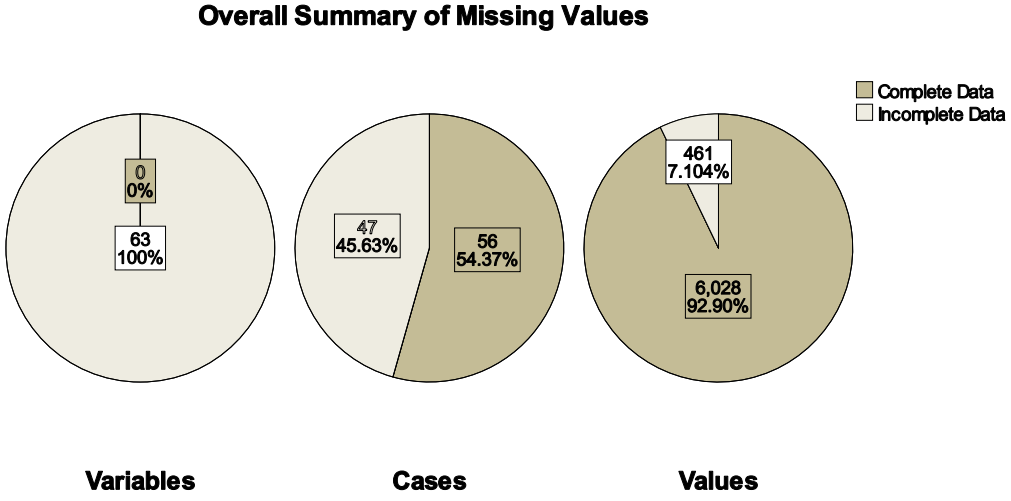

Figure 1. Missing data analysis

This missing data analysis identified the variables with large numbers of missing data, shown in Table 2. The minimum percentage of missing values for variable to be included is 10.0%, to manage the size of table by not showing variables with only a few missing data.

Table 2

Variables with Large Numbers of Missing Data

	N	Percent	Valid N
9CredentialsH4	15	14.60%	88
46FacultySatisNewStudent	13	12.60%	90
34#JobsThruExternal$	13	12.60%	90
33Total$GrantsAs%Total$	13	12.60%	90
45FacultySatisfOtherFaculty	12	11.70%	91
42#GrantsByFacultyStudent	12	11.70%	91
29TutionFees%ExpendInstitution	12	11.70%	91
11EmployerSatisH5	12	11.70%	91
8StudtPlaceRateH3	12	11.70%	91
59StudentRetention	11	10.70%	92
55NationalRank	11	10.70%	92
49FacultySatisDeliveryMethodH22	11	10.70%	92
41FacultySatisfactionStudentRatio	11	10.70%	92

Data Imputation with Amos

The IBM SPSS Version 19 Graduate Pack Missing Values Analysis procedure (IBM, 2010) allowed for missing value analysis and consideration of the statistical approach of multiple imputation. While the missing value analysis was of value in understanding the missing data, the multiple imputation techniques were not suitable for this research and the intention of using one-way ANOVA, related post hoc tests, and other related analysis. Consequently, the IBM SPSS Amos software (Arbuckle, 2010), a general approach software package for structural equation modeling, was used for data imputation. It was possible to use the IBM SPSS Version 19 Graduate Pack Missing Values Analysis multiple imputation (MI) procedure to calculate the means of all 63 quality indicators by imputating data into 5 data sets and a pooled data set, suggested by both Graham (2009) and Howell (2009) as most effective of the data imputation procedures readily available. This set of means was compared to the IBM SPSS Amos

maximum likelihood imputation (MLE) (Graham, 2009, p. 551; Howell, 2009, p. 555; University of Colorado, n.d.) single data set, which was then used by IBM SPSS Version 19 Graduate Pack one-way ANOVA to calculate the means of all 63 quality indicators. Running a paired-samples *t test* (Norusis, 2004, p. 255) with the paired means from the Amos MLE with the SPSS MI imputed means resulted in a correlation of .997 and a Sig. of .000. This Sig. value is less than zero, and with a 95% confidence interval, the null hypothesis of equal means is rejected. However, following the recommendation of Norusis (p. 440), the data was plotted, as shown in Figure 2.

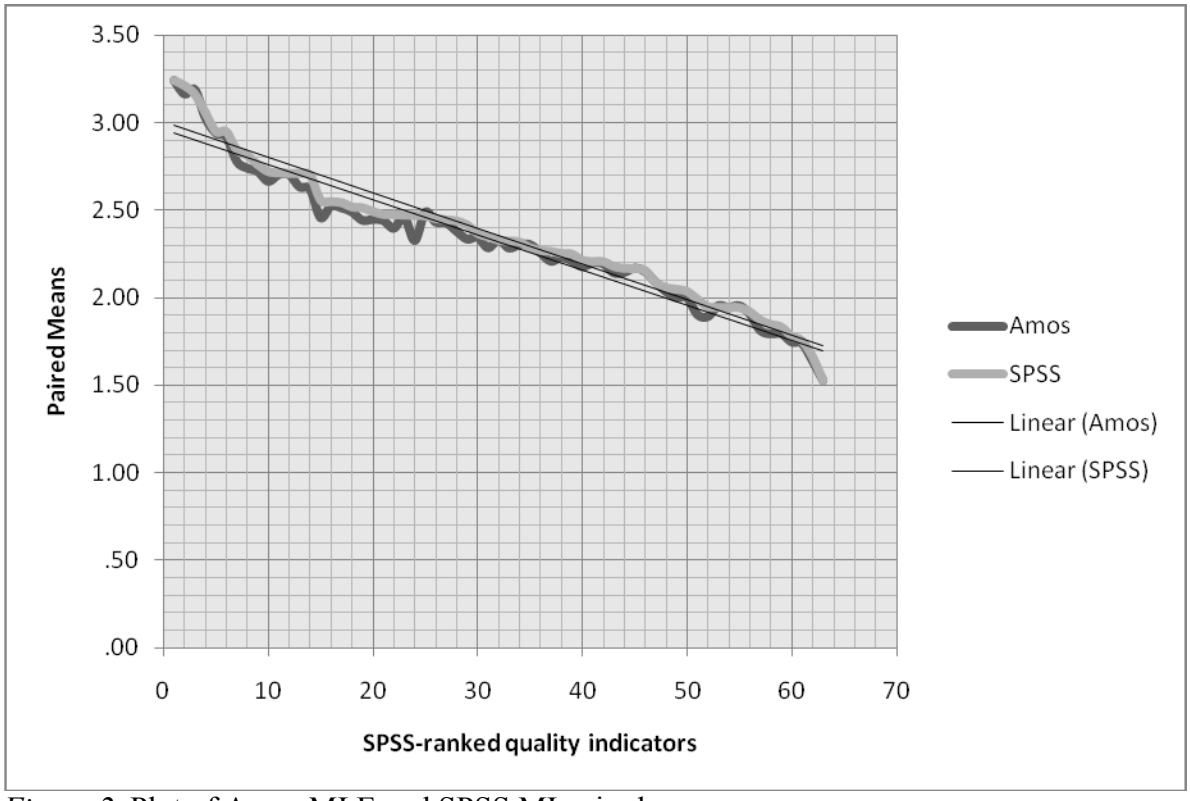

Figure 2. Plot of Amos MLE and SPSS MI paired means

This plot shows the descending ranked mean pairs of the means of the 63 quality indicators as calculated with Amos MLE and SPSS MI procedures; see Appendix J for ranked and paired

means from imputed data. The literature had indicated there was missing values analysis and data imputation techniques that ranged from simplistic to best practice. The SPSS MI procedure is arguably the most sophisticated statistical technique for data imputation. However, it is not pervasive enough within the statistical tools found in the IBM SPSS 19 Graduate Pack for Widows to support the data analysis for this research, specifically the one-way ANOVA and related statistical techniques. However, the maximum likelihood imputation (MLE) procedure is a less robust but related data imputation technique. Significantly, the MLE data set will support the data analysis for this research, specifically the one-way ANOVA and related statistical techniques. The plot of the paired imputated data gives credibility to the use of the MLE imputated data set. From Figure 2 it is concluded that the Amos MLE data would be acceptable for further analysis given the intended uses of the imputed research data. See Appendix J for the initial data with 103 cases and missing data and zeros, and the final survey data had 88 cases with imputed data and no missing data or zeros. In these 88 cases there were 18 faculty responses, 36 graduate responses and 34 student responses. Within the student responses there were 12 first year students and 22 students who have passed their preliminary exams.

Power and Sample Size Revisited

Previously discussed was the power and sample size analysis, which followed the procedure suggested by Minium et al. (1999, p. 317). For this proposed research a sample difference with $d = 0.80$, power 0.80 and $\alpha = 0.05$ (two-tailed) and using Table 17d, an anticipated 26 participants from each group would be needed. These criteria result in a probability of at least .80 of detecting a difference of $d = 0.80$ (a large difference) with a 5% level of significance (two-tailed). Smaller group sizes would be considered effective if the criteria were relaxed further.

As stated there were 88 cases with 18 faculty responses, 36 graduate responses, and 34 student responses. While the graduate and student responses meet the previous analysis criteria, the faculty group of $n = 18$ requires further analysis and becomes the controlling factor in the power analysis. From the research data a sample difference with $d = 0.95$, and not the previous 0.80, a larger difference in Cohen's effect size classification (Minium et al., 1999, p. 316), power 0.75 (not the previous 0.80, and less power) and $\alpha = 0.05$ (two-tailed) was specified. The method of Minium, et al (1999, p. 318) was used, with Table 17d and interpolation. It was determined 17 participants from the smallest group would be needed, and the data was slightly larger, with 18 faculty cases. These criteria resulted in a slightly higher probability of at least .75 of detecting a difference of $d = 0.95$ (a large difference) with a 5% level of significance (two-tailed).

Reliability Analysis with Cronbach's α

Reliability Analysis with Cronbach's α was utilized to examine internal consistency of the survey data. The IBM SPSS 19.0 Scale/Reliability procedure options resulted in the use of quality indicators 1 through 63 for the total data set of 103 survey responses, with cases excluded listwise. Two other datasets were considered. For the reduced survey dataset of 88 survey responses with survey responses missing more than 50% responses deleted and including missing data, Cronbach's α was .954. For the Amos imputed reduced survey dataset of 88 survey with no missing data, Cronbach's α was the .958. The literature suggests rules of thumb for Cronbach's reliability coefficient α of .70 or .80 as acceptable, while George and Mallery (2003, p. 231) (as cited in Gliem & Gliem, 2003, p. 87) provides a more specific rules of thumb: "_ > .9 – Excellent, _ > .8 – Good, _ > .7 – Acceptable, _ > .6 – Questionable, _ > .5 – Poor, and

_ < .5 – Unacceptable [*sic*]". For Cronbach's alpha reliability coefficient normally ranges between 0 and 1. Table 3 shows related information.

Table 3

Case Processing Summary and Reliability Statistics

		N	%
Cases	Valid	56	54.4
	Excluded	47	45.6
	Total	103	100

Reliability Statistics	
Cronbach's Alpha	*N* of Items
0.957	63

The survey data was investigated with consideration of the hypothesis in the initial analysis to determine where these differences between groups were with respect to the full survey data set; see Appendix K. The use of the one-way ANOVA (Minium et al., 1999, Chapter 18; Norusis (2004), Chapter 18; Norusis (2006), Chapter 15; Gall et al., 2003, Chapter 10) involved a number of assumptions underlying the *F* test associated with one-way ANOVA that needed to be examined and a determination if the assumptions were satisfied by the data set. From Minium et al. (pp. 345-346) for the k samples each population of observations should be normally distributed and equally variable. The equal variance was acceptable if the ratio of largest group n to smallest group n is greater than 1.5. A further consideration was small sample sizes resulting in non-significant results allowing a Type 2 error, retaining a false H_0.

The data analysis started in IBM SPSS Graduate Pack 19.0 for Windows with Analyze\Descriptive Statistics\Explore with the option set for excluding cases listwise. This was followed with the Analyze\Compare Means\Means and Analyze\Compare Means\One-Way

ANOVA procedures. The Shapiro-Wilk and Kolmogorov-Smirnov statistics were calculated as a test for normality, and most of the sample distributions were indicated to not meet the normality assumption, although many of the 63 bar charts with superimposed normal curves were recognizably normal distributions. The Shapiro-Wilk statistic with consideration of Sig. ≥ 0.05 indicated 15 faculty and Ph.D. graduate student responses of the 63 quality indicators were normally distributed and the remaining 48 faculty, graduate and Ph.D. student responses or 76.2% of 63 quality indicators, were not normally distributed. The Kolmogorov-Smirnov statistic with consideration of Sig. ≥ 0.05 indicated a slightly different result. Fourteen faculty, graduate and Ph.D. student responses of 63 samples were normally distributed and the remaining 49 faculty, graduate and Ph.D. student responses or 77.8% of 63 quality indicators, were not normally distributed. See Appendix L for the Kolmogorov-Smirnov and Shapiro-Wilk data.

The next ANOVA assumption considered was that of equal variance, which was determined with the Levene statistic. From Table 4 with SPSS consideration of Sig. ≥ 0.05 indicating equal variance can be assumed for all the data. However for 52 of 63 quality indicators the assumption of equal variance was not dismissed. For the other 11 quality indicators assumption of equal variance was not supported, indicated in Table 5.

Table 4

Levene Statistic, Not Significant

Quality Indicator	Levene Statistic	Ranked; Sig.>.05
15Alum/GradSatisf	0.035	0.966
54Accreditation	0.044	0.957
17Student:FacultyCustomer	0.047	0.954
12IfNotOnlineH16	0.124	0.884
38StudentPubsH7	0.139	0.871
46FacultySatisNewStudent	0.243	0.785
49FacultySatisDeliveryMethodH22	0.249	0.780

Table 4 (Continued)

Quality Indicator	Levene Statistic	Ranked; Sig.>.05
29TutionFees%ExpendInstitution	0.266	0.767
50ConsortiumConsistency	0.275	0.760
44#FacultyPresentations	0.351	0.705
37StudentDropOutDue$	0.360	0.699
16Avail24x7	0.394	0.675
42#GrantsByFacultyStudent	0.412	0.664
23StudentSatisAcademicSupport	0.447	0.641
9CredentialsH4	0.457	0.635
40Student:FacultyWorkforceH15	0.470	0.626
34#JobsThruExternal$	0.500	0.608
6Comp%PassH1	0.502	0.607
7DissQualH2	0.530	0.591
55NationalRank	0.540	0.585
21StudentSatisTechnoH17	0.552	0.578
18StudentSatisFaculty	0.564	0.571
22StudentSatisSupportH18	0.586	0.559
56QualCurriculum	0.590	0.557
10StudentPresentationsH8	0.608	0.547
27AveInstructorCost	0.614	0.543
61TimeDegCompH11	0.615	0.543
53QualIncommingStudents	0.621	0.540
35#StudentAcceptedH21	0.646	0.527
28TutionFees%ExpendProg	0.801	0.452
14#StudentsApplyH23	0.807	0.450
13StudentEnrolH20	0.850	0.431
20StudentSatisOnLineProgramH13	0.857	0.428
45FacultySatisfOtherFaculty	0.864	0.425
32InstructCostAs%Total$	0.886	0.416
19StudentSatisOnLineTeach	0.967	0.385
36YieldRate	1.029	0.362
31CreditsHrs/Faculty/Institution	1.042	0.357
8StudtPlaceRateH3	1.060	0.351
57QualOverallTeachProcess	1.155	0.320
24StudentFeedbackOK	1.217	0.301
60%StudentCompletionH10	1.241	0.294
25CostEffectH6	1.556	0.217
39FacultyPubsH12	1.679	0.193

Table 4 (Continued)

Quality Indicator	Levene Statistic	Ranked; Sig.>.05
41FacultySatisfactionStudentRatio	1.692	0.190
65StudentIDWithInstitution?	1.709	0.187
43FacultyCredentials	1.881	0.159
68FlowchartOK?	2.052	0.135
33Total$GrantsAs%Total$	2.068	0.133
48FacultySatisOnlineResourcesH14	2.067	0.133
11EmployerSatisH5	2.078	0.131
51CommunicationQual	2.286	0.108

Table 5

Levene Statistic, Significant

Quality Indicator	Levene Statistic	Ranked; Sig.<.05
62AlignOutcomes	3.134	0.049
26FundingByStudFacultyH9	3.210	0.045
66StudentIDWithProgram?	3.518	0.034
52ConsotriumGovern	3.742	0.028
59StudentRetention	4.027	0.021
30CreditsHrs/Faculty	5.130	0.008
64QualImprov?	5.436	0.006
58QualEquip	5.967	0.004
63Mission?	6.560	0.002
47FacultySatisProgLeadership	7.083	0.001
67AnnualAssessment	13.575	0.000

Minium et al. (1999, p. 345) suggest that if the ratio of the largest group n to the smallest group n exceeds 1.5, alternative procedures should be considered. The ratio of the largest group to the smallest group was graduates to faculty, or 36 to 18, which was 2, and exceeds the 1.5 threshold previously mentioned. These alternative procedures include the Welch and Brown-Forsythe equality of means procedures. SPSS indicates the Welch is more powerful in situations

of unequal sample size and variance, which was indicated with this data. The data for the Welch procedure is found in Appendix M, and there were 53 survey indicators for which the Welch result in Sig. > 0.05 and the assumption of equal variance was not rejected, while the remaining ten survey indicators for which the Welch result in Sig. < 0.05 and the assumption of equal variance was rejected.

The one-way ANOVA procedure was run with consideration of Sig. ≥ 0.05 on the three groups of faculty, graduates and students indicating both significant and insignificant differences between means of the three groups for 63 quality indicators. Shown in Table 6 are 47 ranked quality indicators, or 73.0%, for which the hypothesis of no difference in mean was not rejected and which were indicated to have no difference in means. See Appendix N for complete data. Shown in Table 7 are 16 quality indicators which were indicated to have a statistical difference in means.

Table 6

One-way ANOVA with No Difference in Means

Quality Indicator	*F*	Ranked, Sig.>.05
17Student:FacultyCustomer	0.007	0.993
44#FacultyPresentations	0.014	0.986
46FacultySatisNewStudent	0.056	0.946
7DissQualH2	0.065	0.937
38StudentPubsH7	0.118	0.889
16Avail24x7	0.173	0.841
40Student:FacultyWorkforceH15	0.181	0.835
14#StudentsApplyH23	0.216	0.806
39FacultyPubsH12	0.225	0.799
53QualIncommingStudents	0.292	0.747
23StudentSatisAcademicSupport	0.295	0.745
48FacultySatisOnlineResourcesH14	0.423	0.657
12IfNotOnlineH16	0.468	0.628
49FacultySatisDeliveryMethodH22	0.469	0.627

41FacultySatisfactionStudentRatio	0.477	0.622
6Comp%PassH1	0.578	0.563

Table 6 (Continued)

Quality Indicator	*F*	Ranked, Sig.>.05
15Alum/GradSatisf	0.663	0.518
21StudentSatisTechnoH17	0.665	0.517
22StudentSatisSupportH18	0.822	0.443
18StudentSatisFaculty	0.854	0.429
57QualOverallTeachProcess	0.865	0.425
42#GrantsByFacultyStudent	0.902	0.410
58QualEquip	0.921	0.402
61TimeDegCompH11	0.998	0.373
13StudentEnrolH20	1.117	0.332
43FacultyCredentials	1.246	0.293
8StudtPlaceRateH3	1.254	0.291
19StudentSatisOnLineTeach	1.318	0.273
56QualCurriculum	1.480	0.234
51CommunicationQual	1.670	0.194
24StudentFeedbackOK	1.740	0.182
25CostEffectH6	1.752	0.180
54Accreditation	1.814	0.169
10StudentPresentationsH8	1.834	0.166
27AveInstructorCost	1.940	0.150
60%StudentCompletionH10	1.978	0.145
55NationalRank	1.979	0.145
35#StudentAcceptedH21	2.005	0.141
9CredentialsH4	2.294	0.107
29TutionFees%ExpendInstitution	2.393	0.098
68FlowchartOK?	2.576	0.082
50ConsortiumConsistency	2.653	0.076
11EmployerSatisH5	2.675	0.075
26FundingByStudFacultyH9	2.949	0.058
45FacultySatisfOtherFaculty	2.996	0.055
65StudentIDWithInstitution?	3.022	0.054
62AlignOutcomes	3.055	0.052

Table 7

One-way ANOVA with Difference in Means

Quality Indicator	*F*	Ranked, Sig<.05
28TutionFees%ExpendProg	3.573	0.032
66StudentIDWithProgram?	3.600	0.032
37StudentDropOutDue$	3.693	0.029
20StudentSatisOnLineProgramH13	3.699	0.029
34#JobsThruExternal$	3.953	0.023
52ConsotriumGovern	4.131	0.019
36YieldRate	4.135	0.019
32InstructCostAs%Total$	4.224	0.018
47FacultySatisProgLeadership	4.259	0.017
59StudentRetention	4.453	0.014
33Total$GrantsAs%Total$	5.466	0.006
63Mission?	6.092	0.003
31CreditsHrs/Faculty/Institution	6.094	0.003
64QualImprov?	6.440	0.002
30CreditsHrs/Faculty	7.005	0.002
67AnnualAssessment	9.227	0.000

Bonferroni and Games-Howell Post hoc multiple comparison tests (Gertsman, 2006; Norusis, 2006) were run along with the one-way ANOVA. These multiple comparison procedures were run to determine where the differences between groups were (Norusis 2004, p. 309). Several tests were available, and the Bonferroni procedures (assuming equal variance) along with a related test that does not assume equal variance, Games-Howell (Field, 2008), were run. Elvers (2011) stated that there are different opinions about when to look at the multiple comparisons output. One of the leading opinions is that the multiple comparison output is only meaningful if the overall *F* ratio of the between and within variance estimates is statistically significant.

From the Games-Howell post hoc test (no missing data, data excluded listwise), it was determined most of the pair-wise comparisons between groups indicated the null hypothesis of no difference in means cannot be rejected. However, there were several pair-wise comparisons between groups for which this was not true and the null hypothesis of no difference in means was rejected. The complete analysis data is found in Appendix O and indicates the mean difference was significant at the .05 level with this notation, (*). Table 8 shows paired comparisons that had a statistically significant difference in the mean. Twelve of the 63 quality indicators from the survey (indicated in left column) show some statistically significant difference. There are nine faculty-student pairs, six faculty-graduate pairs and one student-graduate pair, with this notation (*) in the Mean Difference column. A related 32 of the 189 total pairs of the three groups of faculty, graduates and students showed some statistically significant difference, or 16.9%. The significant majority – 83.1% of the paired comparisons – did not show a statistically significant difference.

Table 8

Twelve Quality Indicators with Statistically Significant Differences

Quality Indicator	(I) Member Type	(J) Member Type	(I-J) Mean Difference	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
11EmployerSatisH5	Faculty	Graduate	-.472*	0.193	0.048	-0.941	-0.004
11EmployerSatisH7	Graduate	Faculty	.472*	0.193	0.048	0.004	0.941
28TutionFees%ExpendProg	Faculty	Student	.803*	0.279	0.018	0.119	1.488
28TutionFees%ExpendProg	Student	Faculty	-.803*	0.279	0.018	-1.488	-0.119
30CreditsHrs/Faculty	Faculty	Student	1.174*	0.281	0.001	0.476	1.872

Table 8 (Continued)

Quality Indicator	(I) Member Type	(J) Member Type	(I-J) Mean Difference	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
30CreditsHrs/Faculty	Student	Faculty	-1.174*	0.281	0.001	-1.872	-0.476
31CreditsHrs/Faculty/Institution	Faculty	Graduate	.889*	0.294	0.012	0.175	1.603
31CreditsHrs/Faculty/Institution	Faculty	Student	1.064*	0.283	0.002	0.373	1.755
31CreditsHrs/Faculty/Institution	Graduate	Faculty	-.889*	0.294	0.012	-1.603	-0.175
31CreditsHrs/Faculty/Institution	Student	Faculty	-1.064*	0.283	0.002	-1.755	-0.373
32InstructCostAs%Total$	Faculty	Student	.906*	0.268	0.004	0.256	1.555
32InstructCostAs%Total$	Student	Faculty	-.906*	0.268	0.004	-1.555	-0.256
33Total$GrantsAs%Total$	Faculty	Student	.989*	0.301	0.007	0.248	1.730
33Total$GrantsAs%Total$	Graduate	Student	.651*	0.266	0.045	0.013	1.290
33Total$GrantsAs%Total$	Student	Faculty	-.989*	0.301	0.007	-1.730	-0.248
33Total$GrantsAs%Total$	Student	Graduate	-.651*	0.266	0.045	-1.290	-0.013
34#JobsThruExternal$	Faculty	Student	.969*	0.324	0.014	0.177	1.761
34#JobsThruExternal$	Student	Faculty	-.969*	0.324	0.014	-1.761	-0.177
36YieldRate	Faculty	Graduate	.787*	0.288	0.028	0.073	1.500
36YieldRate	Graduate	Faculty	-.787*	0.288	0.028	-1.500	-0.073
37StudentDropOutDue$	Faculty	Graduate	.775*	0.315	0.049	0.002	1.549
37StudentDropOutDue$	Faculty	Student	.901*	0.343	0.032	0.066	1.736
37StudentDropOutDue$	Graduate	Faculty	-.775*	0.315	0.049	-1.549	-0.002
37StudentDropOutDue$	Student	Faculty	-.901*	0.343	0.032	-1.736	-0.066
59StudentRetention	Faculty	Student	.887*	0.282	0.012	0.184	1.591

Table 8 (Continued)

Quality Indicator	(I) Member Type	(J) Member Type	(I-J) Mean Difference	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
59StudentRetention	Student	Faculty	-.887*	0.282	0.012	-1.591	-0.184
64QualImprov?	Faculty	Graduate	1.115*	0.399	0.027	0.112	2.118
64QualImprov?	Graduate	Faculty	-1.115*	0.399	0.027	-2.118	-0.112
67AnnualAssessment	Faculty	Graduate	1.422*	0.488	0.021	0.196	2.648
67AnnualAssessment	Faculty	Student	1.450*	0.487	0.018	0.226	2.675
67AnnualAssessment	Graduate	Faculty	-1.422*	0.488	0.021	-2.648	-0.196
67AnnualAssessment	Student	Faculty	-1.450*	0.487	0.018	-2.675	-0.226

* The mean difference is significant at the 0.05 level.

To investigate hypothesis H_{04}, a one-way ANOVA was used on the means from the student survey respondents for both the first-year student and passed preliminary exam groups. The ANOVA table output is available at Appendix P—with complete data run with excluded cases listwise—to examine the null hypothesis of no significant difference between the 12 first-year students and the 22 passed preliminary exam students. The results from the Shapiro-Wilk statistic indicated normal data while the Welch statistic variance assumption was violated.

To further investigate hypothesis H_{04} –that there is no significant difference in quality indicators between first-year students and Ph.D. candidates (after passing preliminary exams)—the data file was conditioned with if-then statements to specify the appropriate independent variable (V4) for H_{04}. In examining the data for H_{04} for first-year students and Ph.D. candidates small sample size was a concern. An analysis of power was done (Minium, et al., 1999, p. 317)

with the smaller n =12 of the first-year students, $\alpha = .05$ (two-tailed), power = .65 and $d = 1.0$ and using and interpolating Table 17d. These criteria resulted in a probability of at least .65 of detecting a difference of d = 1.0 (a large difference) with a 5% level of significance (two-tailed). This analysis for H_{04} has reduced power in comparison to the power of the analysis for H_{01}, H_{02} and H_{03}.

There were 12 first-year students and 22 Ph.D. candidates and the data for both sets was indicated to not be normally distributed by both the Kolmogorov-Smirnov and Shapiro-Wilk tests and by plotting the data. Further the Welch statistic for the 63 quality indicators showed 42 quality indicators where the hypothesis of equality of means could not be rejected, while the remaining 21 quality indicators did appear to be statistically significant at the SPSS Sig. = 0.05 level and equality of means was not statistically supported. From the data in Table 9, the ANOVA null hypothesis that there was no difference in the means at the 0.05 significance level was not rejected; see Appendix P for all one-way ANOVA results. From the one-way ANOVA analysis there were 43 quality indicators for which the hypothesis of equal variance could not be rejected, and 20 quality indicators for which the hypothesis of equal means was rejected and a statistically significant difference in the group means indicated. For 68.3% of the quality indicators it was interpreted that there was no difference in the quality indicator means of the two groups.

Table 9

ANOVA Data for H_{04}

Quality Indicator	*F*	Sig.>.05
31CreditsHrs/Faculty/Institution	0.000	1.000
34#JobsThruExternal$	0.001	0.971
17Student:FacultyCustomer	0.002	0.962
23StudentSatisAcademicSupport	0.007	0.933
18StudentSatisFaculty	0.007	0.932
41FacultySatisfactionStudentRatio	0.010	0.922
29TutionFees%ExpendInstitution	0.011	0.917
6Comp%PassH1	0.021	0.887
55NationalRank	0.022	0.882
39FacultyPubsH12	0.025	0.876
16Avail24x7	0.034	0.855
11EmployerSatisH5	0.034	0.854
9CredentialsH4	0.036	0.851
12IfNotOnlineH16	0.037	0.849
38StudentPubsH7	0.037	0.848
19StudentSatisOnLineTeach	0.038	0.847
44#FacultyPresentations	0.039	0.845
36YieldRate	0.042	0.839
22StudentSatisSupportH18	0.046	0.831
28TutionFees%ExpendProg	0.048	0.829
32InstructCostAs%Total$	0.055	0.816
45FacultySatisfOtherFaculty	0.061	0.807
60%StudentCompletionH10	0.061	0.807
20StudentSatisOnLineProgramH13	0.090	0.766
33Total$GrantsAs%Total$	0.109	0.743
15Alum/GradSatisf	0.127	0.724
7DissQualH2	0.143	0.707
61TimeDegCompH11	0.150	0.701
37StudentDropOutDue$	0.157	0.695
62AlignOutcomes	0.159	0.692
27AveInstructorCost	0.166	0.686
43FacultyCredentials	0.196	0.661
46FacultySatisNewStudent	0.201	0.657
8StudtPlaceRateH3	0.238	0.629
65StudentIDWithInstitution?	0.242	0.626
52ConsotriumGovern	0.314	0.579
56QualCurriculum	0.329	0.570
10StudentPresentationsH8	0.361	0.552
51CommunicationQual	0.363	0.551
49FacultySatisDeliveryMethodH22	0.403	0.530

Table 9 (Continued)

Quality Indicator	*F*	Sig.>.05
40Student:FacultyWorkforceH15	0.448	0.508
13StudentEnrolH20	0.453	0.506
30CreditsHrs/Faculty	0.464	0.500
35#StudentAcceptedH21	0.495	0.487
53QualIncommingStudents	0.521	0.476
42#GrantsByFacultyStudent	0.538	0.469
14#StudentsApplyH23	0.571	0.455
24StudentFeedbackOK	0.640	0.429
47FacultySatisProgLeadership	0.813	0.374
58QualEquip	0.826	0.370
66StudentIDWithProgram?	0.886	0.354
54Accreditation	0.918	0.345
50ConsortiumConsistency	1.042	0.315
26FundingByStudFacultyH9	1.076	0.307
63Mission?	1.115	0.299
48FacultySatisOnlineResourcesH14	1.120	0.298
57QualOverallTeachProcess	1.191	0.283
59StudentRetention	1.231	0.275
68FlowchartOK?	1.272	0.268
64QualImprov?	1.382	0.248
25CostEffectH6	1.479	0.233
67AnnualAssessment	1.665	0.206
21StudentSatisTechnoH17	3.543	0.069

Results for H_{05}

The summary mean data to test H_{05} was developed with the IBM SPSS 19 descriptive procedures. This approach was different than that used to analyze the survey data for the first four hypotheses. H_{01}, $H_{02,}$ H_{03}, and H_{04} were examined with one-way ANOVA to determine if there were statistically significant differences between the three groups of faculty, graduates and current Ph.D. students. Then Games-Howell post hoc analysis was done to determine specifically how the three groups differed in their survey scores of the 63 quality indicators. In examining H_{05} the means of each of each of the three groups of faculty, graduates and current

Ph.D. students was extracted from the analysis of the survey data that was used in the analysis of H_{01}, H_{02}, H_{03}, and H_{04}. Shown in Table 10 are the group means from 88 cases with 18 faculty responses, 36 graduate responses and 34 student responses for each of the 63 quality indicators.

Table 10

Data to Test H_{05}

	Group Means		
Quality Indicator	Faculty	Graduate	Student
6Comp%PassH1	1.775	1.972	2.028
7DissQualH2	1.556	1.500	1.545
8StudtPlaceRateH3	2.063	2.559	2.405
9CredentialsH4	2.379	2.717	2.246
10StudentPresentationsH8	2.300	2.833	2.815
11EmployerSatisH5	1.667	2.139	2.029
12IfNotOnlineH16	2.025	1.750	1.789
13StudentEnrolH20	2.628	2.258	2.224
14#StudentsApplyH23	2.238	2.087	2.185
15Alum/GradSatisf	1.793	1.518	1.666
16Avail24x7	2.583	2.528	2.397
17Student:FacultyCustomer	2.177	2.200	2.176
18StudentSatisFaculty	2.339	1.972	1.941
19StudentSatisOnLineTeach	2.021	1.611	1.882
20StudentSatisOnLineProgramH13	2.199	1.500	1.912
21StudentSatisTechnoH17	2.412	2.089	2.271
22StudentSatisSupportH18	2.572	2.278	2.571
23StudentSatisAcademicSupport	2.502	2.278	2.353
24StudentFeedbackOK	2.328	1.806	1.912
25CostEffectH6	2.333	2.167	1.882
26FundingByStudFacultyH9	3.471	3.485	2.867
27AveInstructorCost	2.503	2.722	2.295
28TutionFees%ExpendProg	3.166	2.676	2.363
29TutionFees%ExpendInstitution	3.191	2.663	2.513
30CreditsHrs/Faculty	3.423	2.628	2.249
31CreditsHrs/Faculty/Institution	3.541	2.652	2.477
32InstructCostAs%Total$	3.237	2.646	2.331
33Total$GrantsAs%Total$	3.684	3.347	2.695

Table 10 (Continued)

	Group Means		
Quality Indicator	Faculty	Graduate	Student
34#JobsThruExternal$	3.809	3.238	2.840
35#StudentAcceptedH21	3.142	2.577	2.840
36YieldRate	2.993	2.207	2.421
37StudentDropOutDue$	3.602	2.826	2.701
38StudentPubsH7	2.414	2.429	2.543
39FacultyPubsH12	2.500	2.287	2.304
40Student:FacultyWorkforceH15	2.278	2.139	2.123
41FacultySatisfactionStudentRatio	2.611	2.327	2.480
42#GrantsByFacultyStudent	3.114	3.169	2.826
43FacultyCredentials	2.156	1.775	1.909
44#FacultyPresentations	2.528	2.528	2.486
45FacultySatisfOtherFaculty	3.608	2.771	2.816
46FacultySatisNewStudent	2.333	2.380	2.304
47FacultySatisProgLeadership	3.167	2.204	2.317
48FacultySatisOnlineResourcesH14	2.389	2.176	2.074
49FacultySatisDeliveryMethodH22	2.111	1.917	2.029
50ConsortiumConsistency	2.833	2.098	2.133
51CommunicationQual	2.722	2.090	2.102
52ConsotriumGovern	3.000	1.981	2.262
53QualIncommingStudents	1.995	1.911	1.842
54Accreditation	2.260	1.800	1.788
55NationalRank	2.590	2.178	2.048
56QualCurriculum	2.000	1.597	1.787
57QualOverallTeachProcess	2.000	1.632	1.728
58QualEquip	2.611	2.230	2.210
59StudentRetention	2.849	2.321	1.962
60%StudentCompletionH10	2.796	2.119	2.254
61TimeDegCompH11	2.722	2.355	2.259
62AlignOutcomes	2.675	2.008	2.013
63Mission?	2.609	1.804	1.763
64QualImprov?	2.953	1.837	2.034
65StudentIDWithInstitution?	3.261	2.464	2.697
66StudentIDWithProgram?	3.024	2.178	2.395
67AnnualAssessment	3.344	1.922	1.894
68FlowchartOK?	2.886	2.541	2.249

To investigate hypothesis H_{05} a one-way ANOVA was run on the mean of means for the 63 quality indicators by respondents in each of the three survey groups. The data in Table 10 was reconfigured as the SPSS data file and a one-way ANOVA procedure was run. The Shapiro-Wilk and Kolmogorov-Smirnov statistics were calculated as a test for normality, with consideration of Sig. ≥ 0.05. All three groups were normally distributed, as indicated in Table 11.

Table 11

Kolmogorov-Smirnov Statistics Indicate Normally Distributed

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	GroupType	Statistic	df	Sig.	Statistic	df	Sig.
GroupVariableMean#	faculty	.092	63	.200*	.979	63	.355
	graduates	.082	63	.200*	.970	63	.121
	students	.065	63	.200*	.974	63	.203

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

The ANOVA assumption of equal variances was examined with the Levene statistic and the assumption of equal variance, with consideration of Sig. ≥ 0.05. As indicated in Table 12, the assumption of uniform variance was not justified. More specifically, the variances were significantly different and the assumption of homogeneity of variance has been violated (Field, 2008). Related tests were run for robust equality of means, with data in Table 13.

Table 12

Levene Statistic

Levene Statistic	df1	df2	Sig.
6.785	2	186	.001

Table 13

Robust Equality of Means

	Statistic[a]	df1	df2	Sig.
Welch	13.736	2	118.911	0

a. Asymptotically *F* distributed.

The ANOVA analysis results are shown Table 14, and with SPSS the significance Sig. was of consequence as it is less than p = 0.05, and the null hypothesis that the group summary means are equal was rejected. As indicated by this analysis, there were differences in the group summary means, with Sig. = 0 ≤ 0.05.

Table 14

ANOVA Results

	Sum of Squares	*df*	Mean Square	*F*	Sig.
Between Groups	6.371	2	3.186	16.179	0
Within Groups	36.622	186	0.197		
Total	42.993	188			

Post hoc multiple comparison tests were run as indicated in Table 15. These multiple comparison procedures were run to determine where the differences between groups were (Norusis 2004, p. 309), with the Games-Howell procedure assumption of unequal variances. From the results the assumption of no difference between the group means was not rejected for the group pairs of graduates and current Ph.D. students, while the assumption of no difference between the group means was rejected for the group pairs of faculty and graduates, and faculty and current Ph.D. students.

Table 15

Post Hoc Multiple Comparison Tests- Games-Howell

(I) GroupType	(J) GroupType	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
faculty	graduates	.37133*	0.088	0.000	0.163	0.579
	students	.40538*	0.079	0.000	0.217	0.593
graduates	faculty	-.37133*	0.088	0.000	-0.579	-0.163
	students	0.03400	0.069	0.876	-0.131	0.199
students	faculty	-.40538*	0.079	0.000	-0.593	-0.217
	graduates	-0.03400	0.069	0.876	-0.199	0.131

* The mean difference is significant at the 0.05 level.

Graphical Model/Flowcharts

A flowchart of the ISU Technology Management Ph.D. Consortium processes was developed and incorporated into both the delphi panel and survey. However, there was limited engagement with both delphi and survey participants. The very limited responses from the delphi was that the flowchart was accepted. There was more response from the survey, as indicated in Table 16, with graduates and students and the faculty slightly agreeing with the researcher that the Excel flowchart with three major parts was suitable for utilization of all—or almost all—of the previously identified quality indicators.

Table 16

RQ3 and Survey Question 68 on Flowchart

Member Type		68FlowchartOK?
Faculty	Mean	2.886
	N	18.000
	Std. Deviation	1.107
Graduate	Mean	2.541
	N	36.000
	Std. Deviation	1.045
Student	Mean	2.249
	N	34.000
	Std. Deviation	0.809
Total	Mean	2.499
	N	88.000
	Std. Deviation	0.991

Gap Analysis

There was only minor engagement by both the delphi panelists and the survey respondents in consideration of the proposed flowchart that the researcher interprets as acknowledgement of a suitable flowchart of the IUS Technology Management Ph.D. Consortium. There were not sufficient delphi or survey comments to lead to changes in the flowchart or a useful gap analysis.

Results Summary

The results of the research was 63 quality indicators produced through a three round delphi panel process, which started out with a basis of thirty-three indicators. It was also of interest to determine how the delphi panelists responded to the 24 quality indicators from Hendrix (2005) that were used as part of the basis of quality indicators for the first round of the delphi panel. The acceptance rate for the Hendrix quality indicators was 51%.

The survey response was not as great as anticipated and the researcher gathered the data and proceeded with the analysis. A survey instrument was planned to be developed and administered to the three groups in the ISU Technology Management Ph.D. Consortium, the faculty, graduates, and current Ph.D. students. A fourth group of university support staff associated with the five member universities was planned for in the research. However, too few university staff were identified and the response was modest. Consequently, the university staff group was removed from analysis. SPSS exploratory and descriptive statistical analysis indicated that from the initial 103 survey with listwise deletion of data, there were a total of 55 complete survey responses. After missing data analysis and imputation of data using IBM SPSS Amos Maximum Likelihood Estimation there were 88 complete cases for subsequent analysis.

Results of the one-way ANOVA procedure was run with considerations of Sig. ≥ 0.05 on the three groups of faculty, graduates and students indicating both significant and insignificant differences between means of the three groups of 63 quality indicators. Shown in Table 6 this chapter are 46 quality indicators for which the null hypothesis that there was no difference in the means was not rejected at the 0.05 significance level. This is related to Table 7 of this chapter showing the corresponding 16 quality indicators for which the hypothesis of equal means was rejected and a difference in the group means indicated.

Post hoc multiple comparison tests (Gertsman, 2006; Norusis 2006) were run to determine where the differences between the three groups were (Norusis 2004, p. 309) and results are found in Appendix O. From the Games-Howell post hoc test it was determined most of the paired comparisons between groups indicated the null hypothesis of no difference in means cannot be rejected. Table 8 shows paired comparisons which have a statistically significant difference in the mean. Twelve of the 63 quality indicators from the survey

(indicated in left column) show some type of statistically significant difference in combination of faculty-student, faculty-graduate, student-graduate, with this notation (*) in the Mean Difference column. More specifically, 32 of the 189 total pairs of the three groups of faculty, graduates and students show a level of statistically significant difference for which the hypothesis of equal means was rejected and a difference in the group means indicated, or almost 17%. The significant majority—almost 83% of the paired comparisons—did not show a statistically significant difference for which the null hypothesis that there was no difference in the means was not rejected at the 0.05 significance level, indicated in Table 8 of this chapter.

In examining H_{04} regarding the first-year students and Ph.D. candidates with a one-way ANOVA procedure it was determined that there was a difference between the first-year students and the Ph.D. candidates. There were 43 quality indicators for which the hypothesis of equal variance could not be rejected, and 20 quality indicators for which the hypothesis of equal means was rejected and a statistically significant difference in the group means indicated. For 68.3% of the quality indicators it was interpreted that there was no difference in the quality indicator means of the two groups.

Investigating hypothesis H_{05} with a one-way ANOVA on the mean of means for the 63 quality indicators by respondents in each of the three survey groups resulted in the rejection of the hypothesis there was no difference in the means at the 0.05 level of significance. Subsequent Games-Howell post hoc multiple comparison tests were run and the assumption of no difference between the group means was not rejected for the group pairs of Ph.D. graduates and current Ph.D. students. The assumption of no difference between the group means was rejected for the group pairs of faculty and Ph.D. graduates, and faculty and current Ph.D. students at the 0.05 level of significance.

Null Hypotheses

Acceptance or rejection of the research hypotheses was as follows:

H_{01}: There is no significant difference in quality indicators between faculty and students. The first hypothesis was rejected as there were nine significant differences between faculty and student responses reflected in the means analysis. The relevant Table 8 data was reformatted to show the nine faculty and student pairs as indicated in Table 17.

Table 17

Rejection of the Research Hypothesis H_{01}

Quality Indicator	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
28TutionFees%ExpendProg	Faculty	Student	.803*	0.279	0.018	0.119	1.488
30CreditsHrs/Faculty	Faculty	Student	1.174*	0.281	0.001	0.476	1.872
31CreditsHrs/Faculty/ Institution	Faculty	Student	1.064*	0.283	0.002	0.373	1.755
32InstructCostAs%Total$	Faculty	Student	.906*	0.268	0.004	0.256	1.555
33Total$GrantsAs%Total$	Faculty	Student	.989*	0.301	0.007	0.248	1.730
34#JobsThruExternal$	Faculty	Student	.969*	0.324	0.014	0.177	1.761
37StudentDropOutDue$	Faculty	Student	.901*	0.343	0.032	0.066	1.736
59StudentRetention	Faculty	Student	.887*	0.282	0.012	0.184	1.591
67AnnualAssessment	Faculty	Student	1.450*	0.487	0.018	0.226	2.675

* The mean difference is significant at the 0.05 level.

H_{02}: There is no significant difference in quality indicators between faculty and graduates. The second hypothesis was not rejected as there were five significant differences between faculty and graduates responses reflected in the means analysis. The relevant Table 8 data was reformatted to show the five faculty and student pairs as indicated in Table 18.

Table 18

Rejection of the Research Hypothesis H_{02}

Quality Indicator	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
11EmployerSatisH5	Faculty	Graduate	.472*	0.193	0.048	0.941	0.004
31CreditsHrs/Faculty/ Institution	Faculty	Graduate	.889*	0.294	0.012	0.175	1.603
36YieldRate	Faculty	Graduate	.787*	0.288	0.028	0.073	1.500
37StudentDropOutDue$	Faculty	Graduate	.775*	0.315	0.049	0.002	1.549
64QualImprov?	Faculty	Graduate	1.115*	0.399	0.027	0.112	2.118
67AnnualAssessment	Faculty	Graduate	1.422*	0.488	0.021	0.196	2.648

* The mean difference is significant at the 0.05 level.

H_{03}: There is no significant difference in quality indicators between students and graduates. The third hypothesis was rejected as there was one significant difference between students and graduates responses reflected in the means analysis. The relevant Table 8 data was reformatted to show the one student and graduate pair as indicated in Table 19.

Table 19

Rejection of the Research Hypothesis H_{03}

Quality Indicator	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
33Total$GrantsAs %Total$	Student	Graduate	.651*	0.266	0.045	1.290	0.013

* The mean difference is significant at the 0.05 level.

H_{04}: There is no significant difference in quality indicators between first-year students and Ph.D. candidates (after passing preliminary exams). From Appendix P the fourth hypothesis was rejected as there was a significant difference between first-year students and Ph.D.

candidates (after passing preliminary exams). From the one-way ANOVA analysis there were 43 quality indicators for which the hypothesis of equal variance could not be rejected, and 20 quality indicators for which the hypothesis of equal means was rejected and a statistically significant difference in the group means indicated. For 68.3% of the quality indicators it was interpreted that there was no difference in the quality indicator means of the two groups.

H_{05}: There is no significant difference in quality indicators between faculty, students, and graduates. From the one-way ANOVA results found in Table 14 the fifth hypothesis was rejected as there was a significant difference among faculty, graduate, and student responses reflected in the means analysis. Games-Howell post hoc multiple comparison tests were run as indicated in Table 15. These multiple comparison procedures were run to determine where the differences between groups were (Norusis 2004, p. 309). From the results, the hypothesis of equal variance between the group means was not rejected for the group pair of graduates and current Ph.D. students. The hypothesis of equal group means was rejected and a statistically significant difference in the group means was indicated for the group pairs of faculty and graduates, and faculty and current Ph.D. students.

Survey Comments

Along with the survey responses in Likert scale format, there were also comments by the survey respondents that were solicited by the researcher. This was not a major strategy such as found with the delphi panel structure and process, but was used in this survey. While the data was qualitative, the comments did provide some interesting insights. Useful to the researcher were those comments directed to the flowchart.

Researcher's Influence on the Research

There was consideration given to the influence of the researcher on this research. This is in the context of the famous management research referred to as the 'Hawthorn Effect' demonstrating the researcher's influence on the research. There were no realistic means to factor this potential effect out given the nature of the research on a Ph.D. consortium and the relationship of the researcher as part of that Ph.D. consortium. The researcher suggests that in this case the researcher impact was minor in the context of 'I knew Mark the researcher and did respond'. This is because of the already discussed limited and less than expected response to participating in the delphi panel as well as in responding to the web-based survey to be used in Ph.D. dissertation research.

Related considerations were the likely effect that this was just another Ph.D. student request and both faculty and current students didn't respond because it was a Ph.D. student request. The researcher also suggests other effects to consider that may have research response impact. This included the daunting Institutional Review Board permission statement displayed at beginning of delphi and survey, or the ISU Technology Management Ph.D. Consortium director's name in the e-mail sent to the Ph.D. students through the student listserv. This discussion is in contrast to Gall, Gall and Borg's (2003, Chapter 8) suggested strategies to engage survey respondents.

CHAPTER 5

DISCUSSION

The research questions driving this research lead to the utilization of a delphi study to develop and refine quality system model attributes of a successful online doctoral consortium. This was followed by the development and administration of a survey to confirm the quality system model attributes of the existing online ISU Technology Management Ph.D. Consortium. SPSS data analysis and one-way ANOVA statistical techniques were used to analyze the survey data. The research was conducted to address the following research questions:

RQ1. What would be the expected indicators of quality for a quality system model for a successful online technology management Ph.D. consortium?

RQ2. What would be the differences between major groups of the existing online ISU Technology Management Ph.D. Consortium with respect to the expected quality indicators of the quality system model for a successful online technology management Ph.D. consortium?

RQ3. What are the responses to a proposed graphical model of the ISU Technology Management Ph.D. Consortium quality system by the delphi panel and survey respondents?

The first research question, RQ1, was exploratory and intended to determine the characteristics of a quality system for a generic online technology management Ph.D.

consortium. The research used a comprehensive literature review to generate relevant quality indicators for a three round delphi procedure to process. This resulted in 63 quality indicators found in Table 1 and was used to develop a survey. This survey was used to examine research questions RQ1, RQ2 and RQ3.

The second research question, RQ2, was to determine quality system attribute differences between three groups associated with the ISU Technology Management Ph.D. Consortium program (faculty, graduates and students). The survey results allowed for hypotheses testing and statistical analysis.

The third research question, RQ3, was to generate responses to a proposed graphical model of the ISU Technology Management Ph.D. Consortium quality system by the delphi panel and survey respondents. This was qualitative research and required the use of a flowchart of the ISU Technology Management Ph.D. Consortium. There was only minor engagement by the delphi panelists indicating acceptance. There was more response by the survey respondents in consideration of the proposed flowchart that the researcher interpreted as acknowledgement of a suitable flowchart of the ISU Technology Management Ph.D. Consortium. Graduates, students and faculty agreed to slightly agreed that the Excel flowchart was suitable for almost all of the identified quality indicators.

The three research questions lead to five research hypotheses. Acceptance or rejection of the research hypotheses was as follows:

H_{01}: There is no significant difference in quality indicators between faculty and students. The first hypothesis was rejected as there was a significant difference between faculty and student responses reflected in the post hoc analysis of nine of the 63 quality indicators.

H_{02}: There is no significant difference in quality indicators between faculty and

graduates. The second hypothesis was rejected as there was a significant difference between faculty and graduate responses reflected in the post hoc analysis of five of the 63 quality indicators.

H_{03}: There is no significant difference in quality indicators between students and graduates. The third hypothesis was rejected as there was a significant difference between students and graduates responses reflected in the post hoc analysis of one of the 63 quality indicators.

H_{04}: There is no significant difference in quality indicators between first-year students and Ph.D. candidates (after passing preliminary exams). The fourth hypothesis was rejected as there was a significant difference between first-year students and Ph.D. candidates (after passing preliminary exams). From the one-way ANOVA analysis there were 43 quality indicators for which the hypothesis of equal variance could not be rejected, and 20 quality indicators for which the hypothesis of equal means was rejected and a statistically significant difference in the group means indicated. For 31.7% of the quality indicators it was interpreted that there was a statistically significant difference in the quality indicator means of the two groups.

H_{05}: There is no significant difference in quality indicators between faculty, students, and graduates. The fifth hypothesis was rejected as there was a significant difference between faculty, graduate and student responses reflected in the one-way ANOVA analysis as indicated in Table 14. Games-Howell post hoc multiple comparison tests results of the hypothesis of equal variance between the group means was not rejected for the group pair of graduates and current Ph.D. students. The hypothesis of equal group means was rejected and a statistically significant

difference in the group means indicated for the group pairs of faculty and graduates, and faculty and current Ph.D. students.

Summary

The literature review and utilization of the Hendrix (2005) Ph.D. doctoral program quality indicators was successfully utilized and the work extended with the use of a three round delphi panel. This delphi panel extended the initial basis of thirty-three quality indicators and developed 63 quality indicators. These quality indicators are listed in Table 1, and a ranked listing of the 63 quality indicators is found in Appendix Q. Statistical differences were detected between the paired comparisons of the three groups in the post hoc analysis for H_{01}, H_{02}, and H_{03}. These differences could be interpreted a minor differences. The faculty-student pair showed the most difference where the post hoc test indicated nine of 63 quality indicators were statistically different. The pos hoc test of the faculty-graduate pair showed five of 63 quality indicators were statistically different. The post hoc test of the graduate-student pair showed the least difference with one significant difference in quality.

The differences detected between the paired comparisons of the three groups in H_{01}, H_{02} and H_{03} was supported by the post hoc analysis conducted for H_{05}. The assumption of no difference in the means of graduates and current Ph.D. students was not rejected. This compares to H_{01}, with one of 63 quality indicators being statistically different. The assumption of no difference in the means of faculty and graduates was rejected. This compares to H_{02}, with five of 63 quality indicators being statistically different. The assumption of no difference in the means of faculty and current Ph.D. students was rejected. This compares to H_{03}, with nine of 63 quality indicators being statistically different.

More substantial contrast was evident in the analysis of H_{04} where the assumption of no difference in the means was rejected because of a significant difference between first-year students and Ph.D. candidates. There were 43 quality indicators for which the hypothesis of equal variance could not be rejected, and 20 quality indicators for which the hypothesis of equal means was rejected and a statistically significant difference in the group means indicated. For 31.7% of the quality indicators it was interpreted that there was a statistically significant difference in the quality indicator means of the two groups.

The differences in the three groups of faculty, graduates and students indicated in the analysis of H_{01}, H_{02} and H_{03} were not as substantial as the differences indicated in the analysis of H_{04}. Given that contrast it seemed that while there was evidence of differences in the three groups of faculty, graduates and students in the ISU Technology Management Ph.D. Consortium, it was relatively minor. More specifically, 32 of the 189 total pairs of the three groups of faculty, graduates and students show a level of statistically significant difference for which the hypothesis of equal means was rejected and a difference in the group means indicated, or almost 17%, indicated in Table 8 of Chapter 4. This may be a reflection in the similarity of the members of the three groups within the ISU Technology Management Ph.D. Consortium. The Ph.D. students selected are typically working professionals, and consequently are older students. A significant professional track in the program appears to be working faculty and academicians with Master's degrees getting a Ph.D. for career enhancement. This situation is the same with the graduates, who are now typically older as they work through the Ph.D. program. With the acquisition of a Ph.D., they are even more similar to the existing ISU Technology Management Ph.D. Consortium faculty. Several Ph.D. students have been graduate students at the universities

of the ISU Technology Management Ph.D. Consortium and upon graduation continue their careers at that or other higher education institutions.

A fourth group was initially planned to be surveyed and used as part of the research, the university staff that support the ISU Technology Management Ph.D. Consortium at the five universities. However, too few were identified and the response was insufficient for inclusion. Similarly, the initial interest by the researcher in examining the differences between different student specializations (Manufacturing Systems and Quality Systems) was not possible due to small survey response that would not allow for hypotheses testing and statistical analysis.

The use of human subjects was much more difficult and time consuming than the researcher had anticipated. This included the obligatory involvement in two university Institutional Research Boards. The recruitment of eight to twelve qualified delphi panelists selected based on their current involvement with higher education, quality systems, consortia, quality and online higher education programs led the researcher to try to recruit from an extremely successful and very busy candidate pool, which was in turn very difficult. Potential participants did not respond or declined to participate. Similarly the survey of the three groups in the ISU Technology Management Ph.D. Consortium—faculty, graduates, and students—was an effort to get survey responses from an extremely successful and very busy pool of candidates.

A condensed cause-and-effect diagram showing a model of the 63 quality indicators leading to a Ph.D. consortium quality system model is shown in Figure 3. The quality indicators were developed through the three round delphi procedure and confirmed with the survey of the three groups in the ISU Technology Management Ph.D. Consortium, the faculty, graduates and students.

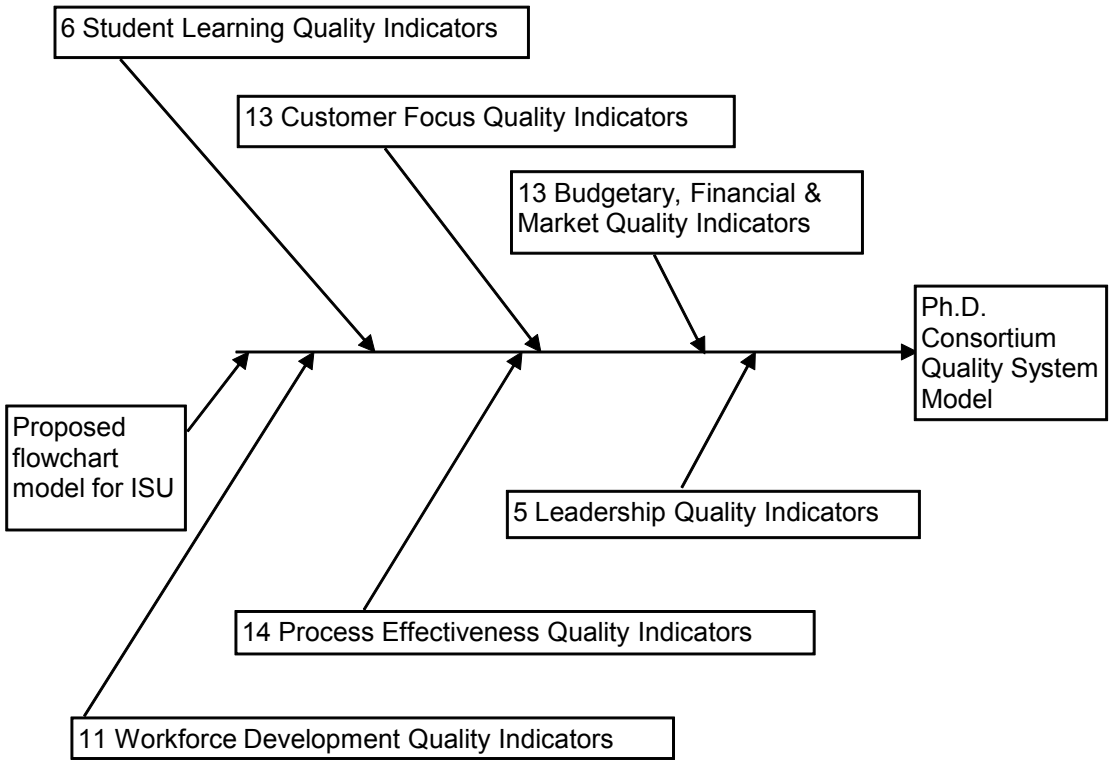

Figure 3. Condensed cause-and-effect diagram with 63 quality indicators

Researcher's Observations

The Institutional Review Board (IRB) involvement of the two responsible universities was unexpectedly difficult and time consuming. In retrospect, this lack of discussion in the numerous resources and articles reviewed on the use of the delphi methodology now stands out. Several relatively recent articles did not address this aspect or potential consequences of this research methodology.

Previously stated was the recruitment of the delphi panel members was unexpectedly difficult. The invited participants are professionally acquainted with the national discussion on

the state of the Ph.D., Ph.D. programs, and what are considered as unacceptably low Ph.D. graduation rates.

Identification of the ISU Technology Management Ph.D. Consortium current Ph.D. students was not possible given privacy constraints, and delivery of the survey through the Ph.D. student listserv was problematic. Identification of ISU Technology Management Ph.D. Consortium Ph.D. graduates was only possible through a list of dissertations and Google searches. Not all graduates were found. While the ISU Technology Management Ph.D. Consortium faculty could be found, the delivery of the survey via e-mail was also problematic. While e-mail is typically acceptably robust, there were multiple "failure to deliver" e-mail responses that were never resolved.

The very modest response rates for participation in the delphi panel and in the survey response of the ISU Technology Management Ph.D. Consortium were not anticipated by the researcher. In retrospect and after discussions with others it appears to be the way our professorate and the Ph.D. level higher education community functions.

The direction of the research was to identify quality indicators and the literature review provided previous research to indicate a basis of quality indicators. It was noted there were many quality indicators that were rejected by the delphi panel or received only slightly agree or slightly disagree Likert scale selections by the ISU Technology Management Ph.D. Consortium faculty, Ph.D. graduates and current Ph.D. students.

Incomplete data sets forced the researcher to consider various options available to deal with missing data. One involved further survey activity and was ruled out because of expected operational difficulties. The next option involved the examination of statistical procedures. This included pairwise data deletion, listwise data deletion, and the range of data imputation

procedures. Currently there are readily accessible and interesting statistical tools for imputating data into incomplete data sets. The researcher anticipates these tools will be improved and become more commonplace.

Conclusion

The problem for this research was that there were no identified and confirmed quality system model attributes for a successful online technology management doctoral consortium. There were a number of interrelated activities that contributed to the research that resolved this problem. The literature review resulted in three main areas within the literature that were relevant to understanding the problem for this research. These three major areas were identified as: 1) quality systems, 2) higher education consortia, and 3) assessment approaches. The research built on the work of Bilke, Xia, Bailey, Rodchua, and Sinn (2006) and Hendrix (2005), and incorporated the work of a number of authors. The literature review lead to the development of the initial 33 quality indicators used in round one of the delphi panel, and found in Appendix H. The literature review also provided the necessary background for the use of the delphi technique and the web-based survey, as well as the major components of the statistical analysis. This included the preliminary analysis of the data, the missing values analysis, the power analysis, the one-way ANOVA and related post hoc analysis used to examine the five hypotheses.

From the research with the delphi panel it was determined that important indicators of quality could be identified for a distance doctoral consortium. The initial 33 quality indicators used in round one of the delphi panel were developed into 63 quality indicators (Table 1) at the conclusion of the third delphi panel round. The delphi panel provided expert opinion that was used to develop a survey instrument that was administered to the three remaining groups in the

ISU Technology Management Ph.D. Consortium. There was only very minor delphi panel engagement in the examination of a proposed graphical model of the ISU Technology Management Ph.D. Consortium quality system. The three round delphi concluded with 13 quality indicators where all panelists only accepted the quality indicator, showing strong agreement for the indicator. There were no quality indicators where all panelists only rejected the quality indicator, which was interpreted as a strong indication of agreement by a diverse panel. Centrally located pairs of acceptance and rejections by the delphi panel showed the least disagreement, and there were eight 3 and 4 pairs, and seven 4 and 3 pairs. With the previously researched basis of quality indicators, it was of interest Table 1 indicated there were 113 of 421 quality indicators that were rejected, or 36.7%.

The 63 quality indicators identified through the delphi panel were suitable for conversion into a web-based six point Likert scale survey. The survey was administered to the ISU Technology Management Ph.D. Consortium faculty, Ph.D. graduates and Ph.D. students via e-mail. The research had identified a suitable basis of quality indicators for a quality system model for a successful online technology management doctoral consortium. Five hypotheses were developed concerning the ISU Technology Management Ph.D. Consortium faculty, Ph.D. graduates and Ph.D. student groups to investigate each group's consideration of the suitability of each quality indicator. The survey data was then statistically analyzed to test the five hypotheses concerning the ISU Technology Management Ph.D. Consortium faculty, Ph.D. graduates and Ph.D. student groups.

During the analysis of the survey data it was necessary to remove 15 survey responses due to missing data considerations of the one-way ANOVA and post hoc statistical analysis. This was followed by consideration of the missing data in the remaining 88 survey responses in the

faculty, Ph.D. candidate and Ph.D. student groups. The resulting missing values analysis determined that listwise deletion would remove too many cases to allow a meaningful statistical analysis. Data imputation techniques were then examined (Howell, 2009; Graham, 2009). The SPSS 19 Graduate Pack for Windows multiple imputation technique was determined to be inappropriate. The selected alternative was the IBM SPSS Amos maximum likelihood imputation (MLI) technique. The initial data set had 103 cases and missing data and zeros, and the final survey data set had 88 cases with imputed data and no missing data or zeros. In these 88 cases there were 18 faculty responses, 36 graduate responses and 34 student responses. Within the student responses there were 12 first year students and 22 students who have passed their preliminary exams.

The null hypothesis form of all five hypotheses was that there was no difference in the mean scores of the groups, and this was rejected for all five hypotheses. The responses of the 88 cases from the three groups were statistically different in the first three hypotheses. This was determined from the one-way ANOVA and post hoc statistical analysis. Although statistically similar, the faculty opinion of the suitability of the quality indicators for use with the ISU Technology Management Ph.D. Consortium was noticeably different compared to the Ph.D. graduates and Ph.D. students. This statistical difference in the faculty group mean of the 63 quality indicators was reported in the context of 12 of the 63 quality indicators from the survey show some statistically significant difference. There are nine faculty-student pairs, six faculty-graduate pairs and one student-graduate pair that are different. These 12 of 63 quality indicators found in Table 8 are also directly related to 32 of the 189 total pairs of the three groups of faculty, graduates and students that showed some statistically significant difference, or 16.9%. Note that the 189 total pairs came from the 63 quality indicators being considered three times.

The significant majority—83.1% of the paired comparisons—did not show a statistically significant difference. This was unexpected by the researcher, with the initial expectation being that there would be more demonstrated and obvious statistical differences. The researcher suggests that in this Ph.D. consortium, the faculty, Ph.D. graduates and current Ph.D. students are more similar than would typically be expected. These results of the differences between the faculty-graduate and faculty-student pairs were supported by the data analysis for the fifth hypothesis.

The fourth hypothesis did show more demonstrated and obvious statistical differences between the groups of first year Ph.D. students and Ph.D. students that had passes their preliminary exams. This was unexpected by the researcher, with the initial expectation being that there would not be statistical differences. In this situation the researcher has no suggestions why there was this difference.

The qualitative component of this research was the examination of a proposed graphical model of the ISU Technology Management Ph.D. Consortium quality system. While of interest to the researcher, it received almost no attention from the delphi panel. The researcher suggests the graphical model was too complex for the delphi panel members to commit the necessary time to review and consider. There was more response from the three groups in the survey, as indicated in Table 16. The response was sufficient to consider examining this topic with further research and consideration of graphical tools.

These research results would be important in developing quality indicators for a multi-university distance Ph.D. consortium to address the interests of these three slightly different groups. The research itself provides some strong indications of potential quality indicators in Table 1 from the delphi panel and Appendix Q from the survey. These are potential quality

indicators that could be considered for use within the ISU Technology Management Ph.D. Consortium leadership. These quality indicators could be of use if low-cost or no-cost strategies can be developed. One example was the quality indicator of a greater focus on current Ph.D. publications. Or the quality indicators could be of substantial use if framed within a quality model such as indicated in Figure 3 or Appendix F, or a quality system such as the Baldrige Education Criteria for Performance Excellence. The results of this research will be taken back to the ISU Technology Management Ph.D. Consortium leadership. Communication will also occur as the researcher does further analysis and develop explanations while unbundling this dissertation for future publications and presentations.

The final conclusion from this research would be that it was possible to determine the important indicators of quality that would be useful in improving a distance doctoral consortium. A panel of professionals in a delphi panel was used to determine 63 quality indicators. These quality indicators were then confirmed in a survey of the ISU Technology Management Ph.D. Consortium faculty, Ph.D. graduates and Ph.D. students. Although statistically similar, the faculty opinion of the suitability of the quality indicators for use with the ISU Technology Management Ph.D. Consortium was noticeably different compared to the Ph.D. graduates and Ph.D. students. These research results would be important in developing quality indicators for a multi-university distance Ph.D. consortium to address the interests of these three slightly different groups.

Recommendations for Further Research

Related to this research it may be appropriate for future research to take the survey data and do modeling and/or factor analysis. This research would be to determine if it is possible to reduce the number of quality indicators or predict responses of the three groups.

As soon as practical, conduct the survey with university administrators from the ISU Technology Management Ph.D. Consortium participating universities and compare to this research. In particular, identify administrators who have some involvement with programs associated with the technology management core and specializations of the ISU Technology Management Ph.D. Consortium. Even though other stakeholders could provide value and insight into identification of quality indicators for an online distance doctoral program, university administrators would be the remaining stakeholder group of greatest consequence.

While research into Ph.D. consortium will be interesting and is expected to move forward, extreme caution is suggested in the future when considering the use of delphi panelists or Ph.D. consortium member surveys. It may be that research candidate response *burn out* has set in. Researcher anticipated engagement of delphi panel or survey participants involved with the "Professoriate" (Boyer, 1997) for research purposes may find substantial difficulty.

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APPENDIX A: LIST OF ACRONYMS

ALN:	Asynchronous Learning Networks
ANOVA:	Analysis of Variance
BOK:	Body of Knowledge
HEI:	Higher Education Institution
IBDL:	Internet-based Distance Learning
ISO:	International Organization for Standardization
MI:	Multiple Imputation
MLE:	Maximum Likelihood Estimation
Ph.D.:	Doctor of Philosophy
URL:	Universal Resource Locator
VCU:	Virtual colleges and Universities

APPENDIX B: LIST OF RELATED TERMS

Monotonicity: Pattern of missing contiguous data; as opposed to non-monotonicity with no pattern of missing contiguous data. (IBM, 2010, p. 49)

APPENDIX C: TOPICS AND SUBTOPICS OF PROBLEM STATEMENT

Topic #: with initial problem statement topic	Related subtopics	Related terms
quality systems	quality system	quality
		total quality management
		strategic management
		quality improvement
		management system
		improvement
		service quality
		organizational improvement
		lean
		lean sustainability
		quality function deployment (QFD)
higher education consortium	higher education	globalization
		faculty
		administrators
		doctoral education
		professoriate
		Ph.D.
		doctoral student(s)
		roles and competencies
		higher education
		higher education institutions (HEIs)
		program administrators
		students
		colleges
		doctoral curriculum
		rubrics
	online education	online learning
		distance learning
		distance education
		Internet & higher education
		electronically offered degree
		virtual
		virtual university
		distributed learning
		distributed education

Topic #: with initial problem statement topic	Related subtopics	Related terms
	consortia	consortium
		consortia
		collaborations
		collaborative
		programs
		educational research
		partnership
	terminology	glossary
		basic terms
		definitions
		key terms
		vocabulary
an approach for assessment	assessment	assessment
		review
		accreditation
		criteria (Baldrige)
		evaluation
		regulation
		standard(s)
	delphi methodology	delphi
	graphical, process and gap analysis and value stream mapping	gap analysis
		configuration map
		value stream map (or mapping)
		concept mapping
		process analysis
	statistics	measurement
		measuring
		importance-performance analysis
		meta-analysis
		scale developing
		measure
		mixed methods evaluations
		validating
		criteria set
		prioritization
		ordinal responses
		conceptual model
		statistical data analysis
		research design
		SPSS (software)
		questionnaire
		Likert scale
		data analysis
		analyzing data

APPENDIX D: DELPHI PANEL INITIAL LITERATURE SOURCES

Citation	General topic	Specific terms
Bilke, T., Xia, J., Rodchua, S., Bailey, W. D., & Sinn, J. W. (2006, October/December).Quality Model in Web-Based Distance Learning: A Case Study. Journal of Industrial Technology, *22*(4). Retrieved June 8, 2008, from http://www.nait.org/jit/Articles/bilke101706.pdf	1) Flowchart of Consortium Ph.D. Processes for turning applicant into graduate (p. 4) 2) Preliminary analyses of strengths and weaknesses of existing quality system (p. 5) 3) Six GPQS elements are the main components in the quality system model (p. 6)	1) Similar to Indiana State University College of Technology PhD in Technology Management Flow Process (2008).
Cleary, Thomas S. (2001). Indicators of Quality. Planning for Higher Education, *29*(3), 19-28.	List of measures of institutional quality; has 60 measure list, plus 3 questions and identify yourself	
Cyr, T. & Muth, R. L.(2006). Portfolios in doctoral education. In P. L. Maki & N. Borkowski (Eds.), *The Assessment of Doctoral Education* (pp. 215-237). Sterling, VA: Stylus Publishing.	1) Portfolios in doctoral education, p. 218; assessment criteria, p. 221 2) Traditional assessment approaches	1) types: documentation, process, & showcase; systematic, cumulative, multifaceted/multidimensional, pragmatic 2) Course grades and comprehensive exams
Funk, K., & Klomparens, K. L.(2006). Using the assessment process to improve doctoral programs. In P. L. Maki & N. Borkowski (Eds.), *The Assessment of Doctoral Education* (pp. 145-162). Sterling, VA: Stylus Publishing.	Assessment of student learning, with both direct and indirect methods (p. 153, 154, respectively).	

Citation	General topic	Specific terms
Fresen, J. (2007). A Taxonomy of Factors to Promote Quality Web-Supported Learning. International Journal on ELearning, *6*(3), 351-362. Retrieved July 22, 2009, from ProQuest database.	P. 357 has taxonomy of 6+ factors to promote quality web-supported learning.	
Huba, M. Schuh, J. & Shelly, M. Recasting doctoral education in an outcomes-based framework. In P. L. Maki & N. Borkowski, N. (Eds.), *The Assessment of Doctoral Education* (pp. 239-272). Sterling, VA: Stylus Publishing.	Outcomes-based framework; see appendixes for outcomes lists, types	
Institute for Higher Education Policy. (2000). Quality on the line: Benchmark for success in Internet-based distance education. Author. Retrieved August 24, 2009, from http://www.ihep.org/Publications/publications-detail.cfm?id=69	P. 11-12: listed 45 benchmarks that were essential for quality IBDL and grouped them into seven categories: 1) institutional support, 2) course development, 3) teaching/learning, 4) course structure, 5) student support, 6) faculty support, and 7) evaluation and assessment	
Mariasingam, M. A., & Hanna, D. E. (2006). Benchmarking Quality in Online Degree Programs Status and Prospects. Online Journal of Distance Learning Administration, IX(III). Retrieved March 15, 2009, from http://www.westga.edu/~distance/ojdla/fall93/mariasingam93.htm	Benchmarking Quality; identified attributes.	

Citation	General topic	Specific terms
Moore, J. C. (2005). A Synthesis of Sloan-C Effective Practices. Journal of Asynchronous Learning Networks, *9*(3), 59-75. Retrieved August 28, 2009, from http://www.sloan-c.org/publications/books/v9n3_moore.pdf	A list of 25 best practices.	
Paris, K. A. (2007). Models for Organizational Improvement: A Comparison. West Hartford, CT: National Consortium for Continuous Improvement in Higher Education. Retrieved April 12, 2009, from http://ncci-cu.org/Visitors/Documents/ReportNCCISurveyJan2007_000.pdf	List of activities (several types) associated with organizational improvement.	
Rovai, A. P, Ponton, M. K., & Baker, J. D. (2008). Distance Learning in Higher Education. New York: Teachers College Press.	List related to 'Evidence of Quality Distance Learning Programs'	
Ruhe, V., and Zumbo, B. D. (2009). Evaluation in Distance Education and E-Learning. New York: The Guilford Press.	List of Summary of the 1994 Program Evaluation Standards.	

APPENDIX E: SELECTED HENDRIX (2005) QUALITY INDICATORS

Hendrix (2005) 24 Indicators of Quality or Outcomes for Online Doctoral Program

Research Question 4

The last research question addressed the indicators of quality or outcomes for an online doctoral program. Twenty-four distinct indicators emerged from Round I. Round 3 results indicated Research Question 4 had the lowest levels of agreement and consensus. The average median rating stabilized at 4.96 alter achieving an average median rating of 5.06 in Round 2. However, this decrease in level of agreement resulted in a shift toward consensus with the average interquartile range stabilizing at 1.04 after achieving a 2.79 in Round 2. One indicator did reach the pre-determined criteria for highest level of agreement (median score of 6) and consensus (0 to.99). This indicator was number 13, which focused on the performance on comprehensive examinations as compared to the face-to-face program.

Table 18 summarizes the results for Round 3 for Research Question 4 by ranking each of the 24 indicators.

Table 18

Rank Order of Indicators Based on Levels of Agreement and Consensus for Research Question 4 after Round 3 Indicators

13. Performance on comprehensive examinations as compared to face-to-face program.
1. Quality of dissertations as compared to dissertations completed by students in face-to-face programs.

4. Student placement rates as compared to face-to-face program.
15. Professional examination/credentialing of graduates (if applicable) compared to graduates of face-to-face programs.
19. Employers' satisfaction with graduates of online program compared with graduates from face-to-face program.
12. Cost effectiveness as compared to face-to-face programs.
2. Quality and number of peer-reviewed publications produced by students compared to students in face-to-face program.
3. Number of presentations made by students at professional conferences and comparison to face to-face program.
6. Total amount of funding from grants secured by faculty and students compared to face-to-face program.
10. Student completion rates as compared to face-to-face program.
11. Time-to-degree rates as compared to face-to-face program.
14. Number of peer-reviewed publications produced by faculty compared to faculty teaching in face-to-face program.
16. Student satisfaction with online program compared to face-to-face program.
22. Faculty satisfaction with resources and support structure compared to face-to-face program.
23. Student-to-faculty ratio and how it compares with face-to-face program.
24. Percentage of students who indicate they would not have been able to complete a doctoral program if it were not available online.
17. Student satisfaction with technology.

18. Student satisfaction with student support service as compared to graduates in face-to- face programs.
5. Number of grants secured by faculty and students and compared to faculty teaching and student's completing face-to-face program.
7. Student enrollment compared 10 face-to-face program.
9. Number of students who are accepted to online program compared to number who are accepted in face-to-face program.
21. Faculty satisfaction with delivery method compared with satisfaction of a face-to-face program.
8. Number of students who apply to program compared to number who apply for face-la-face program.
20. Student and faculty assessment of whether the student identified with the institution compared to students who completed face-to-face programs.

APPENDIX F: PROPOSED PH.D. CONSORTIUM FLOWCHART

Both the delphi panel and the survey participants were asked to consider a semi-qualitative inquiry regarding a proposed ISU Technology Management Ph.D. Consortium flowchart. It is suggested by the researcher to both the delphi panel and the Survey participants that the Excel flowchart with three major parts is suitable for utilization of all - or almost all - of the previously identified quality indicators.

The flowchart found at this URL http://markrchandler.com/TechManagPhDConsortiumFlowchart.xls and will be hosted there for the foreseeable future. It may take a moment to load the flowchart in Excel.

Alternatively the researcher can be contacted to request an electronic or hard copy.

APPENDIX G: DELPHI LETTER

Subject: Ph.D. candidate: your participation in a delphi panel to develop quality attributes for doctoral consortium

Dr. YYY XXX
Address
e-mail

May 23, 2010

Greetings, Dr. XXX. You are being invited to participate in a research study to develop and confirm the quality system model attributes for a successful online multi-university doctoral consortium. This study is being conducted by Mark R. Chandler, Principal Investigator from the Technology Management Department, School of Technology at Indiana State University, under the guidance of Dr. John W. Sinn, faculty advisor, Department of Technology Systems, Bowling Green State University, Bowling Green, OH. The study is being conducted as part of a dissertation (QUALITY SYSTEM FOR A DISTANCE DOCTORAL CONSORTIUM: DETERMINATION AND ANALYSIS OF SPECIFIC INDICATORS). Deciding to participate – or not – will not impact on your relationships to the institutions associated with the Technology Management Doctorial Consortium. The potential benefit of this research is an extension of research regarding quality indicators from individual doctoral programs to multi-university doctoral consortium.

Your participation in the delphi study associated with this research is because you are recognized as an academic expert involved with one or more of the topics of quality, technology management and online higher education programs. The resulting delphi panel quality attributes will be used to develop a survey to determine perceived quality attributes differences between four groups associated with the Technology Management Doctoral Consortium program (faculty, students, alumni and supporting university staff).

There are no known risks if you decide to participate in this research study. There are no costs to you for participating in the study. You are free to stop or withdraw at any time from the delphi panel. The delphi panel information you provide will develop approximately 30 attributes of a quality system model for a successful online multi-university doctoral consortium. You will be asked to participate in three e-mail based delphi panel rounds taking approximately 15 to 30 minutes each, spread over the course of month or so. After completing each delphi round activity please send the related Excel spreadsheet you have worked on back to me (my preferred e-mail address: mark.chandler@dot.gov) as an attachment by replying to the original e-mail. For your privacy it is suggested you delete the initial e-mail(s).

Given the nature of the research and expectations of subjects, there is no more than minimal risk of harm to subjects with no perceived short-term and long-term potential risks (physical, psychological, social, legal or other) to subjects involved in this research as a delphi panel respondents. If you participant in the delphi study your participation will not be anonymous to the researcher, given the typical delphi panel procedure for a minimal risk study. The researcher will treat the delphi participants identity and delphi panel responses as confidential and restricted information. Anonymity will be preserved within the delphi study, and between delphi participants. Absolute anonymity cannot be guaranteed over the Internet. If the data is published, no individual information will be revealed and delphi panel responses will be aggregated. Identifiable hardcopy and data files will be destroyed or deleted 90 days after successful dissertation defense. Sanitized and aggregate data and statistical analysis will be retained for possible future research. The Institutional Review Board may inspect these records.

Your participation in this study is voluntary. By participating in the delphi panel rounds you are voluntarily agreeing to participate. You are free to decline to consider or respond to any delphi panel indicator under consideration for any reason.

If you have any questions about the study, please contact Mark R. Chandler, U.S. DOT – FHWA Wisconsin Division, 525 Junction Road – Suite 8000, Madison, WI 53717, fax: 608-829-7526, office: 608-829-7514, office cell phone: 608-287-4226, mark.chandler@dot.gov or Dr. John W. Sinn, Technology Systems Department, College of Technology, Bowling Green State University, 43403, Office Phone # 419-372-6034, jwsinn@bgsu.edu.

If you have any questions about your rights as a research subject or if you feel you've been placed at risk, you may contact the Indiana State University Institutional Review Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN, 47809, by phone at (812) 237-8217, or by e-mail at irb@indstate.edu. If you are a Bowling Green State University faculty, staff, or student you may also contact the BGSU HSRB Chair at 419-372-7716, hsrb@bgsu.edu, with questions about participant rights.

Thank you for your time and professional courtesy, and best regards,

Mark

Mark R. Chandler, PE, CMfgE
U.S. DOT - FHWA Wisconsin Division
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Field Operations Engineer

Ph.D. candidate e-portfolio: http://markrchandler.com/
Consortium for Ph.D. in Technology Management – Quality System Specialization
http://www.indstate.edu/consortphd/ - Bowling Green State University

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Indiana State University - Institutional Review Board
For Review of Research Involving Human Subjects
INFORMED CONSENT FORM – Delphi Panel Participant
Date of IRB Approval: March 31, 2010
IRB Number: 10-136
Project Expiration Date: (expiration date is not applicable as the study is exempt)

APPENDIX H: DELPHI DATA SUMMARY

The Delphi panel summary data can be found at this URL http://markrchandler.com/DelphiSummary2-4-2011.xls and will be hosted there for the foreseeable future. It may take a moment to load the flowchart in Excel.

Alternatively the researcher can be contacted to request an electronic or hard copy.

APPENDIX I: SURVEY QUESTIONS

Subject: Request your participation in a survey for Dissertation research

This is a survey instrument I developed as part of my dissertation research. It is built on a literature review and a three round delphi panel of experts who have considered quality system model attributes for a successful online doctoral consortium, which are the focus of this survey. Participation is voluntary, no personal information will be asked and your responses will be treated with care, confidentiality and security. I will be using the final survey on four groups of the Technology Management Ph.D. Consortium (http://www.indstate.edu/consortphd/): faculty, Ph.D. graduates, Ph.D. students, and a smaller group of university support staff. I would greatly appreciate your participation in the survey, located at:

Best regards,

Mark R. Chandler, PE, CMfgE
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Field Operations Engineer - SE Region Projects

Ph.D. candidate, Consortium for Ph.D. in Technology Management – Quality System Specialization http://www.indstate.edu/consortphd/ - Bowling Green State University

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Indiana State University - Institutional Review Board
For Review of Research Involving Human Subjects
INFORMED CONSENT FORM –Survey Participant
November 4, 2010

QUALITY SYSTEM FOR A DISTANCE DOCTORAL CONSORTIUM: DETERMINATION AND ANALYSIS OF SPECIFIC INDICATORS

You are being invited to participate in a dissertation research survey to confirm the quality system model attributes for a successful online doctoral consortium. This study is being conducted by Mark R. Chandler, Principal Investigator from the College of Technology at Indiana State University, under the guidance of Dr. John W. Sinn, faculty advisor, College of Technology, Department of Engineering Technologies, Bowling Green State University, Bowling Green, OH. Deciding to participate – or not – will not impact on your relationships to the institutions associated with the Technology Management Doctorial Consortium. The potential benefit of this research is an extension of research regarding quality indicators from individual doctoral programs to multi-university doctoral consortium.

You were selected as a possible participant in the one-time survey associated with this research because of your recognized involvement with the Indiana State University (Terre Haute) Ph.D. in Technology Management and the related universities in the Technology Management Doctoral Consortium program within one of four groups (faculty, doctoral students, doctoral graduates and supporting university staff). You are free to stop or withdraw at any time from the delphi panel or survey at any time.

You will be asked to participate in a one-time web-based survey via SurveyMonkey that will take approximately 5 - 10 minutes to complete. Your participation in this survey is voluntary. By participating in the online survey, you are voluntarily agreeing to participate and this indicates consent. The link to the SurveyMonkey – which collects cookies – is to an encrypted survey. After completing the survey you will be asked to clear your browser cache and page history. You are free to decline to consider or respond to or to answer any particular survey question for any reason.

Given the nature of the research and expectations of subjects, there is no more than minimal risk of harm to subjects with no perceived short-term and long-term potential risks (physical, psychological, social, legal or other) to subjects involved in this research as survey respondents. If you participant in the survey associated with this research, confidentiality will result from the anonymous web-based encrypted survey, although absolute anonymity can not be guaranteed over the Internet. If the data is published, no individual information will be revealed and survey responses will be statistically results. Identifiable hardcopy and data files will be destroyed or deleted 90 days after successful dissertation defense. Sanitized and aggregate data and statistical analysis will be retained for possible future research. The Institutional Review Board may inspect these records.

If you have any questions about the study, please contact Mark R. Chandler, U.S. DOT – FHWA Wisconsin Division, 525 Junction Road – Suite 8000, Madison, WI 53717, fax: 608-829-7526, office: 608-829-7514, office cell phone: 608-287-4226, mark.chandler@dot.gov OR Dr. John W. Sinn, Technology Systems Department, College of Technology, Bowling Green State University, 43403, Office Phone # 419-372-6034, jwsinn@bgsu.edu.

If you have any questions about your rights as a research subject or if you feel you've been placed at risk, you may contact the Indiana State University Institutional Review Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN, 47809, by phone at (812) 237-8217, or by e-mail at irb@indstate.edu. If you are a Bowling Green State

University faculty, staff, or student you may also contact the BGSU HSRB Chair at 419-372-7716, hsrb@bgsu.edu, with questions about participant rights.

Click Agree to take the survey or click Quit to exit:
Agree Quit

Background information

1) In the Technology Management Ph.D. Consortium at one of the participating universities, I am or was:
a. Administrative staff
b. Faculty
c. a Ph.D. graduate
d. a Ph.D. student

Note: if you are both a Ph.D. graduate and also now faculty in the Technology Management Ph.D. Consortium, please respond first as faculty. If you have the time I would ask you also please complete the survey a second time from the perspective as a Ph.D. graduate. For statistical significance I need all the responses I can get in the four categories.

2) If you are a Ph.D. graduate or student, please estimate percentage of distance participation in contrast to on-campus participation:
a. 0% - 10% (Essentially taking just the Residency class at ISU and rest of Ph.D. online).
b. 10% - 50%
c. 50% - 90%
d. 90% - 100% (Essentially a Ph.D. fellow on one of the participating campuses)

3) If you are a Ph.D. graduate or student, please specify your Ph.D. Specialization:
a. Construction Management
b. Digital Communication Systems
c. HRD & Industrial Training
d. Manufacturing Systems
e. Quality Systems Carolina

4) In the survey a Likert scale will be used, with range from highest of 1 (Strongly agree) to lowest of 6 (Strongly disagree), going left to right for agree to disagree.
a. Strongly agree
b. Agree
c. Slightly agree
d. Slightly disagree
e. Disagree
f. Strongly disagree
g. No response is acceptable and move on to next item.

4) Preceding this survey was a three round delphi panel where subject matter experts considered quality system model attributes for a successful online doctoral consortium. The resulting attributes – or quality indicators - have been structured into six general topics with a total of 62 quality attributes. This is consistent with the literature, and with a web-based radio-dial survey, can be done in 5 – 10 minutes. You are being asked to consider these 62 quality attributes for their appropriateness as quality indicators in the Technology Management Ph.D. Consortium. To conclude this survey, there is a semi-qualitative inquiry regarding a proposed Consortium flowchart. (Note: This is not a survey to determine what you would 'score' the various quality indicators.)

6) Student Learning Outcomes
a. Percentage of students who pass comprehensive exams on first attempt.
b. Quality of dissertations.
c. Student placement rates.
d. Professional examination/credentialing of graduates (if applicable).
e. Number of presentations made by students at professional conferences.
f. Employers' satisfaction with graduates of online program.

7) Customer-Focused Outcomes
a. Percentage of students who indicate they would not have been able to complete a doctoral program if it were not available online.
b. Student enrollment.
c. Number of students who apply to program.
d. Alumni/graduates satisfaction with their educational experience.
e. Availability 24x7.
f. Student to faculty ratio (or average class size).
g. Percentage of students satisfied with the quality of Faculty advice and support.
h. Percentage of students satisfied with the quality of Online teaching/learning process (including technology and other resources, curriculum, course syllabi, exams, etc.).
i. Student satisfaction with online program.
j. Student satisfaction with technology.
k. Student satisfaction with student support service.
l. Percentage of students satisfied with the quality of Academic/student support services.
m. Feedback to student assignments and questions is constructive and provided in a timely manner.

8) Budgetary, Financial, and Market Outcomes
a. Cost effectiveness.
b. Total amount of funding from grants secured by faculty and students.
c. Average instructional cost per student enrolled in the program.
d. Tuition and fees generated by the program as a percentage of total program expenditures.
e. Tuition and fees generated by the program at each institution as a percentage of total program expenditures at each institution.
f. Course credits and student credit hours generated per teaching faculty FTE.
g. Course credits and student credit hours generated per teaching faculty FTE per institution.
h. Total instructional costs as a percentage of total expenditures.

i. Total dollars generated from grants and contracts as a percentage of total revenues.
j. Number of jobs supported by external (grants and contracts) dollars.
k. Number of students who are accepted to online program.
l. Yield rate (between accepted and enrolled students).
m. Percentage of students who drop out due to unmet financial needs.

9) Workforce-Focused Outcomes
a. Quality and number of peer-reviewed publications produced by students.
b. Number of peer-reviewed publications produced by faculty.
c. Student-to-faculty ratio.
d. Faculty satisfaction with student to faculty ratio.
e. Number of grants secured by faculty and students.
f. Quality of faculty academic credentials, etc.
g. Number of faculty presentations at professional meetings and conferences.
h. Percentage of program faculty satisfied with the quality of Faculty compensation and benefits.
i. Percentage of program faculty satisfied with the quality of new students.
j. Percentage of program faculty satisfied with the quality of Program leadership, organizational structure, and curriculum.
k. Percentage of program faculty satisfied with the quality of Online teaching/learning processes and resources.

10) Process Effectiveness Outcomes
a. Faculty satisfaction with delivery method.
b. Consistency among and compliance with program and consortium policies, procedures and rules.
c. Quality of communications among institutions in the consortium.
d. Consortium governance.
e. Quality of incoming students (academic qualifications, prior experience, credentials, etc.).
f. Program accreditation status.
g. Program national ranking.
h. Quality (currency) of program curriculum.
i. Quality of online teaching processes, such as quality of course organization and syllabi, constructiveness and timeliness of faculty feedback to students regarding assignments, questions, grades, and quality of exams, etc.
j. Quality (age, currency, cost, location) of teaching/research equipment, supplies, etc.
k. Student retention rates, by course or faculty, and by academic year.
l. Percentage of students who complete their degree within seven years.
m. Average time to degree completion.
n. Alignment of official and published program outcomes with individual course outcomes and content of comprehensive exams.

11) Leadership Outcomes
a. There is a recognizable mission (and/or vision) of the Consortium.
b. Quality of continuous improvement practices in recruitment (students and faculty), curriculum review, equipment acquisitions and upgrades, teaching and learning processes, etc.
c. Student and faculty assessment of whether the student identified with the institution.

d. Student and faculty assessment of whether the student identified with the program.
e. Measurable Learning Outcomes for the Ph.D. program that are annually assessed and used as a feedback loop for continuous improvement.

12) To conclude this survey, there is a semi-qualitative inquiry regarding a proposed Consortium flowchart. It is suggested by the researcher that the Excel flowchart with three major parts is suitable for utilization of all - or almost all - of the previously identified quality indicators.
a. Please look over the flowchart found at this URL (http://markrchandler.com/TechManagPhDConsortiumFlowchart.xls; may take a moment to load in Excel), and select from the range for six-item Likert scale.
b. You may have to more your view of the spreadsheet around to see all three parts of the spreadsheet; this is usually with 'arrow bar' on far right and bottom right of spreadsheet.
c. If you have any specific comments, please include in text box that follows.

APPENDIX J: RANKED AND PAIRED MEANS FROM IMPUTED DATA

Amos-MLE	SPSS-MI
3.24	3.24
3.16	3.21
3.19	3.16
3.02	3.05
2.94	2.95
2.92	2.95
2.78	2.84
2.74	2.81
2.72	2.76
2.66	2.72
2.70	2.71
2.70	2.71
2.63	2.71
2.62	2.70
2.46	2.56
2.52	2.55
2.51	2.54
2.49	2.52
2.44	2.51
2.45	2.49
2.44	2.47
2.40	2.47
2.46	2.47
2.33	2.47
2.49	2.47
2.43	2.45
2.43	2.44
2.38	2.44
2.33	2.42
2.34	2.37
2.28	2.35
2.33	2.33
2.28	2.32

Amos-MLE	SPSS-MI
2.30	2.32
2.30	2.29
2.26	2.27
2.21	2.27
2.23	2.25
2.21	2.25
2.18	2.21
2.20	2.21
2.19	2.21
2.14	2.18
2.14	2.17
2.17	2.17
2.15	2.16
2.09	2.09
2.03	2.06
2.00	2.05
2.00	2.04
1.90	1.99
1.89	1.95
1.95	1.95
1.94	1.95
1.95	1.94
1.91	1.92
1.81	1.87
1.79	1.85
1.80	1.83
1.75	1.78
1.74	1.76
1.64	1.66
1.53	1.53

APPENDIX K: SURVEY RESULTS AND DATA SETS

The SurveyMonkey results for this dissertation research has been consolidated into an Excel spreadsheet and located at this URL http://markrchandler.com/SurveyResults2-5-2011.xls, and will be hosted there for the foreseeable future. It may take a moment to load the flowchart in Excel.

The initial and final data sets for this dissertation research has been consolidated into an Excel spreadsheet and located at this URL http://markrchandler.com/InitialandFinalSurveyDataSets.xls, and will be hosted there for the foreseeable future. It may take a moment to load the flowchart in Excel.

Alternatively the researcher can be contacted to request an electronic or hard copy.

APPENDIX L: KOLMOGOROV-SMIRNOV AND SHAPIRO-WILK STATISTIC

Quality Indicator	Member type	Kolmogorov-Smirnova		
		Statistic	df	Sig.>0.05
34#JobsThruExternal$	Faculty	.160	18	.200
60%StudentCompletionH10	Faculty	.164	18	.200
64QualImprov?	Faculty	.155	18	.200
66StudentIDWithProgram?	Faculty	.144	18	.200
59StudentRetention	Faculty	.167	18	.200
45FacultySatisfOtherFaculty	Faculty	.169	18	.187
26FundingByStudFacultyH10	Graduate	.125	36	.168
10StudentPresentationsH8	Faculty	.174	18	.153
52ConsotriumGovern	Faculty	.177	18	.139
65StudentIDWithInstitution?	Faculty	.182	18	.116
33Total$GrantsAs%Total$	Faculty	.187	18	.096
61TimeDegCompH11	Faculty	.188	18	.091
8StudtPlaceRateH3	Faculty	.191	18	.081
16Avail24x7	Faculty	.196	18	.065
27AveInstructorCost	Faculty	.198	18	.061
30CreditsHrs/Faculty	Faculty	.208	18	.039
58QualEquip	Faculty	.210	18	.035
38StudentPubsH7	Faculty	.212	18	.032
36YieldRate	Faculty	.214	18	.028
34#JobsThruExternal$	Graduate	.155	36	.028
22StudentSatisSupportH18	Faculty	.217	18	.025
31CreditsHrs/Faculty/Institution	Faculty	.219	18	.022
23StudentSatisAcademicSupport	Faculty	.219	18	.022
9CredentialsH4	Faculty	.223	18	.019
67AnnualAssessment	Faculty	.223	18	.018
42#GrantsByFacultyStudent	Graduate	.168	36	.012
25CostEffectH6	Faculty	.232	18	.012
28TutionFees%ExpendProg	Faculty	.235	18	.010
37StudentDropOutDue$	Graduate	.172	36	.009

Quality Indicator	Member type	Kolmogorov-Smirnova		
		Statistic	df	Sig.>0.05
35#StudentAcceptedH21	Faculty	.238	18	.008
29TutionFees%ExpendInstitution	Faculty	.246	18	.005
47FacultySatisProgLeadership	Faculty	.247	18	.005
26FundingByStudFacultyH9	Faculty	.248	18	.005
8StudtPlaceRateH4	Graduate	.184	36	.003
55NationalRank	Student	.189	34	.003
30CreditsHrs/Faculty	Graduate	.184	36	.003
13StudentEnrolH20	Faculty	.255	18	.003
59StudentRetention	Graduate	.186	36	.003
16Avail24x8	Graduate	.189	36	.002
30CreditsHrs/Faculty	Student	.196	34	.002
37StudentDropOutDue$	Faculty	.264	18	.002
28TutionFees%ExpendProg	Graduate	.196	36	.001
33Total$GrantsAs%Total$	Graduate	.198	36	.001
58QualEquip	Graduate	.198	36	.001
54Accreditation	Faculty	.273	18	.001
37StudentDropOutDue$	Student	.204	34	.001
14#StudentsApplyH23	Faculty	.275	18	.001
53QualIncommingStudents	Faculty	.275	18	.001
41FacultySatisfactionStudentRatio	Graduate	.201	36	.001
52ConsotriumGovern	Student	.207	34	.001
56QualCurriculum	Faculty	.278	18	.001
57QualOverallTeachProcess	Faculty	.278	18	.001
46FacultySatisNewStudent	Faculty	.279	18	.001
51CommunicationQual	Faculty	.281	18	.001
50ConsortiumConsistency	Faculty	.282	18	.001
27AveInstructorCost	Student	.212	34	.000
32InstructCostAs%Total$	Faculty	.286	18	.000
63Mission?	Faculty	.287	18	.000
12IfNotOnlineH16	Faculty	.288	18	.000
21StudentSatisTechnoH17	Faculty	.290	18	.000
46FacultySatisNewStudent	Student	.217	34	.000
31CreditsHrs/Faculty/Institution	Graduate	.212	36	.000
68FlowchartOK?	Faculty	.292	18	.000
22StudentSatisSupportH20	Student	.219	34	.000
55NationalRank	Faculty	.293	18	.000
31CreditsHrs/Faculty/Institution	Student	.220	34	.000

Quality Indicator	Member type	Kolmogorov-Smirnova		
		Statistic	df	Sig.>0.05
48FacultySatisOnlineResourcesH16	Student	.221	34	.000
55NationalRank	Graduate	.217	36	.000
67AnnualAssessment	Student	.223	34	.000
14#StudentsApplyH25	Student	.223	34	.000
32InstructCostAs%Total$	Graduate	.218	36	.000
16Avail24x9	Student	.226	34	.000
42#GrantsByFacultyStudent	Faculty	.305	18	.000
15Alum/GradSatisf	Faculty	.306	18	.000
39FacultyPubsH14	Student	.231	34	.000
51CommunicationQual	Graduate	.225	36	.000
68FlowchartOK?	Graduate	.225	36	.000
38StudentPubsH9	Student	.232	34	.000
47FacultySatisProgLeadership	Student	.232	34	.000
34#JobsThruExternal$	Student	.234	34	.000
35#StudentAcceptedH22	Graduate	.228	36	.000
64QualImprov?	Graduate	.229	36	.000
41FacultySatisfactionStudentRatio	Student	.236	34	.000
40Student:FacultyWorkforceH16	Graduate	.230	36	.000
62AlignOutcomes	Faculty	.318	18	.000
51CommunicationQual	Student	.239	34	.000
13StudentEnrolH21	Graduate	.234	36	.000
21StudentSatisTechnoH18	Graduate	.234	36	.000
65StudentIDWithInstitution?	Student	.240	34	.000
45FacultySatisfOtherFaculty	Student	.241	34	.000
65StudentIDWithInstitution?	Graduate	.235	36	.000
17Student:FacultyCustomer	Graduate	.235	36	.000
61TimeDegCompH13	Student	.242	34	.000
11EmployerSatisH5	Faculty	.324	18	.000
48FacultySatisOnlineResourcesH14	Faculty	.324	18	.000
33Total$GrantsAs%Total$	Student	.243	34	.000
8StudtPlaceRateH5	Student	.244	34	.000
42#GrantsByFacultyStudent	Student	.244	34	.000
60%StudentCompletionH11	Graduate	.237	36	.000
36YieldRate	Graduate	.238	36	.000
66StudentIDWithProgram?	Graduate	.240	36	.000
14#StudentsApplyH24	Graduate	.240	36	.000
29TutionFees%ExpendInstitution	Graduate	.240	36	.000

Quality Indicator	Member type	Kolmogorov-Smirnova		
		Statistic	df	Sig.>0.05
43FacultyCredentials	Faculty	.330	18	.000
39FacultyPubsH13	Graduate	.243	36	.000
54Accreditation	Graduate	.244	36	.000
45FacultySatisfOtherFaculty	Graduate	.245	36	.000
24StudentFeedbackOK	Faculty	.336	18	.000
44#FacultyPresentations	Student	.252	34	.000
58QualEquip	Student	.253	34	.000
63Mission?	Graduate	.248	36	.000
19StudentSatisOnLineTeach	Faculty	.340	18	.000
29TutionFees%ExpendInstitution	Student	.256	34	.000
13StudentEnrolH22	Student	.256	34	.000
63Mission?	Student	.257	34	.000
41FacultySatisfactionStudentRatio	Faculty	.343	18	.000
6Comp%PassH1	Faculty	.343	18	.000
59StudentRetention	Student	.258	34	.000
27AveInstructorCost	Graduate	.252	36	.000
12IfNotOnlineH18	Student	.261	34	.000
26FundingByStudFacultyH11	Student	.261	34	.000
32InstructCostAs%Total$	Student	.261	34	.000
17Student:FacultyCustomer	Faculty	.349	18	.000
25CostEffectH8	Student	.263	34	.000
54Accreditation	Student	.264	34	.000
22StudentSatisSupportH19	Graduate	.258	36	.000
39FacultyPubsH12	Faculty	.356	18	.000
28TutionFees%ExpendProg	Student	.267	34	.000
35#StudentAcceptedH23	Student	.267	34	.000
10StudentPresentationsH10	Student	.268	34	.000
38StudentPubsH8	Graduate	.263	36	.000
7DissQualH2	Faculty	.363	18	.000
6Comp%PassH2	Graduate	.265	36	.000
66StudentIDWithProgram?	Student	.274	34	.000
12IfNotOnlineH17	Graduate	.267	36	.000
46FacultySatisNewStudent	Graduate	.267	36	.000
43FacultyCredentials	Student	.275	34	.000
15Alum/GradSatisf	Student	.276	34	.000
64QualImprov?	Student	.278	34	.000

Quality Indicator	Member type	Kolmogorov-Smirnova		
		Statistic	df	Sig.>0.05
52ConsotriumGovern	Graduate	.271	36	.000
40Student:FacultyWorkforceH15	Faculty	.371	18	.000
18StudentSatisFaculty	Faculty	.372	18	.000
50ConsortiumConsistency	Student	.279	34	.000
36YieldRate	Student	.280	34	.000
19StudentSatisOnLineTeach	Student	.280	34	.000
21StudentSatisTechnoH19	Student	.281	34	.000
24StudentFeedbackOK	Student	.283	34	.000
57QualOverallTeachProcess	Graduate	.276	36	.000
44#FacultyPresentations	Faculty	.381	18	.000
17Student:FacultyCustomer	Student	.286	34	.000
9CredentialsH5	Graduate	.280	36	.000
48FacultySatisOnlineResourcesH15	Graduate	.280	36	.000
49FacultySatisDeliveryMethodH22	Faculty	.386	18	.000
19StudentSatisOnLineTeach	Graduate	.282	36	.000
23StudentSatisAcademicSupport	Graduate	.282	36	.000
60%StudentCompletionH12	Student	.291	34	.000
20StudentSatisOnLineProgramH15	Student	.292	34	.000
50ConsortiumConsistency	Graduate	.285	36	.000
40Student:FacultyWorkforceH17	Student	.293	34	.000
43FacultyCredentials	Graduate	.287	36	.000
24StudentFeedbackOK	Graduate	.288	36	.000
11EmployerSatisH6	Graduate	.291	36	.000
18StudentSatisFaculty	Graduate	.293	36	.000
20StudentSatisOnLineProgramH13	Faculty	.404	18	.000
47FacultySatisProgLeadership	Graduate	.295	36	.000
10StudentPresentationsH9	Graduate	.297	36	.000
44#FacultyPresentations	Graduate	.298	36	.000
6Comp%PassH3	Student	.307	34	.000
56QualCurriculum	Graduate	.299	36	.000
49FacultySatisDeliveryMethodH23	Graduate	.301	36	.000
25CostEffectH7	Graduate	.304	36	.000
67AnnualAssessment	Graduate	.304	36	.000
9CredentialsH6	Student	.316	34	.000
23StudentSatisAcademicSupport	Student	.317	34	.000
62AlignOutcomes	Graduate	.309	36	.000
53QualIncommingStudents	Graduate	.310	36	.000

Quality Indicator	Member type	Kolmogorov-Smirnova		
		Statistic	df	Sig.>0.05
61TimeDegCompH12	Graduate	.314	36	.000
56QualCurriculum	Student	.323	34	.000
62AlignOutcomes	Student	.324	34	.000
57QualOverallTeachProcess	Student	.326	34	.000
7DissQualH4	Student	.326	34	.000
53QualIncommingStudents	Student	.338	34	.000
7DissQualH3	Graduate	.333	36	.000
20StudentSatisOnLineProgramH14	Graduate	.350	36	.000
18StudentSatisFaculty	Student	.363	34	.000
49FacultySatisDeliveryMethodH24	Student	.368	34	.000
15Alum/GradSatisf	Graduate	.360	36	.000
68FlowchartOK?	Student	.386	34	.000
11EmployerSatisH7	Student	.400	34	.000
66StudentIDWithProgram?	Faculty	.940	18	.289
34#JobsThruExternal$	Faculty	.939	18	.281
59StudentRetention	Faculty	.938	18	.272
65StudentIDWithInstitution?	Faculty	.932	18	.212
33Total$GrantsAs%Total$	Faculty	.927	18	.170
64QualImprov?	Faculty	.917	18	.117
52ConsotriumGovern	Faculty	.916	18	.110
36YieldRate	Faculty	.914	18	.102
61TimeDegCompH11	Faculty	.914	18	.101
35#StudentAcceptedH21	Faculty	.913	18	.098
26FundingByStudFacultyH10	Graduate	.945	36	.072
60%StudentCompletionH10	Faculty	.904	18	.068
37StudentDropOutDue$	Faculty	.901	18	.059
31CreditsHrs/Faculty/Institution	Faculty	.900	18	.058
34#JobsThruExternal$	Graduate	.939	36	.049
27AveInstructorCost	Faculty	.896	18	.048
38StudentPubsH7	Faculty	.896	18	.048
16Avail24x7	Faculty	.894	18	.045
28TutionFees%ExpendProg	Faculty	.891	18	.041
29TutionFees%ExpendInstitution	Faculty	.890	18	.039
32InstructCostAs%Total$	Faculty	.890	18	.038
30CreditsHrs/Faculty	Faculty	.889	18	.037
10StudentPresentationsH8	Faculty	.886	18	.033
26FundingByStudFacultyH9	Faculty	.879	18	.026

Quality Indicator	Member type	Kolmogorov-Smirnova		
		Statistic	df	Sig.>0.05
58QualEquip	Faculty	.877	18	.023
50ConsortiumConsistency	Faculty	.874	18	.021
45FacultySatisfOtherFaculty	Faculty	.873	18	.020
23StudentSatisAcademicSupport	Faculty	.871	18	.018
46FacultySatisNewStudent	Faculty	.863	18	.013
42#GrantsByFacultyStudent	Graduate	.920	36	.013
22StudentSatisSupportH18	Faculty	.858	18	.011
53QualIncommingStudents	Faculty	.854	18	.010
33Total$GrantsAs%Total$	Graduate	.916	36	.009
51CommunicationQual	Faculty	.848	18	.008
30CreditsHrs/Faculty	Graduate	.912	36	.008
14#StudentsApplyH23	Faculty	.846	18	.007
28TutionFees%ExpendProg	Graduate	.912	36	.007
68FlowchartOK?	Faculty	.845	18	.007
9CredentialsH4	Faculty	.845	18	.007
8StudtPlaceRateH3	Faculty	.844	18	.007
63Mission?	Faculty	.841	18	.006
54Accreditation	Faculty	.841	18	.006
67AnnualAssessment	Faculty	.840	18	.006
31CreditsHrs/Faculty/Institution	Graduate	.908	36	.006
42#GrantsByFacultyStudent	Student	.902	34	.005
37StudentDropOutDue$	Graduate	.906	36	.005
8StudtPlaceRateH4	Graduate	.905	36	.005
47FacultySatisProgLeadership	Faculty	.832	18	.004
26FundingByStudFacultyH11	Student	.894	34	.003
37StudentDropOutDue$	Student	.893	34	.003
35#StudentAcceptedH23	Student	.891	34	.003
22StudentSatisSupportH20	Student	.890	34	.002
21StudentSatisTechnoH17	Faculty	.815	18	.002
41FacultySatisfactionStudentRatio	Graduate	.895	36	.002
32InstructCostAs%Total$	Graduate	.894	36	.002
12IfNotOnlineH16	Faculty	.812	18	.002
39FacultyPubsH14	Student	.888	34	.002
29TutionFees%ExpendInstitution	Graduate	.893	36	.002
16Avail24x8	Graduate	.891	36	.002
41FacultySatisfactionStudentRatio	Faculty	.806	18	.002
56QualCurriculum	Faculty	.802	18	.002

Quality Indicator	Member type	Kolmogorov-Smirnova		
		Statistic	df	Sig.>0.05
30CreditsHrs/Faculty	Student	.882	34	.002
25CostEffectH6	Faculty	.796	18	.001
58QualEquip	Graduate	.885	36	.001
47FacultySatisProgLeadership	Student	.878	34	.001
28TutionFees%ExpendProg	Student	.878	34	.001
16Avail24x9	Student	.876	34	.001
45FacultySatisfOtherFaculty	Student	.876	34	.001
34#JobsThruExternal$	Student	.875	34	.001
65StudentIDWithInstitution?	Student	.874	34	.001
13StudentEnrolH20	Faculty	.788	18	.001
48FacultySatisOnlineResourcesH14	Faculty	.786	18	.001
65StudentIDWithInstitution?	Graduate	.876	36	.001
24StudentFeedbackOK	Faculty	.778	18	.001
46FacultySatisNewStudent	Student	.868	34	.001
38StudentPubsH9	Student	.868	34	.001
36YieldRate	Graduate	.874	36	.001
35#StudentAcceptedH22	Graduate	.873	36	.001
27AveInstructorCost	Student	.866	34	.001
55NationalRank	Student	.866	34	.001
42#GrantsByFacultyStudent	Faculty	.773	18	.001
66StudentIDWithProgram?	Graduate	.871	36	.001
31CreditsHrs/Faculty/Institution	Student	.864	34	.001
22StudentSatisSupportH19	Graduate	.870	36	.001
43FacultyCredentials	Faculty	.770	18	.001
17Student:FacultyCustomer	Graduate	.870	36	.001
27AveInstructorCost	Graduate	.867	36	.000
40Student:FacultyWorkforceH16	Graduate	.866	36	.000
68FlowchartOK?	Graduate	.864	36	.000
38StudentPubsH8	Graduate	.863	36	.000
55NationalRank	Graduate	.863	36	.000
52ConsotriumGovern	Student	.856	34	.000
39FacultyPubsH12	Faculty	.754	18	.000
41FacultySatisfactionStudentRatio	Student	.855	34	.000
17Student:FacultyCustomer	Student	.854	34	.000
29TutionFees%ExpendInstitution	Student	.853	34	.000
11EmployerSatisH5	Faculty	.751	18	.000
57QualOverallTeachProcess	Faculty	.750	18	.000

Quality Indicator	Member type	Kolmogorov-Smirnova		
		Statistic	df	Sig.>0.05
21StudentSatisTechnoH18	Graduate	.860	36	.000
23StudentSatisAcademicSupport	Graduate	.856	36	.000
49FacultySatisDeliveryMethodH22	Faculty	.740	18	.000
14#StudentsApplyH24	Graduate	.854	36	.000
59StudentRetention	Student	.845	34	.000
59StudentRetention	Graduate	.852	36	.000
17Student:FacultyCustomer	Faculty	.735	18	.000
55NationalRank	Faculty	.735	18	.000
39FacultyPubsH13	Graduate	.852	36	.000
48FacultySatisOnlineResourcesH16	Student	.844	34	.000
32InstructCostAs%Total$	Student	.842	34	.000
33Total$GrantsAs%Total$	Student	.842	34	.000
19StudentSatisOnLineTeach	Faculty	.729	18	.000
6Comp%PassH1	Faculty	.729	18	.000
11EmployerSatisH6	Graduate	.848	36	.000
10StudentPresentationsH10	Student	.839	34	.000
40Student:FacultyWorkforceH15	Faculty	.723	18	.000
15Alum/GradSatisf	Faculty	.721	18	.000
44#FacultyPresentations	Faculty	.720	18	.000
10StudentPresentationsH9	Graduate	.841	36	.000
18StudentSatisFaculty	Faculty	.715	18	.000
44#FacultyPresentations	Graduate	.841	36	.000
40Student:FacultyWorkforceH17	Student	.830	34	.000
62AlignOutcomes	Faculty	.708	18	.000
14#StudentsApplyH25	Student	.827	34	.000
43FacultyCredentials	Student	.826	34	.000
58QualEquip	Student	.825	34	.000
45FacultySatisfOtherFaculty	Graduate	.833	36	.000
25CostEffectH8	Student	.824	34	.000
13StudentEnrolH22	Student	.823	34	.000
9CredentialsH5	Graduate	.831	36	.000
20StudentSatisOnLineProgramH13	Faculty	.690	18	.000
6Comp%PassH3	Student	.818	34	.000
66StudentIDWithProgram?	Student	.812	34	.000
21StudentSatisTechnoH19	Student	.808	34	.000
60%StudentCompletionH11	Graduate	.816	36	.000
51CommunicationQual	Student	.804	34	.000

Quality Indicator	Member type	Kolmogorov-Smirnova		
		Statistic	df	Sig.>0.05
46FacultySatisNewStudent	Graduate	.813	36	.000
6Comp%PassH2	Graduate	.812	36	.000
13StudentEnrolH21	Graduate	.812	36	.000
61TimeDegCompH13	Student	.801	34	.000
64QualImprov?	Graduate	.810	36	.000
61TimeDegCompH12	Graduate	.810	36	.000
51CommunicationQual	Graduate	.809	36	.000
18StudentSatisFaculty	Graduate	.806	36	.000
25CostEffectH7	Graduate	.804	36	.000
63Mission?	Student	.791	34	.000
44#FacultyPresentations	Student	.790	34	.000
7DissQualH2	Faculty	.638	18	.000
63Mission?	Graduate	.798	36	.000
24StudentFeedbackOK	Student	.787	34	.000
53QualIncommingStudents	Graduate	.797	36	.000
23StudentSatisAcademicSupport	Student	.784	34	.000
8StudtPlaceRateH5	Student	.782	34	.000
49FacultySatisDeliveryMethodH23	Graduate	.789	36	.000
47FacultySatisProgLeadership	Graduate	.785	36	.000
12IfNotOnlineH18	Student	.771	34	.000
64QualImprov?	Student	.769	34	.000
36YieldRate	Student	.768	34	.000
48FacultySatisOnlineResourcesH15	Graduate	.779	36	.000
54Accreditation	Graduate	.779	36	.000
52ConsotriumGovern	Graduate	.778	36	.000
24StudentFeedbackOK	Graduate	.776	36	.000
54Accreditation	Student	.763	34	.000
50ConsortiumConsistency	Student	.761	34	.000
50ConsortiumConsistency	Graduate	.768	36	.000
20StudentSatisOnLineProgramH15	Student	.749	34	.000
43FacultyCredentials	Graduate	.760	36	.000
7DissQualH4	Student	.746	34	.000
60%StudentCompletionH12	Student	.745	34	.000
9CredentialsH6	Student	.744	34	.000
19StudentSatisOnLineTeach	Student	.742	34	.000
67AnnualAssessment	Student	.741	34	.000
15Alum/GradSatisf	Student	.723	34	.000

Quality Indicator	Member type	Kolmogorov-Smirnova		
		Statistic	df	Sig.>0.05
56QualCurriculum	Graduate	.734	36	.000
67AnnualAssessment	Graduate	.730	36	.000
49FacultySatisDeliveryMethodH24	Student	.706	34	.000
62AlignOutcomes	Graduate	.719	36	.000
20StudentSatisOnLineProgramH14	Graduate	.717	36	.000
53QualIncommingStudents	Student	.702	34	.000
15Alum/GradSatisf	Graduate	.701	36	.000
11EmployerSatisH7	Student	.681	34	.000
57QualOverallTeachProcess	Graduate	.697	36	.000
12IfNotOnlineH17	Graduate	.696	36	.000
18StudentSatisFaculty	Student	.669	34	.000
19StudentSatisOnLineTeach	Graduate	.685	36	.000
56QualCurriculum	Student	.649	34	.000
7DissQualH3	Graduate	.664	36	.000
62AlignOutcomes	Student	.642	34	.000
68FlowchartOK?	Student	.614	34	.000
57QualOverallTeachProcess	Student	.610	34	.000

APPENDIX M: WELCH RESULTS

Quality Indicator	Statistic	Ranked; Sig.>.05
17Student:FacultyCustomer	0.008	0.992
44#FacultyPresentations	0.014	0.987
46FacultySatisNewStudent	0.050	0.951
7DissQualH2	0.068	0.935
38StudentPubsH7	0.112	0.894
40Student:FacultyWorkforceH15	0.125	0.883
39FacultyPubsH12	0.154	0.858
16Avail24x7	0.182	0.834
23StudentSatisAcademicSupport	0.246	0.783
53QualIncommingStudents	0.260	0.772
14#StudentsApplyH23	0.267	0.767
48FacultySatisOnlineResourcesH14	0.345	0.711
41FacultySatisfactionStudentRatio	0.436	0.649
49FacultySatisDeliveryMethodH22	0.457	0.636
12IfNotOnlineH16	0.464	0.631
58QualEquip	0.533	0.591
57QualOverallTeachProcess	0.615	0.545
21StudentSatisTechnoH17	0.627	0.539
15Alum/GradSatisf	0.629	0.538
18StudentSatisFaculty	0.668	0.518
22StudentSatisSupportH18	0.877	0.423
43FacultyCredentials	0.884	0.421
61TimeDegCompH11	0.911	0.409
6Comp%PassH1	0.941	0.397
42#GrantsByFacultyStudent	0.976	0.385
13StudentEnrolH20	0.986	0.381
51CommunicationQual	1.141	0.329
24StudentFeedbackOK	1.360	0.268
19StudentSatisOnLineTeach	1.431	0.251
55NationalRank	1.473	0.241
56QualCurriculum	1.481	0.240
60%StudentCompletionH10	1.604	0.213

Quality Indicator	Statistic	Ranked; Sig.>.05
25CostEffectH6	1.664	0.202
54Accreditation	1.679	0.198
8StudtPlaceRateH3	1.818	0.173
62AlignOutcomes	1.875	0.166
27AveInstructorCost	2.033	0.143
35#StudentAcceptedH21	2.156	0.128
9CredentialsH4	2.171	0.126
65StudentIDWithInstitution?	2.219	0.122
47FacultySatisProgLeadership	2.236	0.120
10StudentPresentationsH8	2.270	0.114
50ConsortiumConsistency	2.289	0.113
66StudentIDWithProgram?	2.415	0.102
45FacultySatisfOtherFaculty	2.473	0.096
68FlowchartOK?	2.538	0.091
29TutionFees%ExpendInstitution	2.694	0.078
52ConsotriumGovern	2.963	0.063
63Mission?	3.147	0.054
11EmployerSatisH5	3.234	0.048
26FundingByStudFacultyH9	3.298	0.046
36YieldRate	3.690	0.033
64QualImprov?	3.870	0.029
37StudentDropOutDue$	3.952	0.026
20StudentSatisOnLineProgramH13	4.124	0.024
28TutionFees%ExpendProg	4.097	0.023
34#JobsThruExternal$	4.420	0.017
67AnnualAssessment	4.561	0.017
59StudentRetention	5.262	0.009
32InstructCostAs%Total$	5.894	0.005
33Total$GrantsAs%Total$	6.325	0.004
30CreditsHrs/Faculty	8.694	0.001
31CreditsHrs/Faculty/Institution	7.481	0.001

APPENDIX N: ONE-WAY ANOVA RESULTS

		Sum of Squares	df	Mean Square	*F*	Sig.
6Comp%PassH1	Between Groups	0.776	2	0.388	0.578	0.563
	Within Groups	57.038	85	0.671		
	Total	57.814	87			
7DissQualH2	Between Groups	0.052	2	0.026	0.065	0.937
	Within Groups	33.627	85	0.396		
	Total	33.678	87			
8StudtPlaceRateH3	Between Groups	2.958	2	1.479	1.254	0.291
	Within Groups	100.246	85	1.179		
	Total	103.204	87			
9CredentialsH4	Between Groups	4.054	2	2.027	2.294	0.107
	Within Groups	75.116	85	0.884		
	Total	79.170	87			
10StudentPresentationsH8	Between Groups	3.940	2	1.970	1.834	0.166
	Within Groups	91.284	85	1.074		
	Total	95.224	87			
11EmployerSatisH5	Between Groups	2.724	2	1.362	2.675	0.075
	Within Groups	43.276	85	0.509		
	Total	46.000	87			
12IfNotOnlineH16	Between Groups	0.963	2	0.481	0.468	0.628
	Within Groups	87.359	85	1.028		
	Total	88.322	87			

		Sum of Squares	df	Mean Square	*F*	Sig.
13StudentEnrolH20	Between Groups	2.159	2	1.079	1.117	0.332
	Within Groups	82.164	85	0.967		
	Total	84.323	87			
14#StudentsApplyH23	Between Groups	0.319	2	0.160	0.216	0.806
	Within Groups	62.646	85	0.737		
	Total	62.965	87			
15Alum/GradSatisf	Between Groups	0.977	2	0.488	0.663	0.518
	Within Groups	62.583	85	0.736		
	Total	63.560	87			
16Avail24x7	Between Groups	0.502	2	0.251	0.173	0.841
	Within Groups	122.987	85	1.447		
	Total	123.488	87			
17Student:FacultyCustomer	Between Groups	0.011	2	0.006	0.007	0.993
	Within Groups	65.012	85	0.765		
	Total	65.023	87			
18StudentSatisFaculty	Between Groups	2.106	2	1.053	0.854	0.429
	Within Groups	104.789	85	1.233		
	Total	106.894	87			
19StudentSatisOnLineTeach	Between Groups	2.395	2	1.197	1.318	0.273
	Within Groups	77.205	85	0.908		
	Total	79.600	87			
20StudentSatisOnLineProgramH13	Between Groups	6.537	2	3.269	3.699	0.029
	Within Groups	75.103	85	0.884		
	Total	81.640	87			

		Sum of Squares	df	Mean Square	*F*	Sig.
21StudentSatisTechnoH17	Between Groups	1.366	2	0.683	0.665	0.517
	Within Groups	87.337	85	1.027		
	Total	88.703	87			
22StudentSatisSupportH18	Between Groups	1.836	2	0.918	0.822	0.443
	Within Groups	94.975	85	1.117		
	Total	96.811	87			
23StudentSatisAcademicSupport	Between Groups	0.603	2	0.301	0.295	0.745
	Within Groups	86.809	85	1.021		
	Total	87.412	87			
24StudentFeedbackOK	Between Groups	3.375	2	1.688	1.740	0.182
	Within Groups	82.438	85	0.970		
	Total	85.814	87			
25CostEffectH6	Between Groups	2.743	2	1.372	1.752	0.180
	Within Groups	66.529	85	0.783		
	Total	69.273	87			
26FundingByStudFacultyH9	Between Groups	7.859	2	3.930	2.949	0.058
	Within Groups	113.263	85	1.333		
	Total	121.122	87			
27AveInstructorCost	Between Groups	3.186	2	1.593	1.940	0.150
	Within Groups	69.802	85	0.821		
	Total	72.989	87			
28TutionFees%ExpendProg	Between Groups	7.624	2	3.812	3.573	0.032
	Within Groups	90.697	85	1.067		
	Total	98.321	87			

		Sum of Squares	df	Mean Square	*F*	Sig.
29TutionFees%ExpendInstitution	Between Groups	5.564	2	2.782	2.393	0.098
	Within Groups	98.824	85	1.163		
	Total	104.388	87			
30CreditsHrs/Faculty	Between Groups	16.237	2	8.118	7.005	0.002
	Within Groups	98.511	85	1.159		
	Total	114.748	87			
31CreditsHrs/Faculty/Institution	Between Groups	14.120	2	7.060	6.094	0.003
	Within Groups	98.483	85	1.159		
	Total	112.603	87			
32InstructCostAs%Total$	Between Groups	9.651	2	4.825	4.224	0.018
	Within Groups	97.094	85	1.142		
	Total	106.745	87			
33Total$GrantsAs%Total$	Between Groups	13.546	2	6.773	5.466	0.006
	Within Groups	105.315	85	1.239		
	Total	118.861	87			
34#JobsThruExternal$	Between Groups	11.129	2	5.564	3.953	0.023
	Within Groups	119.633	85	1.407		
	Total	130.762	87			
35#StudentAcceptedH21	Between Groups	3.942	2	1.971	2.005	0.141
	Within Groups	83.577	85	0.983		
	Total	87.520	87			
36YieldRate	Between Groups	7.474	2	3.737	4.135	0.019
	Within Groups	76.831	85	0.904		
	Total	84.306	87			

		Sum of Squares	df	Mean Square	*F*	Sig.
37StudentDropOutDue$	Between Groups	10.290	2	5.145	3.693	0.029
	Within Groups	118.405	85	1.393		
	Total	128.695	87			
38StudentPubsH7	Between Groups	0.296	2	0.148	0.118	0.889
	Within Groups	106.881	85	1.257		
	Total	107.177	87			
39FacultyPubsH12	Between Groups	0.606	2	0.303	0.225	0.799
	Within Groups	114.615	85	1.348		
	Total	115.221	87			
40Student:FacultyWorkforceH15	Between Groups	0.313	2	0.157	0.181	0.835
	Within Groups	73.434	85	0.864		
	Total	73.747	87			
41FacultySatisfactionStudentRatio	Between Groups	1.043	2	0.522	0.477	0.622
	Within Groups	92.957	85	1.094		
	Total	94.000	87			
42#GrantsByFacultyStudent	Between Groups	2.243	2	1.122	0.902	0.410
	Within Groups	105.706	85	1.244		
	Total	107.949	87			
43FacultyCredentials	Between Groups	1.744	2	0.872	1.246	0.293
	Within Groups	59.494	85	0.700		
	Total	61.238	87			
44#FacultyPresentations	Between Groups	0.036	2	0.018	0.014	0.986
	Within Groups	112.952	85	1.329		
	Total	112.988	87			

		Sum of Squares	df	Mean Square	*F*	Sig.
45FacultySatisfOtherFaculty	Between Groups	9.540	2	4.770	2.996	0.055
	Within Groups	135.350	85	1.592		
	Total	144.891	87			
46FacultySatisNewStudent	Between Groups	0.102	2	0.051	0.056	0.946
	Within Groups	77.671	85	0.914		
	Total	77.773	87			
47FacultySatisProgLeadership	Between Groups	12.024	2	6.012	4.259	0.017
	Within Groups	119.976	85	1.411		
	Total	132.000	87			
48FacultySatisOnlineResourcesH14	Between Groups	1.165	2	0.583	0.423	0.657
	Within Groups	117.124	85	1.378		
	Total	118.289	87			
49FacultySatisDeliveryMethodH22	Between Groups	0.502	2	0.251	0.469	0.627
	Within Groups	45.498	85	0.535		
	Total	46.000	87			
50ConsortiumConsistency	Between Groups	7.418	2	3.709	2.653	0.076
	Within Groups	118.821	85	1.398		
	Total	126.238	87			
51CommunicationQual	Between Groups	5.625	2	2.813	1.670	0.194
	Within Groups	143.128	85	1.684		
	Total	148.753	87			
52ConsotriumGovern	Between Groups	12.541	2	6.270	4.131	0.019
	Within Groups	129.019	85	1.518		
	Total	141.560	87			

		Sum of Squares	df	Mean Square	*F*	Sig.
53QualIncommingStudents	Between Groups	0.282	2	0.141	0.292	0.747
	Within Groups	40.928	85	0.482		
	Total	41.210	87			
54Accreditation	Between Groups	3.110	2	1.555	1.814	0.169
	Within Groups	72.890	85	0.858		
	Total	76.000	87			
55NationalRank	Between Groups	3.532	2	1.766	1.979	0.145
	Within Groups	75.855	85	0.892		
	Total	79.388	87			
56QualCurriculum	Between Groups	2.012	2	1.006	1.480	0.234
	Within Groups	57.800	85	0.680		
	Total	59.812	87			
57QualOverallTeachProcess	Between Groups	1.643	2	0.822	0.865	0.425
	Within Groups	80.729	85	0.950		
	Total	82.372	87			
58QualEquip	Between Groups	2.196	2	1.098	0.921	0.402
	Within Groups	101.276	85	1.191		
	Total	103.472	87			
59StudentRetention	Between Groups	9.323	2	4.661	4.453	0.014
	Within Groups	88.981	85	1.047		
	Total	98.304	87			
60%StudentCompletionH10	Between Groups	5.661	2	2.830	1.978	0.145
	Within Groups	121.625	85	1.431		
	Total	127.286	87			

		Sum of Squares	df	Mean Square	*F*	Sig.
61TimeDegCompH11	Between Groups	2.617	2	1.308	0.998	0.373
	Within Groups	111.419	85	1.311		
	Total	114.036	87			
62AlignOutcomes	Between Groups	6.321	2	3.160	3.055	0.052
	Within Groups	87.923	85	1.034		
	Total	94.244	87			
63Mission?	Between Groups	9.755	2	4.877	6.092	0.003
	Within Groups	68.057	85	0.801		
	Total	77.812	87			
64QualImprov?	Between Groups	15.568	2	7.784	6.440	0.002
	Within Groups	102.738	85	1.209		
	Total	118.306	87			
65StudentIDWithInstitution?	Between Groups	7.650	2	3.825	3.022	0.054
	Within Groups	107.575	85	1.266		
	Total	115.224	87			
66StudentIDWithProgram?	Between Groups	8.660	2	4.330	3.600	0.032
	Within Groups	102.234	85	1.203		
	Total	110.894	87			
67AnnualAssessment	Between Groups	29.533	2	14.766	9.227	0.000
	Within Groups	136.027	85	1.600		
	Total	165.560	87			
68FlowchartOK?	Between Groups	4.887	2	2.443	2.576	0.082
	Within Groups	80.615	85	0.948		
	Total	85.501	87			

APPENDIX O: GAMES-HOWELL POST HOC TEST RESULTS

Dependent Variable	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
6Comp%PassH1	Faculty	Graduate	-0.198	0.195	0.572	-0.669	0.274
	Faculty	Student	-0.253	0.197	0.411	-0.730	0.224
	Graduate	Faculty	0.198	0.195	0.572	-0.274	0.669
	Graduate	Student	-0.056	0.209	0.962	-0.556	0.445
	Student	Faculty	0.253	0.197	0.411	-0.224	0.730
	Student	Graduate	0.056	0.209	0.962	-0.445	0.556
7DissQualH2	Faculty	Graduate	0.056	0.163	0.938	-0.339	0.450
	Faculty	Student	0.011	0.165	0.998	-0.390	0.411
	Graduate	Faculty	-0.056	0.163	0.938	-0.450	0.339
	Graduate	Student	-0.045	0.157	0.956	-0.420	0.330
	Student	Faculty	-0.011	0.165	0.998	-0.411	0.390
	Student	Graduate	0.045	0.157	0.956	-0.330	0.420
8StudtPlaceRateH3	Faculty	Graduate	-0.496	0.265	0.159	-1.139	0.146
	Faculty	Student	-0.342	0.270	0.421	-0.995	0.312
	Graduate	Faculty	0.496	0.265	0.159	-0.146	1.139
	Graduate	Student	0.155	0.275	0.840	-0.504	0.814
	Student	Faculty	0.342	0.270	0.421	-0.312	0.995
	Student	Graduate	-0.155	0.275	0.840	-0.814	0.504
9CredentialsH4	Faculty	Graduate	-0.338	0.269	0.426	-0.993	0.316
	Faculty	Student	0.133	0.257	0.863	-0.496	0.762
	Graduate	Faculty	0.338	0.269	0.426	-0.316	0.993
	Graduate	Student	0.471	0.227	0.103	-0.073	1.016
	Student	Faculty	-0.133	0.257	0.863	-0.762	0.496
	Student	Graduate	-0.471	0.227	0.103	-1.016	0.073

Dependent Variable	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
10StudentPresentationsH8	Faculty	Graduate	-0.533	0.270	0.132	-1.192	0.125
	Faculty	Student	-0.515	0.283	0.176	-1.202	0.173
	Graduate	Faculty	0.533	0.270	0.132	-0.125	1.192
	Graduate	Student	0.019	0.257	0.997	-0.596	0.634
	Student	Faculty	0.515	0.283	0.176	-0.173	1.202
	Student	Graduate	-0.019	0.257	0.997	-0.634	0.596
11EmployerSatisH5	Faculty	Graduate	-.472*	0.193	0.048	-0.941	-0.004
	Faculty	Student	-0.363	0.182	0.126	-0.805	0.080
	Graduate	Faculty	.472*	0.193	0.048	0.004	0.941
	Graduate	Student	0.109	0.176	0.809	-0.313	0.532
	Student	Faculty	0.363	0.182	0.126	-0.080	0.805
	Student	Graduate	-0.109	0.176	0.809	-0.532	0.313
12IfNotOnlineH16	Faculty	Graduate	0.275	0.294	0.623	-0.445	0.994
	Faculty	Student	0.236	0.290	0.697	-0.474	0.946
	Graduate	Faculty	-0.275	0.294	0.623	-0.994	0.445
	Graduate	Student	-0.039	0.243	0.986	-0.620	0.543
	Student	Faculty	-0.236	0.290	0.697	-0.946	0.474
	Student	Graduate	0.039	0.243	0.986	-0.543	0.620
13StudentEnrolH20	Faculty	Graduate	0.370	0.312	0.471	-0.396	1.135
	Faculty	Student	0.404	0.291	0.360	-0.316	1.125
	Graduate	Faculty	-0.370	0.312	0.471	-1.135	0.396
	Graduate	Student	0.035	0.227	0.987	-0.509	0.579
	Student	Faculty	-0.404	0.291	0.360	-1.125	0.316
	Student	Graduate	-0.035	0.227	0.987	-0.579	0.509
14#StudentsApplyH23	Faculty	Graduate	0.151	0.214	0.763	-0.373	0.675
	Faculty	Student	0.053	0.242	0.974	-0.535	0.641
	Graduate	Faculty	-0.151	0.214	0.763	-0.675	0.373
	Graduate	Student	-0.098	0.214	0.892	-0.611	0.416
	Student	Faculty	-0.053	0.242	0.974	-0.641	0.535
	Student	Graduate	0.098	0.214	0.892	-0.416	0.611

Dependent Variable	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
15Alum/GradSatisf	Faculty	Graduate	0.276	0.265	0.559	-0.381	0.932
	Faculty	Student	0.127	0.277	0.890	-0.553	0.808
	Graduate	Faculty	-0.276	0.265	0.559	-0.932	0.381
	Graduate	Student	-0.148	0.198	0.735	-0.622	0.326
	Student	Faculty	-0.127	0.277	0.890	-0.808	0.553
	Student	Graduate	0.148	0.198	0.735	-0.326	0.622
16Avail24x7	Faculty	Graduate	0.055	0.352	0.987	-0.806	0.916
	Faculty	Student	0.186	0.341	0.849	-0.650	1.022
	Graduate	Faculty	-0.055	0.352	0.987	-0.916	0.806
	Graduate	Student	0.131	0.287	0.892	-0.557	0.820
	Student	Faculty	-0.186	0.341	0.849	-1.022	0.650
	Student	Graduate	-0.131	0.287	0.892	-0.820	0.557
17Student:FacultyCustomer	Faculty	Graduate	-0.022	0.269	0.996	-0.687	0.643
	Faculty	Student	0.001	0.276	1.000	-0.678	0.679
	Graduate	Faculty	0.022	0.269	0.996	-0.643	0.687
	Graduate	Student	0.023	0.202	0.993	-0.462	0.508
	Student	Faculty	-0.001	0.276	1.000	-0.679	0.678
	Student	Graduate	-0.023	0.202	0.993	-0.508	0.462
18StudentSatisFaculty	Faculty	Graduate	0.367	0.338	0.532	-0.473	1.207
	Faculty	Student	0.398	0.366	0.529	-0.500	1.296
	Graduate	Faculty	-0.367	0.338	0.532	-1.207	0.473
	Graduate	Student	0.031	0.256	0.992	-0.584	0.647
	Student	Faculty	-0.398	0.366	0.529	-1.296	0.500
	Student	Graduate	-0.031	0.256	0.992	-0.647	0.584
19StudentSatisOnLineTeach	Faculty	Graduate	0.410	0.306	0.389	-0.359	1.179
	Faculty	Student	0.139	0.340	0.913	-0.698	0.975
	Graduate	Faculty	-0.410	0.306	0.389	-1.179	0.359
	Graduate	Student	-0.271	0.212	0.413	-0.783	0.240
	Student	Faculty	-0.139	0.340	0.913	-0.975	0.698
	Student	Graduate	0.271	0.212	0.413	-0.240	0.783

Dependent Variable	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
20StudentSatisOnLineProgramH13	Faculty	Graduate	0.699	0.283	0.054	-0.011	1.410
	Faculty	Student	0.288	0.326	0.654	-0.510	1.086
	Graduate	Faculty	-0.699	0.283	0.054	-1.410	0.011
	Graduate	Student	-0.412	0.216	0.147	-0.933	0.110
	Student	Faculty	-0.288	0.326	0.654	-1.086	0.510
	Student	Graduate	0.412	0.216	0.147	-0.110	0.933
21StudentSatisTechnoH17	Faculty	Graduate	0.323	0.318	0.574	-0.466	1.112
	Faculty	Student	0.141	0.331	0.905	-0.673	0.956
	Graduate	Faculty	-0.323	0.318	0.574	-1.112	0.466
	Graduate	Student	-0.182	0.232	0.714	-0.737	0.373
	Student	Faculty	-0.141	0.331	0.905	-0.956	0.673
	Student	Graduate	0.182	0.232	0.714	-0.373	0.737
22StudentSatisSupportH18	Faculty	Graduate	0.294	0.307	0.608	-0.464	1.052
	Faculty	Student	0.000	0.332	1.000	-0.811	0.812
	Graduate	Faculty	-0.294	0.307	0.608	-1.052	0.464
	Graduate	Student	-0.294	0.250	0.472	-0.894	0.306
	Student	Faculty	0.000	0.332	1.000	-0.812	0.811
	Student	Graduate	0.294	0.250	0.472	-0.306	0.894
23StudentSatisAcademicSupport	Faculty	Graduate	0.224	0.320	0.766	-0.568	1.017
	Faculty	Student	0.149	0.326	0.892	-0.655	0.953
	Graduate	Faculty	-0.224	0.320	0.766	-1.017	0.568
	Graduate	Student	-0.075	0.230	0.943	-0.627	0.477
	Student	Faculty	-0.149	0.326	0.892	-0.953	0.655
	Student	Graduate	0.075	0.230	0.943	-0.477	0.627
24StudentFeedbackOK	Faculty	Graduate	0.523	0.317	0.241	-0.258	1.303
	Faculty	Student	0.417	0.307	0.377	-0.343	1.176
	Graduate	Faculty	-0.523	0.317	0.241	-1.303	0.258
	Graduate	Student	-0.106	0.224	0.884	-0.644	0.431
	Student	Faculty	-0.417	0.307	0.377	-1.176	0.343
	Student	Graduate	0.106	0.224	0.884	-0.431	0.644

Dependent Variable	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
25CostEffectH6	Faculty	Graduate	0.167	0.311	0.854	-0.608	0.941
	Faculty	Student	0.451	0.310	0.328	-0.321	1.223
	Graduate	Faculty	-0.167	0.311	0.854	-0.941	0.608
	Graduate	Student	0.284	0.189	0.295	-0.168	0.737
	Student	Faculty	-0.451	0.310	0.328	-1.223	0.321
	Student	Graduate	-0.284	0.189	0.295	-0.737	0.168
26FundingByStudFacultyH9	Faculty	Graduate	-0.015	0.347	0.999	-0.860	0.831
	Faculty	Student	0.604	0.315	0.152	-0.174	1.382
	Graduate	Faculty	0.015	0.347	0.999	-0.831	0.860
	Graduate	Student	0.619	0.274	0.070	-0.040	1.277
	Student	Faculty	-0.604	0.315	0.152	-1.382	0.174
	Student	Graduate	-0.619	0.274	0.070	-1.277	0.040
27AveInstructorCost	Faculty	Graduate	-0.220	0.283	0.720	-0.913	0.473
	Faculty	Student	0.207	0.262	0.713	-0.442	0.856
	Graduate	Faculty	0.220	0.283	0.720	-0.473	0.913
	Graduate	Student	0.427	0.211	0.115	-0.079	0.933
	Student	Faculty	-0.207	0.262	0.713	-0.856	0.442
	Student	Graduate	-0.427	0.211	0.115	-0.933	0.079
28TutionFees%ExpendProg	Faculty	Graduate	0.490	0.296	0.235	-0.231	1.212
	Faculty	Student	.803*	0.279	0.018	0.119	1.488
	Graduate	Faculty	-0.490	0.296	0.235	-1.212	0.231
	Graduate	Student	0.313	0.250	0.425	-0.285	0.911
	Student	Faculty	-.803*	0.279	0.018	-1.488	-0.119
	Student	Graduate	-0.313	0.250	0.425	-0.911	0.285
29TutionFees%ExpendInstitution	Faculty	Graduate	0.528	0.283	0.164	-0.164	1.220
	Faculty	Student	0.678	0.303	0.076	-0.058	1.414
	Graduate	Faculty	-0.528	0.283	0.164	-1.220	0.164
	Graduate	Student	0.150	0.266	0.839	-0.487	0.788
	Student	Faculty	-0.678	0.303	0.076	-1.414	0.058
	Student	Graduate	-0.150	0.266	0.839	-0.788	0.487

Dependent Variable	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
30CreditsHrs/Faculty	Faculty	Graduate	0.795	0.331	0.053	-0.010	1.600
	Faculty	Student	1.174*	0.281	0.001	0.476	1.872
	Graduate	Faculty	-0.795	0.331	0.053	-1.600	0.010
	Graduate	Student	0.379	0.255	0.305	-0.235	0.993
	Student	Faculty	-1.174*	0.281	0.001	-1.872	-0.476
	Student	Graduate	-0.379	0.255	0.305	-0.993	0.235
31CreditsHrs/Faculty/Institution	Faculty	Graduate	.889*	0.294	0.012	0.175	1.603
	Faculty	Student	1.064*	0.283	0.002	0.373	1.755
	Graduate	Faculty	-.889*	0.294	0.012	-1.603	-0.175
	Graduate	Student	0.175	0.264	0.786	-0.458	0.809
	Student	Faculty	-1.064*	0.283	0.002	-1.755	-0.373
	Student	Graduate	-0.175	0.264	0.786	-0.809	0.458
32InstructCostAs%Total$	Faculty	Graduate	0.591	0.261	0.072	-0.042	1.223
	Faculty	Student	.906*	0.268	0.004	0.256	1.555
	Graduate	Faculty	-0.591	0.261	0.072	-1.223	0.042
	Graduate	Student	0.315	0.270	0.478	-0.333	0.963
	Student	Faculty	-.906*	0.268	0.004	-1.555	-0.256
	Student	Graduate	-0.315	0.270	0.478	-0.963	0.333
33Total$GrantsAs%Total$	Faculty	Graduate	0.338	0.329	0.565	-0.464	1.139
	Faculty	Student	.989*	0.301	0.007	0.248	1.730
	Graduate	Faculty	-0.338	0.329	0.565	-1.139	0.464
	Graduate	Student	.651*	0.266	0.045	0.013	1.290
	Student	Faculty	-.989*	0.301	0.007	-1.730	-0.248
	Student	Graduate	-.651*	0.266	0.045	-1.290	-0.013
34#JobsThruExternal$	Faculty	Graduate	0.571	0.333	0.213	-0.241	1.383
	Faculty	Student	.969*	0.324	0.014	0.177	1.761
	Graduate	Faculty	-0.571	0.333	0.213	-1.383	0.241
	Graduate	Student	0.398	0.288	0.357	-0.293	1.088
	Student	Faculty	-.969*	0.324	0.014	-1.761	-0.177
	Student	Graduate	-0.398	0.288	0.357	-1.088	0.293

Dependent Variable	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
35#StudentAcceptedH21	Faculty	Graduate	0.565	0.281	0.130	-0.133	1.262
	Faculty	Student	0.302	0.314	0.606	-0.466	1.070
	Graduate	Faculty	-0.565	0.281	0.130	-1.262	0.133
	Graduate	Student	-0.263	0.236	0.509	-0.829	0.304
	Student	Faculty	-0.302	0.314	0.606	-1.070	0.466
	Student	Graduate	0.263	0.236	0.509	-0.304	0.829
36YieldRate	Faculty	Graduate	.787*	0.288	0.028	0.073	1.500
	Faculty	Student	0.572	0.307	0.165	-0.180	1.325
	Graduate	Faculty	-.787*	0.288	0.028	-1.500	-0.073
	Graduate	Student	-0.215	0.221	0.597	-0.744	0.315
	Student	Faculty	-0.572	0.307	0.165	-1.325	0.180
	Student	Graduate	0.215	0.221	0.597	-0.315	0.744
37StudentDropOutDue$	Faculty	Graduate	.775*	0.315	0.049	0.002	1.549
	Faculty	Student	.901*	0.343	0.032	0.066	1.736
	Graduate	Faculty	-.775*	0.315	0.049	-1.549	-0.002
	Graduate	Student	0.125	0.289	0.901	-0.567	0.818
	Student	Faculty	-.901*	0.343	0.032	-1.736	-0.066
	Student	Graduate	-0.125	0.289	0.901	-0.818	0.567
38StudentPubsH7	Faculty	Graduate	-0.015	0.305	0.999	-0.760	0.730
	Faculty	Student	-0.129	0.317	0.914	-0.900	0.643
	Graduate	Faculty	0.015	0.305	0.999	-0.730	0.760
	Graduate	Student	-0.113	0.274	0.910	-0.770	0.543
	Student	Faculty	0.129	0.317	0.914	-0.643	0.900
	Student	Graduate	0.113	0.274	0.910	-0.543	0.770
39FacultyPubsH12	Faculty	Graduate	0.213	0.390	0.849	-0.754	1.180
	Faculty	Student	0.196	0.390	0.871	-0.772	1.164
	Graduate	Faculty	-0.213	0.390	0.849	-1.180	0.754
	Graduate	Student	-0.017	0.256	0.998	-0.631	0.597
	Student	Faculty	-0.196	0.390	0.871	-1.164	0.772
	Student	Graduate	0.017	0.256	0.998	-0.597	0.631

Dependent Variable	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
40Student:FacultyWorkforceH15	Faculty	Graduate	0.139	0.313	0.898	-0.638	0.916
	Faculty	Student	0.155	0.313	0.874	-0.622	0.933
	Graduate	Faculty	-0.139	0.313	0.898	-0.916	0.638
	Graduate	Student	0.016	0.205	0.997	-0.474	0.506
	Student	Faculty	-0.155	0.313	0.874	-0.933	0.622
	Student	Graduate	-0.016	0.205	0.997	-0.506	0.474
41FacultySatisfactionStudentRatio	Faculty	Graduate	0.285	0.347	0.694	-0.580	1.149
	Faculty	Student	0.131	0.362	0.930	-0.763	1.026
	Graduate	Faculty	-0.285	0.347	0.694	-1.149	0.580
	Graduate	Student	-0.153	0.231	0.785	-0.707	0.400
	Student	Faculty	-0.131	0.362	0.930	-1.026	0.763
	Student	Graduate	0.153	0.231	0.785	-0.400	0.707
42#GrantsByFacultyStudent	Faculty	Graduate	-0.056	0.360	0.987	-0.946	0.835
	Faculty	Student	0.288	0.358	0.704	-0.598	1.175
	Graduate	Faculty	0.056	0.360	0.987	-0.835	0.946
	Graduate	Student	0.344	0.252	0.366	-0.261	0.948
	Student	Faculty	-0.288	0.358	0.704	-1.175	0.598
	Student	Graduate	-0.344	0.252	0.366	-0.948	0.261
43FacultyCredentials	Faculty	Graduate	0.381	0.305	0.438	-0.384	1.146
	Faculty	Student	0.247	0.311	0.710	-0.530	1.025
	Graduate	Faculty	-0.381	0.305	0.438	-1.146	0.384
	Graduate	Student	-0.134	0.172	0.717	-0.546	0.278
	Student	Faculty	-0.247	0.311	0.710	-1.025	0.530
	Student	Graduate	0.134	0.172	0.717	-0.278	0.546
44#FacultyPresentations	Faculty	Graduate	0.001	0.353	1.000	-0.871	0.873
	Faculty	Student	0.042	0.362	0.993	-0.849	0.933
	Graduate	Faculty	-0.001	0.353	1.000	-0.873	0.871
	Graduate	Student	0.041	0.267	0.987	-0.599	0.682
	Student	Faculty	-0.042	0.362	0.993	-0.933	0.849
	Student	Graduate	-0.041	0.267	0.987	-0.682	0.599

Dependent Variable	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
45FacultySatisfOtherFaculty	Faculty	Graduate	0.837	0.388	0.096	-0.121	1.795
	Faculty	Student	0.791	0.399	0.133	-0.191	1.773
	Graduate	Faculty	-0.837	0.388	0.096	-1.795	0.121
	Graduate	Student	-0.045	0.292	0.987	-0.745	0.655
	Student	Faculty	-0.791	0.399	0.133	-1.773	0.191
	Student	Graduate	0.045	0.292	0.987	-0.655	0.745
46FacultySatisNewStudent	Faculty	Graduate	-0.046	0.253	0.982	-0.659	0.566
	Faculty	Student	0.029	0.241	0.992	-0.556	0.615
	Graduate	Faculty	0.046	0.253	0.982	-0.566	0.659
	Graduate	Student	0.076	0.238	0.946	-0.494	0.645
	Student	Faculty	-0.029	0.241	0.992	-0.615	0.556
	Student	Graduate	-0.076	0.238	0.946	-0.645	0.494
47FacultySatisProgLeadership	Faculty	Graduate	0.963	0.454	0.106	-0.170	2.096
	Faculty	Student	0.850	0.440	0.154	-0.257	1.956
	Graduate	Faculty	-0.963	0.454	0.106	-2.096	0.170
	Graduate	Student	-0.113	0.236	0.881	-0.680	0.454
	Student	Faculty	-0.850	0.440	0.154	-1.956	0.257
	Student	Graduate	0.113	0.236	0.881	-0.454	0.680
48FacultySatisOnlineResourcesH14	Faculty	Graduate	0.212	0.407	0.861	-0.794	1.218
	Faculty	Student	0.314	0.387	0.699	-0.653	1.282
	Graduate	Faculty	-0.212	0.407	0.861	-1.218	0.794
	Graduate	Student	0.102	0.256	0.916	-0.511	0.715
	Student	Faculty	-0.314	0.387	0.699	-1.282	0.653
	Student	Graduate	-0.102	0.256	0.916	-0.715	0.511
49FacultySatisDeliveryMethodH22	Faculty	Graduate	0.194	0.224	0.665	-0.360	0.749
	Faculty	Student	0.082	0.235	0.936	-0.497	0.660
	Graduate	Faculty	-0.194	0.224	0.665	-0.749	0.360
	Graduate	Student	-0.113	0.169	0.784	-0.518	0.293
	Student	Faculty	-0.082	0.235	0.936	-0.660	0.497
	Student	Graduate	0.113	0.169	0.784	-0.293	0.518

Dependent Variable	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
50ConsortiumConsistency	Faculty	Graduate	0.736	0.357	0.115	-0.143	1.615
	Faculty	Student	0.701	0.368	0.154	-0.203	1.605
	Graduate	Faculty	-0.736	0.357	0.115	-1.615	0.143
	Graduate	Student	-0.035	0.276	0.991	-0.697	0.627
	Student	Faculty	-0.701	0.368	0.154	-1.605	0.203
	Student	Graduate	0.035	0.276	0.991	-0.627	0.697
51CommunicationQual	Faculty	Graduate	0.633	0.433	0.326	-0.444	1.709
	Faculty	Student	0.620	0.439	0.348	-0.467	1.708
	Graduate	Faculty	-0.633	0.433	0.326	-1.709	0.444
	Graduate	Student	-0.012	0.287	0.999	-0.699	0.675
	Student	Faculty	-0.620	0.439	0.348	-1.708	0.467
	Student	Graduate	0.012	0.287	0.999	-0.675	0.699
52ConsotriumGovern	Faculty	Graduate	1.019	0.420	0.057	-0.027	2.066
	Faculty	Student	0.738	0.428	0.215	-0.324	1.800
	Graduate	Faculty	-1.019	0.420	0.057	-2.066	0.027
	Graduate	Student	-0.281	0.268	0.548	-0.923	0.361
	Student	Faculty	-0.738	0.428	0.215	-1.800	0.324
	Student	Graduate	0.281	0.268	0.548	-0.361	0.923
53QualIncommingStudents	Faculty	Graduate	0.083	0.229	0.930	-0.483	0.650
	Faculty	Student	0.153	0.224	0.775	-0.402	0.708
	Graduate	Faculty	-0.083	0.229	0.930	-0.650	0.483
	Graduate	Student	0.070	0.155	0.895	-0.303	0.442
	Student	Faculty	-0.153	0.224	0.775	-0.708	0.402
	Student	Graduate	-0.070	0.155	0.895	-0.442	0.303
54Accreditation	Faculty	Graduate	0.460	0.271	0.222	-0.207	1.127
	Faculty	Student	0.472	0.279	0.224	-0.212	1.156
	Graduate	Faculty	-0.460	0.271	0.222	-1.127	0.207
	Graduate	Student	0.012	0.219	0.998	-0.514	0.538
	Student	Faculty	-0.472	0.279	0.224	-1.156	0.212
	Student	Graduate	-0.012	0.219	0.998	-0.538	0.514

Dependent Variable	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
55NationalRank	Faculty	Graduate	0.412	0.318	0.409	-0.375	1.199
	Faculty	Student	0.542	0.314	0.214	-0.237	1.322
	Graduate	Faculty	-0.412	0.318	0.409	-1.199	0.375
	Graduate	Student	0.130	0.209	0.807	-0.369	0.630
	Student	Faculty	-0.542	0.314	0.214	-1.322	0.237
	Student	Graduate	-0.130	0.209	0.807	-0.630	0.369
56QualCurriculum	Faculty	Graduate	0.403	0.259	0.285	-0.248	1.053
	Faculty	Student	0.213	0.292	0.747	-0.503	0.930
	Graduate	Faculty	-0.403	0.259	0.285	-1.053	0.248
	Graduate	Student	-0.190	0.186	0.567	-0.638	0.258
	Student	Faculty	-0.213	0.292	0.747	-0.930	0.503
	Student	Graduate	0.190	0.186	0.567	-0.258	0.638
57QualOverallTeachProcess	Faculty	Graduate	0.368	0.333	0.519	-0.462	1.198
	Faculty	Student	0.272	0.342	0.708	-0.576	1.121
	Graduate	Faculty	-0.368	0.333	0.519	-1.198	0.462
	Graduate	Student	-0.096	0.211	0.893	-0.603	0.411
	Student	Faculty	-0.272	0.342	0.708	-1.121	0.576
	Student	Graduate	0.096	0.211	0.893	-0.411	0.603
58QualEquip	Faculty	Graduate	0.381	0.402	0.616	-0.621	1.383
	Faculty	Student	0.401	0.390	0.566	-0.577	1.380
	Graduate	Faculty	-0.381	0.402	0.616	-1.383	0.621
	Graduate	Student	0.020	0.225	0.995	-0.519	0.560
	Student	Faculty	-0.401	0.390	0.566	-1.380	0.577
	Student	Graduate	-0.020	0.225	0.995	-0.560	0.519
59StudentRetention	Faculty	Graduate	0.528	0.329	0.256	-0.274	1.329
	Faculty	Student	.887*	0.282	0.012	0.184	1.591
	Graduate	Faculty	-0.528	0.329	0.256	-1.329	0.274
	Graduate	Student	0.359	0.237	0.291	-0.211	0.930
	Student	Faculty	-.887*	0.282	0.012	-1.591	-0.184
	Student	Graduate	-0.359	0.237	0.291	-0.930	0.211

Dependent Variable	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
60%StudentCompletionH10	Faculty	Graduate	0.676	0.375	0.187	-0.252	1.605
	Faculty	Student	0.541	0.385	0.350	-0.406	1.489
	Graduate	Faculty	-0.676	0.375	0.187	-1.605	0.252
	Graduate	Student	-0.135	0.274	0.875	-0.792	0.522
	Student	Faculty	-0.541	0.385	0.350	-1.489	0.406
	Student	Graduate	0.135	0.274	0.875	-0.522	0.792
61TimeDegCompH11	Faculty	Graduate	0.367	0.349	0.550	-0.489	1.223
	Faculty	Student	0.464	0.343	0.378	-0.380	1.308
	Graduate	Faculty	-0.367	0.349	0.550	-1.223	0.489
	Graduate	Student	0.097	0.268	0.931	-0.545	0.739
	Student	Faculty	-0.464	0.343	0.378	-1.308	0.380
	Student	Graduate	-0.097	0.268	0.931	-0.739	0.545
62AlignOutcomes	Faculty	Graduate	0.667	0.358	0.170	-0.224	1.557
	Faculty	Student	0.662	0.357	0.173	-0.227	1.551
	Graduate	Faculty	-0.667	0.358	0.170	-1.557	0.224
	Graduate	Student	-0.005	0.217	1.000	-0.524	0.515
	Student	Faculty	-0.662	0.357	0.173	-1.551	0.227
	Student	Graduate	0.005	0.217	1.000	-0.515	0.524
63Mission?	Faculty	Graduate	0.804	0.339	0.066	-0.045	1.654
	Faculty	Student	0.845	0.340	0.052	-0.006	1.696
	Graduate	Faculty	-0.804	0.339	0.066	-1.654	0.045
	Graduate	Student	0.041	0.178	0.971	-0.386	0.468
	Student	Faculty	-0.845	0.340	0.052	-1.696	0.006
	Student	Graduate	-0.041	0.178	0.971	-0.468	0.386
64QualImprov?	Faculty	Graduate	1.115*	0.399	0.027	0.112	2.118
	Faculty	Student	0.919	0.413	0.087	-0.111	1.948
	Graduate	Faculty	-1.115*	0.399	0.027	-2.118	-0.112
	Graduate	Student	-0.196	0.226	0.662	-0.739	0.346
	Student	Faculty	-0.919	0.413	0.087	-1.948	0.111
	Student	Graduate	0.196	0.226	0.662	-0.346	0.739

Dependent Variable	(I) Member Type	(J) Member Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
65StudentIDWithInstitution?	Faculty	Graduate	0.797	0.380	0.111	-0.150	1.744
	Faculty	Student	0.564	0.387	0.328	-0.397	1.525
	Graduate	Faculty	-0.797	0.380	0.111	-1.744	0.150
	Graduate	Student	-0.233	0.246	0.612	-0.823	0.356
	Student	Faculty	-0.564	0.387	0.328	-1.525	0.397
	Student	Graduate	0.233	0.246	0.612	-0.356	0.823
66StudentIDWithProgram?	Faculty	Graduate	0.845	0.385	0.092	-0.115	1.805
	Faculty	Student	0.629	0.388	0.255	-0.337	1.594
	Graduate	Faculty	-0.845	0.385	0.092	-1.805	0.115
	Graduate	Student	-0.216	0.234	0.626	-0.776	0.344
	Student	Faculty	-0.629	0.388	0.255	-1.594	0.337
	Student	Graduate	0.216	0.234	0.626	-0.344	0.776
67AnnualAssessment	Faculty	Graduate	1.422*	0.488	0.021	0.196	2.648
	Faculty	Student	1.450*	0.487	0.018	0.226	2.675
	Graduate	Faculty	-1.422*	0.488	0.021	-2.648	-0.196
	Graduate	Student	0.028	0.247	0.993	-0.563	0.619
	Student	Faculty	-1.450*	0.487	0.018	-2.675	-0.226
	Student	Graduate	-0.028	0.247	0.993	-0.619	0.563
68FlowchartOK?	Faculty	Graduate	0.345	0.314	0.520	-0.425	1.116
	Faculty	Student	0.637	0.295	0.097	-0.096	1.370
	Graduate	Faculty	-0.345	0.314	0.520	-1.116	0.425
	Graduate	Student	0.292	0.223	0.395	-0.242	0.826
	Student	Faculty	-0.637	0.295	0.097	-1.370	0.096
	Student	Graduate	-0.292	0.223	0.395	-0.826	0.242

*. The mean difference is significant at the 0.05 level.

APPENDIX P: H_{04} ANOVA RESULTS

Quality Indicator		Sum of Squares	df	Mean Square	*F*	Sig.
6Comp%PassH1	Between Groups	0.016	1	0.016	0.021	0.887
	Within Groups	24.955	32	0.780		
	Total	24.971	33			
7DissQualH2	Between Groups	0.064	1	0.064	0.143	0.707
	Within Groups	14.318	32	0.447		
	Total	14.382	33			
8StudtPlaceRateH3	Between Groups	0.325	1	0.325	0.238	0.629
	Within Groups	43.705	32	1.366		
	Total	44.029	33			
9CredentialsH4	Between Groups	0.029	1	0.029	0.036	0.851
	Within Groups	25.530	32	0.798		
	Total	25.559	33			
10StudentPresentationsH8	Between Groups	0.456	1	0.456	0.361	0.552
	Within Groups	40.485	32	1.265		
	Total	40.941	33			
11EmployerSatisH5	Between Groups	0.016	1	0.016	0.034	0.854
	Within Groups	14.955	32	0.467		
	Total	14.971	33			

Quality Indicator		Sum of Squares	df	Mean Square	*F*	Sig.
12IfNotOnlineH16	Between Groups	0.036	1	0.036	0.037	0.849
	Within Groups	31.523	32	0.985		
	Total	31.559	33			
13StudentEnrolH20	Between Groups	0.301	1	0.301	0.453	0.506
	Within Groups	21.258	32	0.664		
	Total	21.559	33			
14#StudentsApplyH23	Between Groups	0.578	1	0.578	0.571	0.455
	Within Groups	32.364	32	1.011		
	Total	32.941	33			
15Alum/GradSatisf	Between Groups	0.100	1	0.100	0.127	0.724
	Within Groups	25.341	32	0.792		
	Total	25.441	33			
16Avail24x7	Between Groups	0.045	1	0.045	0.034	0.855
	Within Groups	41.985	32	1.312		
	Total	42.029	33			
17Student:FacultyCustomer	Between Groups	0.002	1	0.002	0.002	0.962
	Within Groups	24.939	32	0.779		
	Total	24.941	33			
18StudentSatisFaculty	Between Groups	0.011	1	0.011	0.007	0.932
	Within Groups	47.871	32	1.496		
	Total	47.882	33			
19StudentSatisOnLineTeach	Between Groups	0.045	1	0.045	0.038	0.847
	Within Groups	37.485	32	1.171		
	Total	37.529	33			

Quality Indicator		Sum of Squares	df	Mean Square	*F*	Sig.
20StudentSatisOnLineProgramH13	Between Groups	0.114	1	0.114	0.090	0.766
	Within Groups	40.621	32	1.269		
	Total	40.735	33			
21StudentSatisTechnoH17	Between Groups	3.451	1	3.451	3.543	0.069
	Within Groups	31.167	32	0.974		
	Total	34.618	33			
22StudentSatisSupportH18	Between Groups	0.064	1	0.064	0.046	0.831
	Within Groups	44.318	32	1.385		
	Total	44.382	33			
23StudentSatisAcademicSupport	Between Groups	0.007	1	0.007	0.007	0.933
	Within Groups	31.758	32	0.992		
	Total	31.765	33			
24StudentFeedbackOK	Between Groups	0.485	1	0.485	0.640	0.429
	Within Groups	24.250	32	0.758		
	Total	24.735	33			
25CostEffectH6	Between Groups	0.863	1	0.863	1.479	0.233
	Within Groups	18.667	32	0.583		
	Total	19.529	33			
26FundingByStudFacultyH9	Between Groups	0.984	1	0.984	1.076	0.307
	Within Groups	29.280	32	0.915		
	Total	30.265	33			
27AveInstructorCost	Between Groups	0.100	1	0.100	0.166	0.686
	Within Groups	19.341	32	0.604		
	Total	19.441	33			

Quality Indicator		Sum of Squares	df	Mean Square	*F*	Sig.
28TutionFees%ExpendProg	Between Groups	0.045	1	0.045	0.048	0.829
	Within Groups	29.985	32	0.937		
	Total	30.029	33			
29TutionFees%ExpendInstitution	Between Groups	0.016	1	0.016	0.011	0.917
	Within Groups	46.455	32	1.452		
	Total	46.471	33			
30CreditsHrs/Faculty	Between Groups	0.301	1	0.301	0.464	0.500
	Within Groups	20.758	32	0.649		
	Total	21.059	33			
31CreditsHrs/Faculty/Institution	Between Groups	0.000	1	0.000	0.000	1.000
	Within Groups	36.500	32	1.141		
	Total	36.500	33			
32InstructCostAs%Total$	Between Groups	0.075	1	0.075	0.055	0.816
	Within Groups	43.689	32	1.365		
	Total	43.765	33			
33Total$GrantsAs%Total$	Between Groups	0.100	1	0.100	0.109	0.743
	Within Groups	29.341	32	0.917		
	Total	29.441	33			
34#JobsThruExternal$	Between Groups	0.002	1	0.002	0.001	0.971
	Within Groups	42.939	32	1.342		
	Total	42.941	33			
35#StudentAcceptedH21	Between Groups	0.643	1	0.643	0.495	0.487
	Within Groups	41.621	32	1.301		
	Total	42.265	33			

Quality Indicator		Sum of Squares	df	Mean Square	*F*	Sig.
36YieldRate	Between Groups	0.045	1	0.045	0.042	0.839
	Within Groups	33.985	32	1.062		
	Total	34.029	33			
37StudentDropOutDue$	Between Groups	0.279	1	0.279	0.157	0.695
	Within Groups	56.780	32	1.774		
	Total	57.059	33			
38StudentPubsH7	Between Groups	0.054	1	0.054	0.037	0.848
	Within Groups	46.417	32	1.451		
	Total	46.471	33			
39FacultyPubsH12	Between Groups	0.029	1	0.029	0.025	0.876
	Within Groups	37.030	32	1.157		
	Total	37.059	33			
40Student:FacultyWorkforceH15	Between Groups	0.325	1	0.325	0.448	0.508
	Within Groups	23.205	32	0.725		
	Total	23.529	33			
41FacultySatisfactionStudentRatio	Between Groups	0.011	1	0.011	0.010	0.922
	Within Groups	36.371	32	1.137		
	Total	36.382	33			
42#GrantsByFacultyStudent	Between Groups	0.578	1	0.578	0.538	0.469
	Within Groups	34.364	32	1.074		
	Total	34.941	33			
43FacultyCredentials	Between Groups	0.114	1	0.114	0.196	0.661
	Within Groups	18.621	32	0.582		
	Total	18.735	33			

Quality Indicator		Sum of Squares	df	Mean Square	*F*	Sig.
44#FacultyPresentations	Between Groups	0.054	1	0.054	0.039	0.845
	Within Groups	44.417	32	1.388		
	Total	44.471	33			
45FacultySatisfOtherFaculty	Between Groups	0.100	1	0.100	0.061	0.807
	Within Groups	52.841	32	1.651		
	Total	52.941	33			
46FacultySatisNewStudent	Between Groups	0.178	1	0.178	0.201	0.657
	Within Groups	28.439	32	0.889		
	Total	28.618	33			
47FacultySatisProgLeadership	Between Groups	0.610	1	0.610	0.813	0.374
	Within Groups	24.008	32	0.750		
	Total	24.618	33			
48FacultySatisOnlineResourcesH14	Between Groups	0.943	1	0.943	1.120	0.298
	Within Groups	26.939	32	0.842		
	Total	27.882	33			
49FacultySatisDeliveryMethodH22	Between Groups	0.236	1	0.236	0.403	0.530
	Within Groups	18.735	32	0.585		
	Total	18.971	33			
50ConsortiumConsistency	Between Groups	1.499	1	1.499	1.042	0.315
	Within Groups	46.030	32	1.438		
	Total	47.529	33			
51CommunicationQual	Between Groups	0.546	1	0.546	0.363	0.551
	Within Groups	48.189	32	1.506		
	Total	48.735	33			

Quality Indicator		Sum of Squares	df	Mean Square	*F*	Sig.
52ConsotriumGovern	Between Groups	0.428	1	0.428	0.314	0.579
	Within Groups	43.689	32	1.365		
	Total	44.118	33			
53QualIncommingStudents	Between Groups	0.197	1	0.197	0.521	0.476
	Within Groups	12.068	32	0.377		
	Total	12.265	33			
54Accreditation	Between Groups	0.824	1	0.824	0.918	0.345
	Within Groups	28.735	32	0.898		
	Total	29.559	33			
55NationalRank	Between Groups	0.016	1	0.016	0.022	0.882
	Within Groups	22.955	32	0.717		
	Total	22.971	33			
56QualCurriculum	Between Groups	0.301	1	0.301	0.329	0.570
	Within Groups	29.258	32	0.914		
	Total	29.559	33			
57QualOverallTeachProcess	Between Groups	1.027	1	1.027	1.191	0.283
	Within Groups	27.591	32	0.862		
	Total	28.618	33			
58QualEquip	Between Groups	0.578	1	0.578	0.826	0.370
	Within Groups	22.364	32	0.699		
	Total	22.941	33			
59StudentRetention	Between Groups	0.546	1	0.546	1.231	0.275
	Within Groups	14.189	32	0.443		
	Total	14.735	33			

Quality Indicator		Sum of Squares	df	Mean Square	*F*	Sig.
60%StudentCompletionH10	Between Groups	0.087	1	0.087	0.061	0.807
	Within Groups	46.030	32	1.438		
	Total	46.118	33			
61TimeDegCompH11	Between Groups	0.178	1	0.178	0.150	0.701
	Within Groups	37.939	32	1.186		
	Total	38.118	33			
62AlignOutcomes	Between Groups	0.129	1	0.129	0.159	0.692
	Within Groups	25.871	32	0.808		
	Total	26.000	33			
63Mission?	Between Groups	0.610	1	0.610	1.115	0.299
	Within Groups	17.508	32	0.547		
	Total	18.118	33			
64QualImprov?	Between Groups	1.448	1	1.448	1.382	0.248
	Within Groups	33.523	32	1.048		
	Total	34.971	33			
65StudentIDWithInstitution?	Between Groups	0.279	1	0.279	0.242	0.626
	Within Groups	36.780	32	1.149		
	Total	37.059	33			
66StudentIDWithProgram?	Between Groups	0.863	1	0.863	0.886	0.354
	Within Groups	31.167	32	0.974		
	Total	32.029	33			
67AnnualAssessment	Between Groups	1.658	1	1.658	1.665	0.206
	Within Groups	31.871	32	0.996		
	Total	33.529	33			

Quality Indicator		Sum of Squares	df	Mean Square	*F*	Sig.
68FlowchartOK?	Between Groups	0.824	1	0.824	1.272	0.268
	Within Groups	20.735	32	0.648		
	Total	21.559	33			

APPENDIX Q: RANKED LISTING OF 63 QUALITY INDICATORS

Ranked Quality Indicator	Mean
• Quality of dissertations.	1.53
• Alumni/graduates satisfaction with their educational experience.	1.65
• Quality of online teaching processes, such as quality of course organization and syllabi, constructiveness and timeliness of faculty feedback to students regarding assignments, questions, grades, and quality of exams, etc.	1.75
• Quality (currency) of program curriculum.	1.76
• Percentage of students satisfied with the quality of On-line teaching/learning process (including technology and other resources, curriculum, course syllabi, exams, etc.).	1.81
• Student satisfaction with online program.	1.81
• Percentage of students who indicate they would not have been able to complete a doctoral program if it were not available online.	1.83
• Program accreditation status.	1.90
• Quality of faculty academic credentials, etc.	1.91
• Quality of incoming students (academic qualifications, prior experience, credentials, etc.).	1.91
• Percentage of students who pass comprehensive exams on first attempt.	1.95
• Feedback to student assignments and questions is constructive and provided in a timely manner.	1.95
• There is a recognizable mission (and/or vision) of the Consortium.	1.95
• Employers' satisfaction with graduates of online program.	2.00
• Faculty satisfaction with delivery method.	2.00
• Percentage of students satisfied with the quality of Faculty advice and support.	2.03
• Cost effectiveness.	2.09
• Alignment of official and published program outcomes with individual course outcomes and content of comprehensive exams.	2.14
• Quality of continuous improvement practices in recruitment (students and faculty), curriculum review, equipment acquisitions and upgrades, teaching and learning processes, etc.	2.14
• Number of students who apply to program.	2.15
• Student-to-faculty ratio.	2.16
• Percentage of program faculty satisfied with the quality of On-line teaching/learning processes and resources.	2.17
• Student to faculty ratio (or average class size).	2.18
• Program national ranking.	2.19

Ranked Quality Indicator	Mean
• Measurable Learning Outcomes for the PhD program that are annually assessed and used as a feedback loop for continuous improvement.	2.19
• Student satisfaction with technology.	2.22
• Quality of communications among institutions in the consortium.	2.22
• Consistency among and compliance with program and consortium policies, procedures and rules.	2.25
• Student retention rates, by course or faculty, and by academic year.	2.26
• Consortium governance.	2.28
• Quality (age, currency, cost, location) of teaching/research equipment, supplies, etc.	2.28
• Percentage of students who complete their degree within seven years.	2.28
• Student enrollment.	2.31
• Percentage of program faculty satisfied with the quality of new students.	2.31
• Number of peer-reviewed publications produced by faculty.	2.33
• Percentage of students satisfied with the quality of Academic/student support services.	2.34
• Student placement rates.	2.36
• Average time to degree completion.	2.38
• Professional examination/credentialing of graduates (if applicable).	2.41
• Faculty satisfaction with student to faculty ratio.	2.41
• Percentage of program faculty satisfied with the quality of Program leadership, organizational structure, and curriculum.	2.41
• Yield rate (between accepted and enrolled students).	2.42
• Student and faculty assessment of whether the student identified with the program.	2.42
• Student satisfaction with student support service.	2.43
• Flowchart OK?	2.44
• Quality and number of peer-reviewed publications produced by students.	2.45
• Availability 24x7.	2.48
• Average instructional cost per student enrolled in the program.	2.53
• Number of faculty presentations at professional meetings and conferences.	2.53
• Course credits and student credit hours generated per teaching faculty FTE.	2.67
• Total instructional costs as a percentage of total expenditures.	2.67
• Tuition and fees generated by the program as a percentage of total program expenditures.	2.68
• Number of presentations made by students at professional conferences.	2.73
• Student and faculty assessment of whether the student identified with the institution.	2.73
• Tuition and fees generated by the program at each institution as a percentage of total program expenditures at each institution.	2.74
• Course credits and student credit hours generated per teaching faculty FTE per institution.	2.78
• Number of students who are accepted to online program.	2.81

Ranked Quality Indicator	Mean
• Percentage of students who drop out due to unmet financial needs.	2.94
• Percentage of program faculty satisfied with the quality of Faculty compensation and benefits.	2.97
• Number of grants secured by faculty and students.	3.02
• Total dollars generated from grants and contracts as a percentage of total revenues.	3.15
• Number of jobs supported by external (grants and contracts) dollars.	3.18
• Total amount of funding from grants secured by faculty and students.	3.23

Mean score: 1 = greatest agreement; 6 = most disagreement