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Using Online Learning Technologies to Teach Basic Capital Budgeting Techniques in an Undergraduate Corporate Finance Course

by

Chris Soon-Shin Andrews

A dissertation
submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Instructional Design
Idaho State University
Summer 2014

COMMITTEE APPROVAL

To the Graduate Faculty:

The members of the committee appointed to examine the dissertation of CHRIS S. ANDREWS find it satisfactory and recommend that it be accepted.

Dr. Jane Strickland
Chair

Dr. Dotty Sammons
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May 15, 2013

Chris Soon-Shin Andrews
1294 N. 16th East
Sugar City, ID 83448

RE: Your application dated 5/15/2013 regarding study number 3929: Using Online Learning Technologies to Teach Basic Capital Budgeting Techniques in an Undergraduate Corporate Finance Course

Dear Mr./Ms. Andrews:

I agree that this study qualifies as exempt from review under the following guideline: 1. Research on educational practices in educational settings. This letter is your approval, please, keep this document in a safe place.

Notify the HSC of any adverse events. Serious, unexpected adverse events must be reported in writing within 10 business days.

You are granted permission to conduct your study effective immediately. The study is not subject to renewal.

Please note that any changes to the study as approved must be promptly reported and approved. Some changes may be approved by expedited review; others require full board review. Contact Patricia Hunter (208-282-2179; fax 208-282-4529; email: humsubj@isu.edu) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair

BYU
IDAHO

May 28, 2013

Dear Chris,

Your proposal to use human subjects from the BYU-Idaho student body for the study entitled *Using Online Learning Technologies to Teach Basic Capital Budgeting Techniques in an Undergraduate Corporate Finance Course* is approved for 12 months from the date of this letter. Please notify the IRB if you intend to make any significant modifications to the study's design or implementation.

Good luck with your study.

Regards,

Scott J. Bergstrom, Ph.D.
Chair, BYU-Idaho Institutional Review Board

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I would like to first acknowledge the Department of Educational Leadership and Instructional Design at Idaho State University for their outstanding program. The things I learned in going through the doctoral program in Instructional Design will affect the lives of many thousands of students for whom I will spend the next 20 years designing instruction.

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Abstract

This dissertation was designed to assess whether differences in student performance existed between college-level learners who received online units of instruction and subjects who were taught in a face-to-face environment. Student achievement in content knowledge was measured and the data was analyzed to see if differences existed between the two modes of instruction. The subject matter for the content knowledge portion of the study included internal rate of return (IRR) and net present value (NPV). These topics are offered as part of a finance course at the institution that housed the study.

This research also explored differences in student achievement in producing working spreadsheet models to enable the user to accurately calculate IRR and NPV. These two spreadsheet modeling techniques were taught in both an online and a face-to-face environment. The data was analyzed to see if significant differences existed between the models produced by online students versus students in a traditional classroom.

The study involved utilizing the university's existing learning management system (LMS) to build online modules as Reusable Learning Objects (RLOs). Four separate RLOs were developed: 1) NPV content, 2) IRR content, 3) IRR spreadsheet modeling, and 4) NPV spreadsheet modeling.

The ADDIE model of instructional design was used to develop the RLOs. From an instructional design standpoint, this study examined whether the ADDIE model

aligned with the development of RLOs for online learning of financial topics and spreadsheet modeling. The ADDIE model was demonstrated to be an effective framework for developing RLOs for this type of instruction.

The results indicated significant differences existed in achievement of the learners who received instruction on NPV content via the RLO versus those who learned about NPV in a classroom. Performance by the online students was significantly higher than the face-to-face students in this portion of the study. No significant differences were found to exist between the online and face-to-face groups on the subjects of IRR content knowledge, IRR spreadsheet modeling, and NPV spreadsheet modeling. For these targeted participants, the results indicate that the four topics can be taught as effectively using RLOs as in a face-to-face environment.

CHAPTER I
Introduction

Purpose of the Study

A university in the western United States currently offers an undergraduate, junior-level, corporate finance course. This class is required of all business management majors and is also treated as an elective within several other programs on campus. The university is considering offering its business management degree, including the corporate finance class, online.

This research focused on the effectiveness of an online reusable learning module in assisting students who were enrolled in the corporate finance class to 1) learn basic capital budgeting methods of calculating internal rate of return and net present value and 2) build a spreadsheet model to solve capital budgeting problems, using the net present value and internal rate of return methods.

The university administration has expressed a desire to offer an online version of the course that is as similar as possible to the current face-to-face class (K. Lundin, personal communication, March 19, 2010). The course includes a significant amount of instructor-to-student interaction, individual training in building working capital budgeting spreadsheets, and feedback on capital budgeting spreadsheets during class sessions. Students are also required to solve capital budgeting problems in a laboratory-like setting, during which they receive feedback and assistance from the instructor.

Developing an online course that is similar to the face-to-face version represents a challenge to the faculty, who perceive that difficulties may arise in helping online students achieve the same degree of success in learning the concepts and the spreadsheet modeling skills. This perception may have some grounding in the literature (Wiley, 2000), because learning objects have typically been used for simple concepts in short term delivery modes. However, a significant gap in the published research exists when addressing the teaching of complex financial topics via learning objects.

This research study provided useful data on the achievement of students enrolled in an online course in which the capital budgeting concepts of internal rate of return and net present value and their related spreadsheet modeling skills are studied. Lessons learned through this research may be applicable to a broader audience of instructional designers who are attempting to create courses focusing on other aspects of finance for college learners.

In addition, this research may benefit instructors who wish to teach spreadsheet modeling skills related to any topic via an online module.

Research Questions

The following research questions were presented for this dissertation investigation:

1) Is there a significant difference in net present value analysis achievement for those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus those who receive instruction via an online learning module, as measured by a standardized departmental test?
2) Is there a significant difference in internal rate of return achievement for those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students who receive instruction via an online learning module, as measured by a standardized departmental test?
3) Is there a significant difference in net present value spreadsheet models produced by those students enrolled in a corporate finance course who

receive traditional face-to-face instruction versus students enrolled in a corporate finance course who receive instruction via an online learning module, as measured by a standardized departmental rubric.

4) Is there a significant difference in internal rate of return spreadsheet models produced by those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students enrolled in a corporate finance course who receive instruction via an online learning module, as measured by a standardized departmental rubric.

5) What is the instructional design evaluation compliance level for each of the five phases of the ADDIE (Analyze, Design, Develop, Implement, and Evaluate) instructional design model in the creation of two Finance RLOs, as measured by a modified Delphi Technique?

Research Design

Because the students cannot be randomly assigned or selected to course sections, a quasi-experimental design was used for this research project. Quasi-experimental research designs are generally used when researchers are unable to randomly assign or select students to sections and the researchers do not have complete control over how the subjects in the study are grouped (Gall, Gall, & Borg, 2003). For the knowledge portion of the current study, the researcher used the non-equivalent control group form of quasi-experimental design, since the participants could not be randomly selected and both a pre-test and a post-test were administered (see Figure 1).

	Pretest Knowledge	Treatment	Posttest Knowledge	Posttest (Product)
Treatment Group	**O_1**	**X**	**O_2**	**O_6**
Control Group	**O_3**		**O_4**	**O_8**

Figure 1. Quasi-Experimental Nonequivalent Control-Group Design
Where:
$O_{1,}$ O_3 = the observation of knowledge pretest
$O_{2,}$ O_4 = the observation of knowledge posttest
$O_{6,}$ O_8 = the observation of students' spreadsheet product posttest

For the spreadsheet product portion of the proposed study, the researcher used the static-group comparison form of quasi-experimental design, since the participants could not be randomly selected and a post-test only was administered (see Figure 1).

The focus of the project was on whether online instructional methods are at least as effective as traditional face-to-face instruction in helping students learn basic internal rate of return and net present value methods and spreadsheet modeling skills. Every semester, corporate finance students enroll in two separate sections with approximately 55 in each and a third section with approximately 30 students. Only the two largest sections participated in this project. One section (N=37) of the corporate finance class was given the treatment of the online learning module, while the other section (N=41) received traditional face-to-face instruction and was considered the control group.

All participants were given the standardized department test on internal rate of return and net present value one month prior to the introduction of capital budgeting as a topic. All participants were given the same test on internal rate of return and net present value at the completion of the learning module. The mean scores between the two class sections were examined to determine whether any significant differences exist between the two instructional methods (Gravetter & Wallnau, 2007). An analysis of covariance (ANCOVA) was used to analyze differences between mean scores of the two groups

(Leech, Barrett, & Morgan, 2008). A major threat to the internal validity of a non-equivalent control-group study is the chance that differences on the post-test are due to differences between the groups, rather to the treatment. An analysis of covariance controls for differences between the groups by factoring the pre-test scores into a compensating adjustment to the post-test scores, thereby reducing any effect that differences between groups may have on the overall analysis (Gall, Gall, & Borg, 2003).

Following the treatment, the students were asked to produce spreadsheet models that calculate both internal rates of return and net present values. The spreadsheet models were graded for accuracy based on a departmental standard rubric. The mean scores between the two class sections were examined to determine whether any significant differences exist between the two class sections (Gravetter & Wallnau, 2007). A single-sample *t*-test was used to analyze differences between the mean scores of the two groups (Leech, Barrett, & Morgan, 2008).

Limitations

Certain factors may affect the internal validity of an experiment. Eight of these factors, known as limitations, have been identified as history, maturation, testing, instrumentation, statistical regression, differential selection, experimental mortality, and selection-maturation reaction (Campbell & Stanley, 1963). Four more limitations were added to this list by Campbell and Cook (1979). These additional limitations include experimental treatment diffusion, compensatory rivalry by the control group, compensatory equalization of treatments, and resentful demoralization of the control group.

History. The participants in the research study (both control and treatment groups) have been exposed to basic concepts of capital budgeting techniques in a prerequisite class. However, the finance instructor verified the instruction they receive was primarily an overview of key concepts; very little time was spent on developing the students' knowledge or skills in solving capital budgeting problems. Additionally, the students did not receive any instruction on building capital budgeting spreadsheets; therefore, there was very little threat to the internal validity of this study based on the learners' history.

Maturation. This study took a total of six weeks. The pre-test was administered four weeks prior to the beginning of the learning unit. The learning unit took two weeks and the post-test was given at the conclusion of the unit. Because the duration of the study was short (six weeks), it can safely be assumed maturation did not have any effect on the internal validity of the data.

Testing. The subjects received the pre-test six weeks prior to the post-test. The portion of the instrument comprised of multiple-choice items was randomly re-ordered prior to being administered as a post-test. Because of the length of the interval between the pre-test and the post-test, as well as the re-ordering of items, the effect of the pre-test on the post-test results was low. Therefore, any threat to the internal validity of the research based on testing was minimal.

Instrumentation. The test of the subjects' abilities to solve internal rate of return and net present value problems was administered as a 20-item multiple-choice instrument. Subject matter experts examined the instrument for both face and content validity. The instrument was field-tested and adjustments were made to improve the level of difficulty.

The spreadsheet modeling skills of the students were measured with a project-based instrument in the form of a rubric. Subject matter experts checked both the parameters for the project and the rubric for face and content validity. The instrument was field-tested and adjustments made as necessary. A test of interrater reliability was conducted on the grading rubric and adjustments were made to the rubric to improve its reliability. It may be assumed instrumentation did not pose a significant threat to the internal validity of the study.

Statistical regression. The subjects of this study were selected based on prior knowledge or performance. Therefore, the researcher assumed regression to the mean for both groups would be similar. The possible exception to this would be if the students were different with regard to knowledge of internal rates of return, payback method, and net present value. Based on data available to the researcher, it appears the students were homogeneous in this regard; therefore, statistical regression did not pose a threat to the internal validity of this study.

Selection. The subjects in both the treatment and control groups for this study were not randomly assigned; rather, the participants represented a sample of convenience. Samples of convenience may pose a threat to the internal validity. The pre-test was provided as a process to determine if significant differences exist between the groups based on selection method. The control and treatment groups for research question 2 achieved similar scores on the pretest, so the researcher assumed selection did not pose a serious threat to the internal validity of the study. Pretest scores for research question 1 were compared and significant differences were found to exist between the control and treatment groups, with the treatment group having the higher mean scores. The researcher acknowledged that selection might pose a threat to the validity of the study with regards to question 2. The researcher chose to use an ANCOVA as an analytical tool to control for differences on the pretest.

Experimental mortality. None of the students dropped the course following the pre-test. In addition, the course was required for completion of the students' degree programs. The threat to internal validity based on experimental mortality was not high.

Selection interactions. The students enrolled in the finance course see each other within a larger business program called the Integrated Business Core (IBC). However, interaction between the control and the treatment groups was fairly limited. The subjects were evaluated individually; this limited the degree to which results were affected by selection interactions. The researcher does assume some threats existed to the validity of the study, based on possible students mixing. The researcher did everything possible to minimize this threat, including instructing the subjects that discussing the course content with other students was not allowed.

Experimental treatment diffusion. Control group members might have attempted to access the treatment, if it was perceived as preferable to the control group condition. Such attempts are usually more likely to occur if the control and treatment (experimental) groups are in close physical proximity to each other. In this study, the control and treatment groups met at separate times for scheduled class sessions. Additionally, the treatment was contained in a password-protected online environment that could not be accessed outside the experimental group. The researcher instructed the control group subjects that they were not to attempt to access the treatment and that it was considered cheating if they did so. The researcher made every reasonable effort to prevent experimental treatment diffusion in this study.

The remaining three possible threats to internal validity (compensatory rivalry; compensatory equalization; resentful demoralization) identified by Campbell and Cook (1979) did not appear to be applicable to this researcher's proposed study.

Delimitations

External validity refers to the extent to which a study's findings can be applied to subjects beyond those included (Gall, Gall, & Borg, 2003). Factors that affect the external validity of an experiment are known as delimitations. Twelve delimitations have been identified in the literature (Bracht & Glass, 1968). These are grouped into two categories: population validity and ecological validity.

Extent to which one can generalize from the experimental sample to a defined population. The population from which the sample was drawn is known as the experimentally accessible population (Bracht & Glass, 1968). In this study, the experimentally accessible population was all the corporate finance students at the university. Because the characteristics of the experimentally accessible population were so similar to the sample drawn from it, the findings of the study were generalized to other junior-level corporate finance students at the university.

The researcher did not attempt to generalize the findings of this study to a larger target population, because the differences between the sample and the target population outside of the experimentally accessible population are probably significant and would render the generalization to be invalid.

Extent to which personological variables interact with treatment effects. The external validity of the study may be affected if results of the experiment apply to subjects with certain characteristics but not to those subjects who have other characteristics (Gall, Gall, & Borg, 2003). Most of the subjects in this study were in the same level of college learning, in the same major, and had met a minimum grade point average as established by the targeted university. Differences due to characteristics such as test anxiety, gender, or technical ability may have some effect on the study. The researcher did not control for any further subject characteristics and accepts the fact that some amount of risk to external validity exists due to personological variables.

Novelty and disruption effects. A treatment that is different from that normally received or that disrupts the students' normal routine may be effective or ineffective simply because it is different. This is a threat to the external validity of the study. In this project, the researcher offered a treatment online via the university's Learning Management System (LMS), with which the students were already familiar. Therefore, the treatment was not considered novel or disruptive and any threats to the external validity should be minimal.

Experimenter effect. Bias occurs when researchers give too much information about the study and have too much influence on the participants. In this study, the researcher had very little interaction with the students beyond the initial set of instructions since the treatment is entirely online. The researcher limited his communication to assignment-specific feedback. This minimized the potential for experimenter bias within the experimental group. Bias toward the control group may be more likely since the researcher had regular interaction with the control group.

Pretest sensitization. Sometimes, the pretest affects the research results by interacting with the treatment. External validity is most likely to be threatened when the pretest contains self-reported measurements of attitude or personality scores. In this research, a content pretest was administered and contained no questions relating to either attitude or personality. Therefore, while there may be some effect from a pretest on the eventual outcome of the research, this is expected to be minimal.

Posttest sensitization. This occurs when the participant connects concepts that were previously unrelated. The posttest in this study was a necessary component of the research. As such, it is recognized and the researcher sequenced items so that posttest sensitization was minimized as much as possible.

Measurement of the dependent variable. An experiment's generalizability may be hampered by assessments used to measure achievement. In this study, the researcher used assessments that have been examined for content validity by subject matter experts. Therefore, risks to external validity resulting from poorly designed assessments were minimized.

Interaction of time of measurement and treatment effects. In this study, the posttest was given immediately following the treatment. The posttest was not administered a second time, as a *post hoc*. The researcher accepts this may result in not observing whether the subjects retained the material over a longer period of time.

The remaining four possible threats to external validity (explicit description of the experimental treatment, multiple treatment interference, Hawthorne effect, and interaction of history and treatment effects) identified by Bracht and Glass (1968) did not appear to be applicable to this researcher's study.

Significance of the Study

Because this study relates directly to the university's goal of placing business courses online it will influence the design of those online courses. The research provided insight into whether quantitative business topics currently being taught in a face-to-face classroom setting can be taught in an online environment with similar results. The study will directly impact approximately 600 students per year who currently enroll in the Finance course. In addition, the university has forecast a total of 10,000 business majors enrolled by the year 2016, of whom 7,500 are expected to be online. Every one of these students will be required to take the course that is the subject of this study. These numbers indicate that the lessons learned by the researcher will affect a large number of students. Also, other similar classes may benefit from the data collected in this study.

The teaching of spreadsheet modeling at the university, both within the College of Business and without, is fairly common. Teaching spreadsheet modeling presents a unique instructional design problem since the spreadsheet model is where knowledge and comprehension merge with application, analysis, and synthesis (Bloom, 1956). Observations and data from the research relating to the teaching of spreadsheet modeling online may impact a number of disciplines not directly related to business.

Capital budgeting also represents a challenging scenario for the instructional design team. Capital budgeting concepts (NPV / IRR) are generally difficult for students to grasp, because in order to fully learn NPV and IRR, students must be able to synthesize a number of related and prerequisite concepts. Minor flaws in the student's understanding of these other concepts tend to result in failure to understand capital budgeting.

The study will add to the published literature on the topics of teaching NPV and IRR content and spreadsheet modeling online and may be helpful to other researchers who are examining ways to effectively use RLOs to teach Finance or spreadsheet modeling topics.

Definition of Key Terms

ADDIE refers to an instructional design model proposed by Robert Gagne (Gagne, Wager, Golas, & Keller, 2005). ADDIE represents the different stages of the instructional design process (Analyze, Design, Develop, Implement, and Evaluate).

LMS: Learning Management System. Generally, this is an Internet or intranet-based system for supporting instruction either for online courses or traditional courses. Components may include assignments, online assessments, a gradebook, and numerous communication tools (Ellis & Calvo, 2007).

IRR: Internal Rate of Return. This refers to a method for analyzing capital budgeting projects. The IRR answers the specific question: "Exactly what rate of annual return does this project earn?" (Keown, Martin, & Petty, 2011).

NPV: Net Present Value. This refers to a method for analyzing capital budgeting projects. The NPV answers the specific question: "Does the project earn *at least* X% return?" The correct answers delivered by NPV are either 'yes' or 'no.' The answer only tells the researcher whether the project meets the return benchmark, but does not give the exact rate of return earned by the project (Keown et al., 2011).

RLO: Reusable Learning Object. A digital object intended for re-use in an educational setting (Churchill, 2007; Wiley, 2000; Krauss & Ally, 2005). Other definitions sometimes include non-digital objects, but for purposes of an online learning experience, the objects are assumed to be digital.

Summary

This study explored the differences in student achievement in an online environment versus a face-to-face classroom experience within the context of a junior-level college Finance course. The learners' acquisition of content knowledge and spreadsheet modeling skills were both measured and compared using an ANCOVA and a single-sample *t*-test, respectively.

The online instruction was developed using an instructional systems design method known as ADDIE. The following chapters will provide a review of the literature (Chapter II) and document the development of the online instruction (Chapter III). Chapter IV will provide results of the study and the results will be discussed in Chapter V.

Chapter II

Review of the Literature

The purpose of this study is to examine the effectiveness of an online reusable learning module in assisting students who are enrolled in a corporate finance class to 1) learn basic capital budgeting methods of calculating internal rate of return and net present value, and 2) build a spreadsheet model to solve capital budgeting problems using the net present value (NPV) and internal rate of return (IRR) methods.

The literature was reviewed related to the following topics: (a) the effectiveness of online versus face-to-face instruction; (b) teaching financial topics online; (c) teaching spreadsheet modeling; (d) the use of reusable learning objects; and, (e) designing instruction for online courses.

The Effectiveness of Online versus Face-to-Face Instruction

Bekele and Menchaca (2008) performed a meta-analysis on how the Internet affects learning within higher education. The researchers compared 29 different studies and learned that 45 percent of the studies indicated the Internet positively affected learning, while 55 percent of studies showed no significant differences between Internet-supported learning and traditional learning. The researchers also found that most studies rely on a quantitative research design method. Bekele and Menchaca also found that Internet-supported learning tended to involve more feedback than face-to-face delivery. These researchers learned the studies that showed a significant difference in achievement were correlated with strong institutional support for online learning. Also, the authors discovered that studies of online versus traditional delivery that showed positive results for the online learning method were cases relying upon a formal, programmatic approach to the online learning (such as the processes of instructional design).

These findings were encouraging to the researcher within the context of the proposed study, since it is concerned with whether student achievement on IRR and NPV can be as high within an online course as in a face-to-face experience. A result of no significant difference in this study was viewed as a positive step in the process of transitioning the course to a fully-online offering.

Other key findings from Bekele and Menchaca's (2008) meta-analysis included: 1) group and project-based learning approaches were preferred methods in online courses; 2) asynchronous, multimedia-supported delivery was used most frequently; 3) the Internet supported course content and delivery; 4) student achievement was the principal outcome measured in evaluating the effectiveness of online learning;, and 5) strong support structures and programmatic implementations resulted in more positive outcomes than those supported only by instructors. Bekele and Menchaca suggested that further studies should include questions about the effectiveness of group and project-based learning in an online environment. They also suggested more studies comparing blended learning to traditional learning.

Means, Toyama, Murphy, Bakia, and Jones (2009) conducted a meta-analysis commissioned by the U. S. Department of Education. They reviewed articles (N=1,000) published from 1996 through 2008 for their analysis. The criteria used for a study's inclusion in the meta-analysis were: 1) that online learning would be compared to face-to-face; 2) that it measured learning outcomes; 3) that it used random-assignment or controlled quasi-experimental research design; and, 4) that the study enabled calculation of an effect size. The researchers' overall findings using these criteria were: 1) on average, students in online learning environments outperformed students in face-to-face environments; 2) students in blended learning environments outperformed students in purely online and purely face-to-face environments (Means et al. observed that this advantage is not necessarily because of the media used, but may be due to differences in content, pedagogy, and learning time); and 3) studies in which the online subjects spent more time on task than students in a face-to-face environment resulted in higher achievement by the online learners.

Means et al. (2009) concluded that even though the meta-analysis supported online learning, the studies did not prove that online learning was superior strictly as a medium of delivery. The researchers suggested the learning advantages derived from the online format were rooted in a combination of additional learning time, materials, and opportunities for collaboration. The expansion of learning time, in particular, was viewed as an advantage offered by online learning, as opposed to the restricted timeframes associated with face-to-face instruction where time and place are limited.

The research by Means, et al. (2009) and Bekele and Menchaca (2008) demonstrated to the researcher that online instruction may be an effective way to present the concepts and practical application for NPV and IRR. A result similar to that described by Means, et al. (where most studies showed no significant differences between online and face-to-face instruction) would be considered positive by the researcher's targeted institution.

Teaching Financial Topics Online

Business and finance courses. The researcher presented the business topics of NPV and IRR via an online medium. A review of the literature yielded several studies involving the presentation of business and financial topics, specifically, within online courses.

Kotey and Anderson (2006) compared the performance of online students in a course titled *Small Business Management* against the performance of traditional classroom students in the same course and discovered the online students performed as well as the traditional students.

In addition to the study by Kotey and Anderson (2006), Buhagiar and Potter (2010) compared student learning in a quantitative business tools course taught through online video streaming versus the same course taught face-to-face. The study focused on a College of Business Administration Department in a large, urban university. Buhagiar and Potter found no statistical difference in performance on grades between the two class sections. Terry (2007) compared different methods of instruction for Master of Business Administration (MBA) courses. The author examined traditional, online, and hybrid deliveries offered by a large, public university. Student performance across the three methods of instruction was equivalent.

In 2009, Terry, Mills, Rosa, and Sollosy examined online student performance on the Business Major Field ETS Exam. The researchers compared the performance of participants who had taken multiple business courses in an online environment to those who had not taken any business courses online. There was no statistically significant difference between the two groups.

Watters and Robertson (2009) compared online delivery versus a traditional (face-to-face) classroom mode for several undergraduate and graduate-level accounting courses. There was no significant difference between the two types of courses, as measured by a student satisfaction survey. Watters and Robertson recommended that more study is needed in the area of student performance, since their conclusions were based solely on a student survey of attitudes.

Since the researcher is investigating whether the teaching of specific business topics can be done as effectively online as in a face-to-face environment, these studies by Buhagiar and Potter (2010), Kotey and Anderson (2006), Terry (2007), Terry et al. (2009), and Watters and Robertson (2009) added to the body of evidence supporting this study.

Challenges surrounding teaching quantitative topics like finance in an online environment. Since this study involved teaching the quantitative subject of finance via an online medium, and since the review of literature yielded few articles specific to the discipline of finance in an online environment, the researcher expanded the search terms to include other quantitative topics (such as accounting and mathematics) that may pose similar challenges to instructional designers and online course instructors. The researcher reviewed the literature for studies relating to the difficulties associated with teaching quantitative subjects online.

Mensch (2010) outlined the difficulties associated with teaching online courses that involve mathematical calculations. The author attempted to determine whether teaching online courses that involved mathematical calculations was more difficult than teaching online courses that did not involve any type of mathematical calculations.

Mensch first examined withdrawal rates from online courses and compared them by topic. Thirty-two percent of enrollees in Business Statistics, 18 percent in Probability and Statistics, 31 percent in Accounting Principles I, and 29 percent in Accounting Principles II withdrew from the online courses. Five other courses not involving mathematical calculations were examined; it was determined that an average of 8.8 percent of the online students withdrew. The researcher suggested incorporating more online tools and improving communication opportunities for the online courses. Mensch was critical of many online courses involving mathematical calculations that rely on only one type of student interaction. He suggested course development must include multiple forms of interaction, such as audio, video, screen-capture video, podcasting, and wikis, in order to improve success rates.

Mensch's conclusions were that withdrawal rates from online courses indicate challenges exist involving mathematical calculations within the courses examined. These findings were a concern to this researcher, since the proposed study involved a significant number of mathematical calculations centered on the topics of NPV and IRR. Clearly, the materials needed to be designed to address some of the issues raised by Mensch, including the proper use of online tools such as audio, screen-capture, and video, effective communication with students via a LMS, email, and telephone, and enabling multiple forms of student interaction through discussion boards, wikis, email, and text messaging.

In a related study, Smith, Torres-Ayala, and Heindel (2008) investigated disciplinary differences (differences between Mathematics and several other general disciplines, including Nursing, Criminal Justice, Education, Engineering, History, Human

Services, Public Safety, Science, Social Science, Health, General, Counseling, and Business) in the instructional design of e-learning. The researchers compared how instructors of Mathematics-related curricula met the challenges within e-learning. Smith et al. studied how instructors perceived the adequacy of Learning Management Systems (LMS) through phone interviews and face to face interviews (N=20 interviews) in an exploratory phase. The interviews were followed by surveys (N=60 valid responses) designed for confirmation of some hypotheses uncovered during the first phase of the study. Smith, et al. compared data from the surveys (N=60) using an ANOVA and discovered that, in comparison to other general disciplines, Mathematics instructors did not believe that current models for online teaching or current versions of a LMS were well suited to the discipline. This attitude among Mathematics instructors was significantly different than the attitude measured among teachers in the disciplines of Nursing, Criminal Justice, Education, Engineering, History, Human Services, Public Safety, Science, Social Science, Health, General, Counseling, and Business.

In 2009, Dunlap, Furtak, and Tucker studied the differences between teaching a module from a calculus-based Physics 100 course online versus in a classroom. The face-to-face version of the course used small group learning and peer tutoring exercises. These methods were mirrored in the online course through collaborative team projects and simulated social interactions. The online module was designed to emphasize the social context of learning physics. These activities in the online physics course were developed based on the REAL model (Dunlap & Grabinger, 1996). The tools used by the researchers included Flash, Javascript, and MySQL. The online module was completed by one section of students (N=30) and the face-to-face learning was completed by a separate group (N=117). A comparison of student performance for both groups on a pretest and posttest was conducted utilizing a two-sample t-test. The two-sample t-test indicated that the online subjects performed better on the posttest than the face-to-face group [$t(145) = 1.86$; $p = 0.065$].

The findings by Smith, et al. (2008) and Mensch (2010) reinforce that teaching a quantitative concept online is considered to be a difficult task. However, Dunlap, Furtak, and Tucker (2009) have shown that a thoughtfully-designed online learning experience involving a mathematics-based subject can result in student performance that is as good as, or better than, a face-to-face group.

This researcher was made aware of the challenges involved in teaching a quantitative topic while maintaining discipline in adhering to sound instructional design practices, in order to produce the most effective online course possible for teaching the NPV and IRR concepts as part of this study.

Teaching Spreadsheet Modeling

The researcher reviewed the literature on including spreadsheet modeling as part of an overall learning experience. A limited number of studies described the importance of including spreadsheet concepts as part of the education of Mathematics or Business students. In fact, Grossman, Mehrotra, and Ozluk (2007) discussed the odd position of spreadsheets as a nearly universal business tool totally ignored by the academic world: "The ubiquity of spreadsheets in business is in marked contrast to their near absence from academic research." (p. 1010). Despite the shortage of peer reviewed articles on spreadsheets, this author did review several papers on the importance of spreadsheets in the business world with regard to teaching spreadsheet skills to business students.

Kruck, Maher, and Barkhi (2003) studied how cognitive skills were affected by formal spreadsheet training. The researchers compared performance on a logical reasoning skills pretest and posttest between subjects who had just completed spreadsheet training (the treatment group) and subjects who had not recently completed spreadsheet training (the control group). An ANOVA was used to examine the data with the results (N=42) indicating logical reasoning skills increased significantly after six weeks of spreadsheet training. Kruck et al. also discovered the increase in logical reasoning skills led to more competent development of spreadsheet models incorporating graphs, data tables, goal seek tools, solver tools, and other forms of data analysis. The authors suggested that further research should focus on understanding cognitive changes in those who develop spreadsheets, contending that further investigation should lead to more effective training methods.

Although the focus of this study was student achievement on NPV and IRR and not on how cognitive skills are affected by formal spreadsheet training, the research by Kruck, et al. (2003) strengthened the argument for spreadsheet modeling as part of the NPV and IRR learning module.

Pemberton and Robson (2000) studied spreadsheet use within the business community. Of the 227 survey respondents within a wide range of business disciplines, 80 percent considered themselves to be regular spreadsheet users. Pemberton and Robson also noted that many advanced features of spreadsheets remain relatively unused with most users focusing on only the basic functionality of their spreadsheets. The researchers also noted that training on spreadsheets is generally limited. According to their survey (N=227), 75 percent of all respondents had no prior educational experience in the use of spreadsheets. The authors stated that within the workplace 53 percent of all respondents had received no spreadsheet training outside their work department. The researchers stated that employers are unlikely to capitalize on the potential of spreadsheets, unless spreadsheet training is more readily available to employees.

Kesner (2008) surveyed employers (N=111) of graduates of the Northeastern University College of Business Administration to identify skills employers expected new hires to have developed by the time they graduated. The detailed survey was followed with focus groups (N=17) and one-on-one interview (N=17) to clarify the results. Kesner concluded that spreadsheet competencies “emerged as the area of greatest need and concern among the survey population” (p. 641).

Bartholomew (2004) surveyed employers (N=23) of graduates of Utah Valley State College to determine skills that employers felt were most important for new hires. The surveys were conducted by phone and mail. The results indicated 95 percent of respondents ranked spreadsheet skills as very important (63%) or important (32%), and that spreadsheet skills ranked highest among all skills on a list that included word processing, database, and presentation skills.

The findings of Kruck, et al. (2003), Pemberton and Robson (2000), Kesner (2008), and Bartholomew (2004) mirror unpublished feedback collected by the College of Business and Communications (J. Taylor, personal communication, 2010) which houses the targeted course for this study and provided further support that the inclusion of spreadsheet modeling in the planned study was a sound approach based on demands in the workplace into which graduates of the targeted business school will matriculate.

The Use of Reusable Learning Objects

Churchill (2007) reviewed the Institute of Electrical and Electronics Engineers' (IEEE) definition of learning objects as well as others and discussed the fact that various definitions of learning objects are directed at solving a variety of problems and are often not pedagogical in orientation. Churchill suggested that all types of learning objects have two common characteristics: 1) they are digital, and 2) they are designed for educational re-use. This author further proposed a classification of six types of learning objects: presentation, practice, simulation, conceptual models, information, and contextual representation. This classification might support instructional designers in establishing a framework for subject matter analysis that leads to better quality learning objects. Churchill suggested further research in exploring matches between different types of learning objects or combinations of objects and suitable activities for their use. Further study of the classification for delivery using emerging technologies was recommended.

Wiley (2000) defined learning objects as digital components delivered over the Internet that can be reused in multiple learning contexts. The definition of learning objects offered by the IEEE's Learning Technology Standards Committee was similar to Wiley's own definition, with the exception that the IEEE assumes the components may be non-digital, as well as digital. Wiley discussed the lack of standardization of key definitions surrounding learning objects. He believed that multiple definitions create difficulty in communicating about learning objects, and pointed to the role of instructional design theory in the application of learning objects,. Very little discussion has occurred within standards-setting bodies and in the learning community regarding the instructional design implications of learning objects. Wiley viewed this as affecting educational institutions that are influenced by those same guidelines.

Wiley (2000) discussed the concept of “granularity,” or the idea of how large learning objects should be. His theory on the size of learning objects is one of optimization for reuse. The size of a learning object represents a tradeoff between the cost of cataloging the elements within the object and the benefits of reusing the object. Wiley also presented the considerable investments that have been made in the concept of reusable learning objects. In reviewing the numerous organizations that have invested in and contributed to the idea of learning objects, Wiley discussed an atom metaphor for learning objects, where 1) not every atom can combine with every other atom; 2) atoms can only be assembled in certain structures based on their own internal structure; and 3) some training is required to assemble them. Learning objects require work to assemble and do not meet the needs of every situation. He proposed a taxonomy of five learning object types: fundamental, combined-closed, combined-open, generative-presentation, and generative-instructional. Numerous learning object characteristics were identified, including number of elements combined, types of objects contained, reusable component objects, common function, extra-object dependence, types of logic contained in the object, and potential for inter-contextual and intra-contextual reuse. Three components of a good learning object for implementation were also considered: instructional design theory, learning object taxonomy, and prescriptive linking material, all of which connect ISD theory to the taxonomy.

Sicilia and Lytras (2001) proposed a scenario-oriented learning object definition with the concept that they should be defined by the scenarios or the services they support.

Based on this definition, a learning object may be considered valid in a certain scenario and worthless in a different scenario, because of a lack of specific characteristics or metadata elements. These authors are critical of the IEEE's definition of learning objects as being too broad. Sicilia and Lytras concluded the scenario-based definition should stipulate that 1) learning objects must be digital, since they define learning objects as only available through an LMS; 2) learning objects need not have an explicit educational purpose; and, 3) learning objects must have at least a minimal metadata record.

Kay, Knaack, and Muirhead (2009) defined learning objects as interactive web-based tools that support the learning of specific concepts by enhancing the students' cognitive process. These researchers studied instructional strategies used by 15 educators to integrate learning objects into 30 different secondary school classrooms. A total of 510 students were enrolled. The researchers looked at the preparation time for each instructor, the intent behind using the learning object, strategies for integrating the learning object into the classroom, and the total time spent actually using a learning object. The researchers observed a significant correlation between the instructor's preparation time and the students' attitudes toward the learning object.

Kay et al. (2009) noticed that when a learning object was used to introduce a concept, motivate students, or teach a new concept, student performance was significantly higher. Using learning objects to review a previously taught concept, however, resulted in lower performance and poor attitudes. The researchers noted that few studies exist on the instructional strategies used by teachers to integrate learning objects into the curriculum. Also of note is of the 17 research studies examined by Kay et al. the majority focus on learning objects as independent web-based tools, not connected to pedagogy. These authors discovered that most of research studies suggested teachers need training in order to effectively use learning objects. The effectiveness of any learning object depends on the pedagogical choices of the instructor and it was concluded that decisions about instructional strategies had a significant impact on the effectiveness of learning objects within the secondary school setting.

While it is clear that definitions of RLOs vary, the literature (Churchill (2007; Wiley, 2000; Sicilia & Lytras, 2001; Kay et al., 2009) indicates that RLOs provide efficiencies to the development of a variety of online learning experiences. The concept of reusability is an important element in the design phase of the proposed research study. Any approach that leverages existing resources by enabling their reuse is of interest to the university community, particularly in the increasing movement toward online access to for higher education.

Designing Instruction for Online Courses

Gagne, Wager, Golas, and Keller (2005) proposed an instructional design model known as ADDIE (Analyze, Design, Develop, Implement, and Evaluate). Gagne, et al. reviewed Gagne’s (1962) original conditions for learning and the rationale for instructional design (Gagne & Driscoll, 1988) and then proposed ADDIE. These researchers described types of learning as verbal information, intellectual skills, cognitive strategies, attitudes, and motor skills.

Gagne et al. (2005) also proposed learning tasks for intellectual skills can be organized into a hierarchy according to complexity. These intellectual skills include stimulus recognition, response generation, procedure following, use of terminology, discriminations, concept formation, rule application, and problem solving. The significance of the intellectual skills hierarchy is to identify prerequisites that should be completed to facilitate learning at each level and provide a basis for sequencing of instruction.

The researchers also discussed learners, objectives, and instructional strategies based on changes in technology. In addition, Gagne et al. reviewed Gagne's Nine Events of Instruction which are external events corresponding to cognitive processes.

The ADDIE model, proposed by Gagne et al. (2005), is intended as a framework for designing instruction based on understanding the needs of the learners and then designing instruction as part of a process. The ADDIE model's components are 1) Analyze: Determine the need for instruction, identify skills to be taught, create objectives, determine prerequisites, analyze timelines; 2) Design: Sequence the units of instruction, define lessons and activities for each unit, and develop assessments to match each objective; 3) Develop: Create lesson materials and activities for each objective; 4) Implement: Place materials with teachers and students and provide them with support; and, 5) Evaluate: Implement plans for student and program evaluation as well as plans for maintenance and revision of course materials.

This researcher used the ADDIE model as the framework for building the learning experiences necessary for this study. While other instructional design models exist, the researcher felt ADDIE provided an adequate foundation for organizing these efforts, in part because of its simplicity and the recognition of ADDIE as a widely-accepted model.

York, Yang, and Dark (2007) claimed that much of online instruction is designed, developed, and delivered without considering instructional design principles. Taking this a step further, Gaytan (2009) studied the perceptions of deans, vice presidents for academic affairs, and distance education administrators regarding online instruction as well as the use of research-validated instructional design frameworks by colleges in planning and delivering online instruction. Gaytan concluded that administrators prefer traditional classroom instruction to the online version. Most administrators also believed that online instruction was inferior to traditional classroom environments. As a result, Gaytan proposed that most colleges' organizational structures for online education lacked an instructional design framework and did not support the learning outcomes. Since the institutional leaders did not believe in online instruction, it received little support in the form of organizational frameworks; actual online instructional practices were in conflict with academic administrators' rhetoric; and, despite anything they may say publicly, most colleges did not support online learning in a programmatic, deliberate, instructional systems design-based fashion.

These findings by Gaytan (2009) are consistent with Salazar's (2010) research: A strong instructional design practice tends to lead to a successful online course, while an absence of instructional design methods tends to lead to online courses that are not perceived as being successful.

Specifically regarding instructional design processes and the development of RLOs, Laverde, Cifuentes, and Rodriguez (2007) stated the instructional design process is central to the generation of learning objects. They proposed the Model of Instructional Design based on Learning Objects (MIDLO), which describes learning objects as following a series of processes whose purpose is to monitor the pedagogy, communication, and technical aspects of their development. The position by Laverde et al. that instructional design processes are critical to the development of RLOs adds further support to this researcher's contention that the RLO materials for this study must be created following instructional design processes.

Wiley (2000) drew connections between the development of RLOs and the need for instructional design theory, and described the importance of instructional design theories in guiding the efforts of those tasked with the development of learning objects. Through his research, Wiley discovered that very few discussions have been held on this topic, and Wiley stated, "While groups like the Learning Technology Standards Committee exist to promote international discussion around the technology standards necessary to support learning object-based instruction, and many people are talking about the financial opportunities about to come into existence, there is astonishingly little conversation around the instructional design implications of learning objects" (p. 9).

Krauss and Ally (2005) studied the process of designing and evaluating learning objects. These authors focused on how the theories of learning and cognition influence the design of learning objects through two questions: 1) How do theories of learning and cognition influence the design of learning objects; and, 2) What instruments can be used to assess the quality of the learning object and provide designers with information for improving it? They concluded that design decisions relating to learning objects are significant because they impact the quality of content. They also indicated that such decisions should be grounded in learning theory. These researchers concluded that reducing the learning object to a level referred to as its most 'common elements' simply recreates the textbook in another format and does not enhance the learning experience. This researcher will try to implement interactive forms of learning into the RLOs planned for this study, in order to avoid the less-enhanced learning experience described here by Krauss and Ally.

Chrysostomos and Papadopoulos (2008) introduced the concept of an Object-Oriented Learning Object (OOLO). The idea behind an OOLO is that it is developed in a manner similar to software objects that are created within the context of Object-Oriented Programming (OOP). The researchers referenced the problem of Internet courses that were expensive to build and not reusable. To address this problem, the authors described an OOLO as a reusable learning object that functions as part of a learning module. The instructional designer would be able to combine learning objects in much the same way that a software engineer combines software programming objects. The result would be a new learning experience made up of reusable pieces that had been combined in a unique way. Chrysostomos and Papadopoulos (2008) reviewed the IEEE definition of learning objects and offered a similar version: "Learning objects are self-contained chunks of learning content that can be reused in a variety of learning contexts." (p. 222).

Summary

The current research (Buhagiar & Potter, 2010; Kruck et al., 2003) on the effectiveness of online business, accounting, mathematics, and spreadsheet courses indicated online courses are generally as effective as other methods. Further research in the area of student performance, when comparing online and traditional accounting classes has been recommended (Watters & Robertson, 2009).

Teaching spreadsheet modeling in a business school is an activity that is highly valued by both potential employers and subject matter experts (Pemberton & Robson, 2000). Among other benefits, researchers have noted increases in the logical reasoning skills of learners who have undergone training in spreadsheet modeling (Kruck et al., 2003). However, a search of the literature has not produced any peer-reviewed research focused on the effectiveness of teaching spreadsheet modeling online. Research on this specific topic will definitely add value to a very lightly covered field of study.

Despite minor differences, RLOs are generally defined as digital objects intended for reuse in an educational setting (Salazar, 2010; Churchill, 2007; Wiley, 2000; Kay et al., 2009). Instructional design is considered essential to the proper development of any learning experience, including RLOs (Krauss & Ally, 2005; Gagne et al., 2005; Laverde et al., 2007; Chrysostomos & Papadopoulos, 2008).

The review indicates that further research is needed on the effectiveness of teaching quantitative business topics and demonstrates a need for further investigation on the effectiveness of teaching spreadsheet modeling online. Taken together, the literature provides this researcher with a strong belief that this study involving the effectiveness of teaching NPV and IRR online will add valuable information to the current body of knowledge. This researcher also concluded, based on the findings in this literature review, that spreadsheet skills are very important to graduates of business schools and studying the effectiveness of teaching spreadsheet skills online will add a unique set of information to the existing knowledge base on business education.

CHAPTER III

Method

Purpose of Study

The purpose of this research was to compare the effectiveness of RLOs for teaching NPV and IRR theory and spreadsheet modeling in an online format (treatment group) with a traditional (face-to-face) (control group) classroom. The research involved subjects from two separate sections of a corporate finance course. The two sections represented the intact control and treatment groups. For the RLOs focused on NPV and IRR theory, a pretest was administered, followed by instruction. For both the treatment and control groups, a posttest was given following the instructional module. Assessment data were collected and analyzed from the pretest and posttest using appropriate statistical methods. Details on the participants, the procedures for developing the learning unit materials and assessment instruments, and the process of analyzing the data are presented in this chapter.

Research Questions

The following research questions were presented for this dissertation investigation:

1) Is there a significant difference in net present value analysis achievement for those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus those who receive instruction via an online learning module, as measured by a standardized departmental test?
2) Is there a significant difference in internal rate of return achievement for those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students who receive instruction via an online learning module, as measured by a standardized departmental test?

3) Is there a significant difference in net present value spreadsheet models produced by those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students enrolled in a corporate finance course who receive instruction via an online learning module, as measured by a standardized departmental rubric.

4) Is there a significant difference in internal rate of return spreadsheet models produced by those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students enrolled in a corporate finance course who receive instruction via an online learning module, as measured by a standardized departmental rubric.

5) What is the instructional design evaluation compliance level for each of the five phases of the ADDIE (Analyze, Design, Develop, Implement, and Evaluate) instructional design model in the creation of two Finance RLOs, as measured by a modified Delphi Technique?

Participants

The subjects in this study were at least third year (junior) undergraduate college-level students at a western United States university enrolled in a corporate finance course. (Freshmen and sophomores are unlikely to enroll in the class since it is a higher division course with a significant number of prerequisites.) All participants completed the same set of prerequisite courses, which includes college algebra, two economics classes, two accounting courses, one statistics class, and a writing course. The majority of the participants were business management majors. Those subjects who were not within this major were required to take the same prerequisite courses as the business management majors. Participants for both the control and the treatment groups were chosen by the section in which they enrolled, making this a sample of convenience.

Sampling

The course was divided between two sections and all students enrolled in both sections participated in the study since the targeted content was considered *required* for the course. One section was designated as the control group and the second section became the treatment group. The population of finance students enrolled university-wide at the time of the study was approximately 800. The sections in this study represented about ten percent of the total population. Control (N=41) and treatment (N=37) groups totaled 78 participants

Research Design

The portion of the study focused on the content knowledge used a non-equivalent control group form of quasi-experimental design since the participants could not be randomly selected and both a pretest and a posttest were administered (see Figure 1). The control group was taught IRR and NPV theory using face-to-face traditional classroom methods. The treatment group learned the theory by using researcher-developed RLOs to deliver the instruction online.

The portion of the study focused on the spreadsheet modeling used a static-group comparison form of quasi-experimental design since the participants could not be randomly selected. A posttest only was administered in the form of a standardized department rubric for evaluating the resultant spreadsheets. The control group was taught to build the spreadsheet models using the current face-to-face lab method. The treatment group learned to build the spreadsheet models from researcher-designed RLOs accessed online.

Experimental Treatment

The RLOs for both the NPV and IRR theory were developed by the researcher. The RLOs instructed the students in the purposes of both NPV and IRR analysis, the theory behind each process, and the specific methods for calculating both NPV and IRR. The RLOs were based on the current capital budgeting techniques within the textbook adopted by the department for this course. Instruction for the control group was delivered in the classroom using the same textbook.

Separate RLOs instructed the students in the application of spreadsheet technology for performing NPV and IRR analyses, as well as the correct techniques for building the spreadsheets.

Learning Unit Materials

The online unit of instruction was created based on the university's existing teaching resources and on generally accepted instructional design methods. The capital budgeting concepts, including NPV and IRR came from the course textbook, which is a custom-published version of *Foundations of Finance* (Keown, Martin, & Petty, 2008). The content of the instructional unit specific to the creation of spreadsheet models came from *Financial Modeling* (Benninga, 2000).

The online learning unit began with a brief overview of capital budgeting. The learners completed four RLOs as part of the learning unit. The students learned to solve capital budgeting problems using two different methods: NPV and IRR. The emphasis next shifted to building spreadsheet models to solve for net present value and internal rate of return.

The control group received the same instruction as the experimental group, including the overview of capital budgeting, the content related to both NPV and IRR, and the spreadsheet modeling exercises related to NPV and IRR. The control group received instruction in a traditional face-to-face classroom environment. The face-to-face instructional modules were completely re-designed and developed in the fall semester of 2008 based on a modified version of the ADDIE model of instructional design. The design of the instructional module was done by a team of two SMEs, and a lead instructional designer from the university's Faculty Resource Center. The instructional module was part of a re-design of the entire course, in preparation for transitioning it to an online version; thus, the learning objectives, activities, and assessments of the face-to-face instructional module were transferable to the online instruction for the experimental group. (See Appendix B for a summary of the tasks and instruments related to this course re-design.)

The delivery of the online instruction was achieved via a Learning Management System (LMS) named *BrainHoney* 2.0. This program is currently in use university-wide, and all of the students were familiar with it. To experience the RLOs, the students in the treatment group logged into the LMS and opened the folder titled *Capital Budgeting*. The treatment group completed an RLO on NPV theory and an RLO on IRR theory. In support of these RLOs, students completed readings and practice assignments, participated in discussion boards, and received feedback via graded assignments, group projects, and quizzes. Following this, the treatment group completed two RLOs on building spreadsheet models: one each for NPV and IRR. All of the treatment group's activities took place online.

Instruments

Two types of assessment instruments were included in this study. The first is a content knowledge assessment on the topics of NPV and IRR. The second type of instrument is a spreadsheet modeling assignment and its associated grading rubric. These assessment instruments are discussed in detail under the Assessment Instruments (Task D04) section. Characteristics of each instrument are summarized in Figure 2.

Assessment	Items	Origin	Additional Testing of Instrument
Content Knowledge NPV	15 item M/C	Department standard instrument	Checked face / content validity using Delphi method
Content Knowledge IRR	15 item M/C	Department standard instrument	Checked face / content validity using Delphi method
Spreadsheet Modeling NPV	Assignment plus 15 item rubric	Department standard instrument and rubric	Checked face / content validity using Delphi method. Checked for interrater reliability of rubric by calculating Cohen's Kappa.
Spreadsheet Modeling IRR	Assignment plus 15 item rubric	Department standard instrument and rubric	Checked face / content validity using Delphi method. Checked for interrater reliability of rubric by calculating Cohen's Kappa.

Figure 2. Characteristics of assessment instruments.

ADDIE Analyze Phase Procedures

The ADDIE model for instructional systems design (Gagne, Wager, Golas, & Keller, 2005) formed the foundation for the researcher's efforts in constructing the online instructional modules. The five phases of the ADDIE model and the details related to the tasks associated with each phase are outlined in the following sections.

The first step in the ADDIE model of instructional systems design involves analysis. Gagne, Wager, Golas, and Keller (2005) described several tasks the instructional designer must complete. Figure 3 illustrates 14 separate tasks considered essential (Moulton, Strickland, Strickland, White, & Zimmerly, 2010) to the completion of the Analyze phase.

Task	Task Description
Task A01	Project Rationale
Task A02	Goal
Task A03	Objectives
Task A04	Content Concept Map
Task A05	Learning Influences Document
Task A06	Learning Outcomes Statement
Task A07	Learning Hierarchy Document
Task A08	Learner Characteristics Profile
Task A09	Target Audience Statement
Task A10	Specific Learner Constraints Statement
Task A11	Pedagogical Considerations Document
Task A12	Learning Environment Statement
Task A13	Delivery Options Statement
Task A14	Timeline for Completion

Figure 3. Tasks associated with Analyze phase of the ADDIE model.

The Delphi Technique (Helmer, 1983) was used by the researcher as a tool for establishing the validity of each of the 14 tasks in the ADDIE model.

The Delphi Technique is a process in which experts respond to a series of survey items related to a specific topic (Linstone & Turoff, 1975). If the data collected reflects consensus by the panel members, the process is ended. Otherwise, the experts are given feedback on the areas of disagreement and the process is repeated. Multiple rounds of surveys may be undertaken before consensus is reached or it is decided that consensus cannot be reached (Grisham, 2009; Moulton, Strickland, Strickland, White, & Zimmerly, 2010).

The 14 tasks associated with the Analyze phase of ADDIE were checked for face and content validity through the administration of five separate Delphi survey instruments as illustrated in Figure 4.

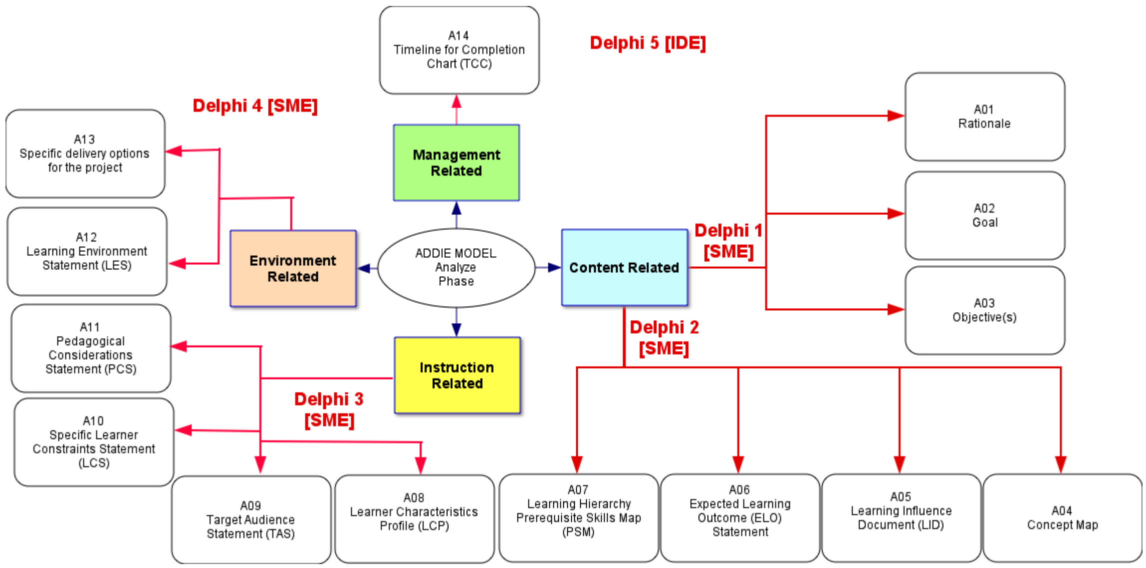

Figure 4. 14 Tasks in Analyze Phase of ADDIE Model and Accompanying Delphi Studies. Reprinted with permission.

These tasks are clustered within four domains: Content, Instruction, Environment, and Management (see Figure 4). The tasks related using this domain structure, including face and/or content validity were established by the Delphi review.

Content-Related Domain. There are seven tasks associated with the Content-Related domain: Rationale, Goal, Objective(s), Concept Map, Learning Influences Document, Expected Learning Outcomes Statement, and Learning Hierarchy Prerequisite Skills Map. Each of these is presented in the following subsections. *Project Rationale (Task A01)*. The Project Rationale (Task A01) is a statement that identifies the need for the project within the context of the targeted learning environment. The rationale for this project is:

A university in the western United States currently offers an undergraduate, junior-level, corporate finance course. This class is required of all business management majors and is also treated as an elective within several other programs on campus. The university is considering offering its business management degree, including the corporate finance class, online.

This research will focus on the effectiveness of an online reusable learning module in assisting students who are enrolled in the corporate finance class to 1) learn basic capital budgeting methods of calculating internal rate of return and net present value, and 2) build a spreadsheet model to solve capital budgeting problems, using the net present value and internal rate of return methods.

The university administration has expressed a desire to offer an online version of the course that is as similar as possible to the current face-to-face class. The course includes a significant amount of instructor-to-student interaction, individual training in building working capital budgeting spreadsheets, and feedback on spreadsheets built during class sessions. Students are also required to solve capital budgeting problems in a laboratory-like setting, during which they receive feedback and assistance from the instructor.

Developing an online course that is similar to the face-to-face version represents a challenge to the faculty, who perceive that difficulties may arise in helping online students achieve the same degree of success in learning the concepts and the spreadsheet modeling skills.

This research study will provide useful data on the achievement of students enrolled in an online course in which the capital budgeting concepts of internal rate of return and net present value and their related spreadsheet modeling skills are studied. Lessons learned through this research may be applicable to a broader audience of instructional designers who are attempting to create courses focusing on other aspects of finance for college learners.

In addition, this research may benefit instructors who wish to teach spreadsheet modeling skills related to any topic via an online module.

Goal (Task A02). The instructional goal of this learning module is: Learners will understand NPV and IRR concepts and will be able to apply those concepts in solving real capital budgeting problems using spreadsheet models.

Objectives (Task A03). The learning unit was designed as four separate RLOs. Two RLOs were focused on content knowledge (NPV and IRR) and two on spreadsheet modeling skills for NPV and IRR. Each RLO represents a self-contained learning experience incorporating content, practice, and assessment items and was aligned with an instructional objective in support of the overall goal. Stated as Gagne five-part learning objectives (Gagne, Wager, Golas, & Keller, 2005), these are:

Objective 1. RLO 1 (NPV content knowledge): Given specific word problems simulating real-life capital budgeting situations, the learner will calculate the NPV using a set of algebraic expressions, a financial calculator, or an Excel spreadsheet at the criterion level of 70 percent.

Objective 2. RLO 2 (IRR content knowledge): Given specific word problems simulating real-life capital budgeting situations, the learner will calculate the IRR using a set of algebraic expressions, a financial calculator, or an Excel spreadsheet at the criterion level of 70 percent.

Objective 3. RLO 3 (NPV spreadsheet model): Given a specific word problem simulating a real-life capital budgeting situation, the learner will build a spreadsheet model that will calculate the project's NPV using an Excel spreadsheet at the criterion level of 70 percent.

Objective 4. RLO 4 (IRR spreadsheet model): Given a specific word problem simulating a real-life capital budgeting situation, the learner will build a spreadsheet model that will correctly calculate the project's IRR using an Excel spreadsheet at the criterion level of 70 percent.

Delphi Survey 01 for Tasks A01-A03. To determine the face and content validity for Tasks A01 through A03, Delphi Survey 01 (N=21 items) was completed (see Appendix C1). Table 1 summarizes the descriptive statistics of Delphi Survey 01. A team of SMEs was asked to evaluate the material based on a four-point Likert scale, with 4 representing Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree.

Table 1

Descriptive Statistics for Delphi Survey 01

	Project Rationale (N=7 items)						
	Iteration 1						
Item	1	2	3	4	5	6	7
Mean	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Median	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00	4.00	4.00	4.00
SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	Project Goal(s) (N=8 items)							
	Iteration 1							
Item	8	9	10	11	12	13	14	15
Mean	3.67	4.00	4.00	3.67	4.00	4.00	4.00	4.00
Median	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
SD	0.58	0.00	0.00	0.58	0.00	0.00	0.00	0.00

	Project Objectives (N=6 items)					
	Iteration 1					
Item	16	17	18	19	20	21
Mean	4.00	4.00	4.00	4.00	4.00	4.00
Median	4.00	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00	4.00	4.00
SD	0.00	0.00	0.00	0.00	0.00	0.00

Items receiving scores indicating a lack of agreement among the SMEs (individual mean scores of less than 3.0) were subject to further review and possible revision based on the feedback from the team of SMEs. The planned procedure was to first address the issues with items scoring below 3.0, and then the Delphi Survey was to be administered to the SME team again, if disagreement was noted. In this specific case, however, the second iteration of the Delphi Survey 01 proved to be unnecessary, because no item scored below 3.0 on the first round of the survey.

A total of 21 items were presented in Delphi Survey 01. Of these items, 19 received scores of 4.0. Two items received scores of 3.67; therefore, the data (all items scored in either the Strongly Agree or Agree category) indicate panel members agreed that no changes were necessary to Tasks A01, A02, or A03 (see Appendix C7 for raw data).

Concept Map (Task A04). A Concept Map illustrating key concepts that were experienced by the learners is presented in Appendix A1. The concept map shows each key concept in relation to other key concepts, but does not necessarily demonstrate the flow of learning activities. The key concepts that are part of this research include Capital Budgeting, Net Present Value, Internal Rate of Return, and Spreadsheet Modeling. Several nodes identified on the map are prerequisites to the core concepts. These include Time Value of Money (both PV and RATE), Net Cash Flow, Net Investment Cost, and Capital Investments. Others apply to tools, such as algebraic functions, financial calculators, and spreadsheet functions, all of which may be used in solving capital budgeting problems. Finally, concepts related to the decision-making process as part of capital budgeting including spreadsheet models, ranking investment alternatives, and investment decisions are represented.

Learning Influences Document (Task A05). The Learning Influences Document illustrates the planned instructional strategies for this project and the corresponding events of instruction (Gagne, Wager, Golas, & Keller, 2005). For this proposed study, there are no significant learning influences that may affect the outcomes: Learners are from a homogenous population with similar experiences and backgrounds. The University has instructional supports in place to assist any participants who may require alternative methods for interacting with the instructor, peers, or content and assessments. In addition, the researcher employed universal design principles and utilized section 508 ADA guidelines for multimedia within the RLOs. A detailed version of the Learning Influences Document is found in Appendix A2.

Learning Outcomes Statement (Task A06). The Learning Outcomes statement for the online module identifies the expected learning effects related to the objectives outlined earlier (see Task A03). The learning outcomes are expressed as short-term learning effects, long-term learning effects, and expected changes resulting from the instruction. The learning outcomes for each objective are as follows:

> *Objective 1*. The short-term learning effect is the ability to calculate NPV using the correct mathematical equations and methodology. The long-term effect is the student's understanding of how project-related cash flows deliver value to the company and how they are measured in terms of NPV. The expected changes in the learner are an enhanced ability to select investments that positively affect the companies for whom they will work.

> *Objective 2*. The short-term learning effect is the ability to calculate IRR using the correct mathematical equations and methodology. The long-term effect is the student's understanding of how project-related cash flows deliver value to the company and how they are measured in terms of IRR. The expected changes in the

learner are an enhanced ability to select investments that positively affect the companies for whom they will work.

Objective 3. The short-term learning effect is the ability to build a spreadsheet that will accurately calculate NPV. The long-term effect is an increase in the student's understanding of how spreadsheet modeling can add value to the financial analysis process. The expected changes in the learner are: 1) An enhanced ability to select investments that positively affect the companies for whom they will work and, 2) An increased aptitude for spreadsheet-based quantitative analysis.

Objective 4. The short-term learning effect is the ability to build a spreadsheet that will accurately calculate NPV. The long-term effect is an increase in the student's understanding of how spreadsheet modeling can add value to the financial analysis process. The expected changes in the learner are: 1) An enhanced ability to select investments that positively affect the companies for whom they will work for, 2) An increased aptitude for spreadsheet-based quantitative analysis.

Learning Hierarchy Prerequisite Skills Map (Task A07). The Learning Hierarchy Prerequisite Skills Map (see Appendix A3) illustrates the knowledge components in a hierarchy based on prerequisite skills. For the NPV content knowledge RLO, the prerequisite skills included Present Value, Net Cash Flows, Capital Budgeting, and Cost of Capital. After learning NPV, the map illustrates the learner should be qualified to attempt ranking of projects and deciding whether to accept or reject the project. For the IRR content knowledge RLO, the prerequisite skills were Present Value, Rate, Payment, Net Cash Flows, and Capital Budgeting. After learning IRR, the map illustrates that the learner is then qualified to attempt Ranking of Projects and deciding whether to accept or reject the project.

For the NPV Spreadsheet Model RLO, the prerequisite skills include spreadsheet basics, NPV, the NPV function, and Net Cash Flows. After building the spreadsheet, the learner should be able to attempt ranking of projects and deciding whether to accept or reject the project. For the IRR Spreadsheet Model RLO, the prerequisite skills are spreadsheet basics, IRR, the IRR function, and Net Cash Flows. After building the spreadsheet, the learner should have the skills to attempt ranking of projects and deciding whether to accept or reject the project.

Delphi 02 for Tasks A04-A07. To determine the face validity for Tasks A04 through A07, Delphi Survey 02 (N=20 items) was distributed to a SME panel for review (see Appendix C2). The Delphi Survey contained sections corresponding to tasks A04 through A07 (Content Concept Map, Learner Influences Document, Learning Outcomes Document, and Learning Hierarchy Prerequisite Skills Map). A team of SMEs was asked to evaluate the material for each of these sections based on a four-point Likert scale, with 4 representing Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree. Items with a mean of less than 3.0 (out of a total of 4.0) were considered as candidates for improvement. Table 2 summarizes the results of Delphi 02.

Table 2

Descriptive Statistics for Delphi Survey 02

Concept Map (N=7 items)								**Learner Influence (N=7 items)**							**Learning Outcome (N=4 items)**				**Learning Hierarchy (N=2 items)**	
	Iteration 1							Iteration 1							Iteration 1				Iteration 1	
Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Mean	4.00	4.00	4.00	2.33	2.33	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Median	4.00	4.00	4.00	2.00	2.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	N/A	N/A	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
SD	0.00	0.00	0.00	1.53	1.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Iteration 2							Iteration 2							Iteration 2				Iteration 2	
Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Mean	4.00	4.00	4.00	3.67	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Median	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
SD	0.00	0.00	0.00	.058	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

A total of 20 items were presented; of these, 18 received scores of 4.0. Two items received scores of 2.33, and resulted in changes to the Concept Map for Task A04. The SMEs indicated that the Concept Map did not present the reader with any information regarding secondary learning objectives. Item 4 in the survey received a mean score of 2.33 from the SMEs. Further feedback from the SMEs showed that the Concept Map simply was inadequate in its construction; it did not explain the secondary objectives to the reader in a way that was easily understood. The researcher created a new concept map that identified both primary and secondary objectives.

Item 5 of the survey also received a mean score of 2.33, and indicated the SMEs did not agree that the concept map demonstrated a linkage between the primary and secondary learning objectives. The researcher created these links in the new version of the concept map. Iteration 2 of the survey (see Table 2) resulted in a mean score of 3.67 for item number 4, indicating that the SMEs were in agreement that the secondary objectives were now clearly identified. A mean score of 4.00 for item number 5 was obtained during this second iteration, indicating that the SMEs were in agreement that the secondary objectives were now clearly linked to the primary objectives on the concept map. For further detail, see Appendix C7 for the raw data from Delphi Survey 02.

Instruction-Related Domain. Within this domain, there are four tasks that specifically align with instructional decisions and for which one Delphi survey is used for analysis: Learner Characteristics Profile, Target Audience Statement, Specific Learner Constraints Statement, and Pedagogical Considerations Statement. Each of these is presented in the following subsections.

Learner Characteristics Profile (Task A08). The learner characteristics were gathered from university registration data, general university publications, course syllabi, and informal interviews with the course instructors. Based on the learner characteristics, the researcher has determined they have sufficient background knowledge and cognitive skills to successfully interact with the new material. The learners can be expected to function at a sufficient level in an online environment to navigate the RLOs that will be developed. The RLOs will need to offer sufficient audio and text choices to maintain ADA Section 508 compliance. Also, the RLOs can be developed in the English language only, since 100 percent of the anticipated participants are fluent in English as supported by University historical records. All of the subjects have basic spreadsheet skills; therefore, the researcher was able to develop RLOs to teach spreadsheet modeling of both IRR and NPV without remedial instruction on basics. (See Appendix A4 for the complete Learner Characteristics Profile).

Targeted Audience Statement (Task A09). The Targeted Audience Statement describes the participants as a group. This can be distilled as follows:

> The target audience of this learning module will be junior-level business management majors. A secondary audience will be any non-business management students who enroll in the course, including majors in accounting, communications, and economics. Enrollment preference will be given to business management students. Other majors will be allowed to participate on a space-available basis. All students are required to complete several pre-requisites prior to enrollment including Math 108, Accounting 201, Accounting 202, Economics 110, and Economics 111.
>
> The target audience is comprised almost entirely of full-time students. All of the learners are on campus and attend class several times each week. The students meet with the instructor at least twice per week for class sessions lasting 90 minutes.
>
> Most of the learners have completed at least two to three years of their college education. All of the students have basic experience using spreadsheets and they each own laptop computers with spreadsheet applications installed. The students are familiar with the university's course management system and they

have Internet access from either their laptop computer, another personal computer, or via the campus computer facilities.

Specific Learner Constraints Statement (Task A10). A Specific Learner Constraints Statement describes obstacles that may be experienced by the subjects. Learner constraints identified by this researcher are as follows:

The subjects will need basic mathematics skills including identifying variables in an equation and solving basic algebraic expressions. Reading skills should be at least at the level of a college sophomore for both groups. Both groups of learners will also need to be able to perform basic spreadsheet navigation, including the equation editor feature of Microsoft *Excel*. Students in either group who have deficient skills in mathematics, reading, or basic spreadsheet navigation will be identified before the study begins and will be referred to the Student Learning Center. The Student Learning Center will inform the researcher of any specific remedies or accommodations that should be made for these learners.

The students in the treatment group will need access to a high-speed Internet connection, in order to view some of the online content. Students who do not have reasonable access to high-speed Internet connections may need to access the online course from on-campus computer labs or other locations that are not as convenient to them as their homes would be. The resulting discomfort with their environment may have a negative effect on the students' learning. The students may spend less time than necessary with the online materials, due to scheduling difficulties in gaining access to high-speed Internet connections.

The subjects in the treatment group must possess basic online navigation skills, including the ability to download text and video. Students will be required to navigate the LMS and to submit assignments via the LMS assignment dialogs. Subjects in the treatment group who do not possess sufficient online navigation skills will be hampered in their efforts to complete the online unit. Some subjects may suffer from disabilities affecting either hearing or vision. For these students, the RLOs will contain ADA compliant materials that will assist them in completing the module. The instructor will screen the treatment group before the study begins to determine whether any of the students are lacking sufficient skills in this area. The students will be offered a basic tutorial in navigating the LMS prior to the start of the experiment.

Pedagogical Considerations Statement (Task A11). A Pedagogical Considerations Statement is a plan for instruction, methods, and tools that will be used to present the learning experience:

The development of this learning module will be guided by the nine events of instruction, as described by Gagne, Wager, Golas, and Keller (2005).

Since the course will be offered online, certain methods of teaching and learning will not be employed (such as face-to-face group exercises or physical field trips). Readings, lectures, group activities, feedback, cases, assignments, examples, and assessments will all be administered via an online medium.

The use of a LMS will enable the students to control the frequency and pace of their learning activities. The specific technology chosen to deliver the course is a LMS named *BrainHoney* 2.0. All of the learning activities will be contained within the LMS. The learning will be self-paced with deadlines for assignment submissions. Specific 'meeting' times will be difficult to employ in the online environment, because of the wide distribution of individual schedules and geographic differences among students in the class. The instructor will need to communicate very clearly with learners about the deadlines and requirements of each learning activity.

Collaborative tools within in the LMS will be used to enable the learner's interactions with both peers and the instructor. These tools will allow the subjects to receive feedback automatically, from their peers, and from the instructor. Videos will be used to gain the learner's attention, to inform the learner of the instructional objectives, and to present key content. The learners will be granted the flexibility to access this content whenever they wish.

The use of advance organizers (Ausubel, 1960) will be part of each RLO. The advance organizers will assist the learner in recalling prior concepts, understanding the learning objectives, and connecting new concepts with prerequisite knowledge.

Delphi 03 for Tasks A08-A11. To determine the face validity for Tasks A08 through A11, Delphi Survey 03 (N=20 items) was administered to the SME panel for review (see Appendix C3). The Delphi survey contained sections corresponding to Tasks A08 through A11 (Learner Characteristics Profile, Target Audience Statement, Specific Learner Constraints Statement, and Pedagogical Considerations Statement). A team of SMEs was asked to evaluate the material for each of these sections based on a four-point Likert scale, with 4 representing Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree. Items with a mean of less than 3.0 (out of a total of 4.0) were considered candidates for improvement. Of these items, 19 received scores of 4.0. One item received a score of 3.33. Table 3 contains descriptive statistics for all items in Delphi Survey 03. Since all 20 items received mean scores higher than 3.0 during the first iteration of the survey, no changes were made to the materials produced. (For further detail, see Appendix C7.)

Table 3

Descriptive Statistics for Delphi Survey 03

Learner Characteristics (N=10 items)											**Target Audience (N=3 items)**			**Learner Constraints (N=3 items)**			**Pedagogical Considerations (N=4 items)**			
	Iteration 1										Iteration 1			Iteration 1			Iteration 1			
Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Mean	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.33	4.00	4.00	4.00	4.00	4.00
Median	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.15	0.00	0.00	0.00	0.00	0.00

Environment-Related Domain. Of concern within this portion of the ADDIE Analyze phase are the learning environment and the options for delivery of the instructional materials. Each of these is presented in the following subsections.

Learning Environment Statement (Task A12). The Learning Environment Statement outlines specific conditions and requirements that may affect the instructional process related to this study. The Learning Environment Statement is as follows:

> The requirements of the learning environment for the learning modules on NPV and IRR are technology-specific. No physical environment is required to enable the learners' experience.
>
> Each student in the treatment group will be required to have access to a computer that has Internet access and a web browser. Some of the course content is being delivered in the form of online video. This creates an additional requirement that the online access be broadband to prevent slow download time of the video.
>
> Each computer used by the learners should be equipped with basic business *Office* suite software, including a spreadsheet and a word processor. Since instruction will be given on how to create spreadsheets in Microsoft's *Excel* spreadsheet program, students must have this software or be able to produce *Excel*-compatible spreadsheet files. Either Windows-based PCs or OS-based Macintosh computers will work, because the formatting of the videos is designed for either environment (.mp4 or flash). .
>
> Since the course is self-paced, student-centered, and online, learners may participate while at home or at school via a laptop computer, a desktop computer, or any mobile device that offers high speed Internet connectivity.

Delivery Options Statement (Task A13). The Delivery Options Statement summarizes the options considered for delivery of the assessments, activities, and content to the targeted learners within the RLOs. The Delivery Options Statement is as follows:

> The RLOs will be delivered entirely within the framework of the university's existing LMS (*BrainHoney* 2.0). The activities associated with gaining attention and delivering objectives will be delivered with .mp4 formatted videos embedded within the LMS. Content will be delivered via embedded videos and reading assignments. Some of the reading assignments are delivered through an online textbook that is installed in the LMS. Other reading assignments will come from printed textbooks to which the students are expected to have access.
>
> Materials that are primarily video will have accompanying text to provide an alternative form of delivery for students needing an ADA Section 508-compliant solution

> and for those who prefer this mode of interface. Each RLO delivered within the LMS will include both text embedded within the video as well as documents students may translate using text-to-speech technologies. Students will be able to access all content in alternative formats as either text or audio, regardless of the initial mode of presentation within the LMS. Video will also be presented in a format allowing the user to start, stop, and pause the video from any point.
>
> Assignments will be delivered as part of the LMS assignment framework. Feedback will be delivered using both the existing framework of the LMS' online communication tools as well as email. Department standardized assessments will be delivered using the LMS' online assessment tools.

Delphi 04 for Tasks A12 and A13. To determine the face validity for Tasks A12 and A13, Delphi Survey 04 (N=12 items) was distributed to a subject matter expert (SME) panel for review (see Appendix C4). The Delphi Survey contained sections for the Learning Environment Statement and Delivery Options Statement. A team of SMEs was asked to evaluate the material for each of these sections based on a four-point Likert scale, with 4 representing Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree. Items with a mean of less than 3.0 (out of a total of 4.0) were considered as candidates for improvement (see Table 4). Eleven items received mean scores of 3.0, or above. One item (item 7) received a mean score of 2.67. This item resulted in changes to Task A12.

Table 4

Descriptive Statistics for Delphi Survey 04

Learning Environment (N=7 items)								**Delivery Options (N=5 items)**				
	Iteration 1							Iteration 1				
Item	1	2	3	4	5	6	7	8	9	10	11	12
Mean	4.00	4.00	4.00	4.00	4.00	3.00	2.67	4.00	4.00	4.00	4.00	3.67
Median	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00	4.00	N/A	3.00	4.00	4.00	4.00	4.00	4.00
SD	0.00	0.00	0.00	0.00	0.00	1.00	0.58	0.00	0.00	0.00	0.00	0.58
	Iteration 2							Iteration 2				
Item	1	2	3	4	5	6	7	8	9	10	11	12
Mean	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	3.67
Median	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00	4.00	N/A	4.00	4.00	4.00	4.00	4.00	4.00
SD	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.58

On this item, the SMEs indicated that specific learner requirements for those with cognitive disabilities had not been accurately described for the project. A clarifying statement was added to Task A12 indicating the students would be expected to utilize existing University resources to for assistance with cognitive disabilities (the Student Learning Center and the Center for Students with Disabilities).

Management-Related Domain. While only one task is within this domain, it is critical to the instructional designer's plan for accomplishing the other 13 tasks in the Analyze phase. An IDE panel reviews the timeline through a Delphi evaluation in order to provide feedback to the instructional designer on the feasibility of the goals for completion of the project. The IDE panel then provides feedback on the length of time established to create materials.

Analysis Timeline Document (Task A14). This document outlines a proposed timeline for the completion of the tasks in the Analyze phase (see Appendix A5 for the complete timeline).

Delphi 05 for Task A14. To determine the face validity for Task A14 (Project Timeline), Delphi 05 (N=12 items) was distributed to an instructional design expert (IDE) panel for review (see Appendix C5). The instrument used a four-point Likert scale, with 4 representing Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree. Items with a mean of less than 3.0 (out of a total of 4.0) were considered candidates for improvement. The IDE panel scored all items at 3.0, or above (see Table 5); therefore, no changes were necessary. (See Appendix C7 for the raw data.)

Table 5

Descriptive Statistics for Delphi Survey 05

Analysis Timeline Document (N=9 items)									
	Iteration 1								
Item	1	2	3	4	5	6	7	8	9
Mean	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Median	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ADDIE Design Phase Procedures

The Design phase of the ADDIE process includes organizing the course and building the tools necessary for the learners. The Design phase includes six tasks: (1) task analysis, (2) flowcharts with content, (3) storyboards, (4) assessment instruments, (5) field test of assessment instruments, and (6) a prototype field-test (RLO).

After completing each of the tasks identified in the Design phase, the researcher sought input from SMEs and IDEs on the validity of the Design phase (see Figure 5 for the distribution) through a modified Delphi Technique. SMEs were used as the judging panel for all six tasks in the Design phase with inclusion of IDEs for the flowcharts with content task (D02) and field-test (D06). The IDEs were the sole expert panel for the storyboards (Task D03).

	Description	Delphi Judging Panel
D01	Task Analysis	SME
D02	Flowcharts with Content	IDE/SME
D03	Storyboards	IDE
D04	Assessment Instruments	SME
D05	Field Test of Assessment Instruments	SME
D06	Prototype Field Test (RLO)	SME/IDE

Figure 5. ADDIE Design Phase Tasks and Delphi Experts

A separate Delphi survey instrument was presented to the judges for each task in the Design phase. In cases where judges did not agree that an item is valid, alterations were made to the items and the panel(s) were asked to review again.

Task Analysis (Task D01). Task analyses for all four RLOs were completed. The task analyses identify each task to be completed by the learner. One of the purposes of a task analysis it to illustrate factors that may contribute to the learner's ability to complete each task. The Task Analysis documents for each of the four RLOs have been arranged in tabular format and are presented as figures (see Appendix D1).

Delphi 06 for Task D01. To determine the face validity for Task D01 (Task Analysis), Delphi 06 (N=8 items) was distributed to an SME panel for review (see Appendix E1). A team of SMEs was asked to evaluate based on a four-point Likert scale, with 4 representing Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree. Items with a mean of less than 3.0 (out of a total of 4.0) were considered candidates for improvement. The SME panel scored six of the eight items at 3.0, or above (see Table 6). Items 1 and 2 both received mean scores of 2.33 in the first iteration of the Delphi survey.

Table 6

Descriptive Statistics for Delphi Survey 06, Task D01

Task Analysis (N=8 items)								
				Iteration 1				
Item	1	2	3	4	5	6	7	8
Mean	2.33	2.33	3.67	4.00	4.00	4.00	4.00	4.00
Median	2.00	2.00	4.00	4.00	4.00	4.00	4.00	4.00
Mode	N/A	N/A	4.00	4.00	4.00	4.00	4.00	4.00
SD	1.53	1.53	0.58	0.00	0.00	0.00	0.00	0.00
				Iteration 2				
Item	1	2	3	4	5	6	7	8
Mean	4.00	4.00	3.67	4.00	4.00	4.00	4.00	4.00
Median	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
SD	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00

Item 1, which received a score of 2.33, resulted in a change to the Task Analysis documents for all four planned RLOs. The SME panel discovered that the objectives were not clearly identified in proximity to the Task Analysis. The researcher changed the Task Analysis document so that the objective of the RLO was prominently displayed at the beginning of the document. Item 2, which also received a score of 2.33, received a low score for the same reason as Item 1: Item 2 asked whether the SMEs thought the tasks were aligned with the objective. Since the objective was not visible, the SMEs agreed that it was difficult to ascertain the alignment. The researcher changed the Task Analysis document so that the alignment between objectives and tasks was more obvious. The SMEs were given a second iteration and this indicated they were now in agreement with items 1 and 2. (For the raw data, see Appendix E3.)

Flowcharts with Content (Task D02). The flowcharts with content were created for all four RLOs (see Appendix D2). These flowcharts contain summaries of the type of content within each learning activity. The Flowcharts with Content form a foundation for the instructional designer as the online learning modules are built.

Delphi 07 for Task D02. To determine the face validity for Task D02 (Flowcharts with Content), Delphi 07 (N=4 items) was distributed to separate panels of SMEs (see Table 7) and IDEs (see Table 8) for review (see Appendix E1). The Delphi Survey was based on a four-point Likert scale, with 4 representing Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree. Items with a mean of less than 3.0 (out of a total of 4.0) were considered candidates for improvement. The SME panel scored all four items at 3.0, or above, as shown in Table 7, and The IDE panel also scored all four items at 3.0, or above as depicted in Table 8.

Table 7

Descriptive Statistics for Delphi Survey 07, SME Panel, Task D02

	Flowcharts with Content (N=4 items)			
	Iteration 1			
Item	1	2	3	4
Mean	4.00	4.00	4.00	4.00
Median	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00
SD	0.00	0.00	0.00	0.00

Table 8

Descriptive Statistics for Delphi Survey 07, IDE Panel, Task D02

Flowcharts with Content (N=4 items)				
	Iteration 1			
Item	1	2	3	4
Mean	4.00	4.00	4.00	4.00
Median	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00
SD	0.00	0.00	0.00	0.00

Storyboards (Task D03). Storyboards were created to illustrate the media and learning technology sequences for every item within each RLO (see Appendix D3 for examples). The storyboards are aligned with the flowcharts (Task D02). Each storyboard contains information about the types of multimedia, text, graphics, navigation, and links within each learning event. The storyboards guide the efforts of the instructional designer in constructing the RLOs.

Delphi 08 for Task D03. To determine the face validity for Task D03 (Storyboards), Delphi 08 (N=6 items) was distributed to a panel of IDEs for review (see Appendix E1). The survey was based on a four-point Likert scale, with 4 representing Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree. Items with a mean of less than 3.0 (out of a total of 4.0) were considered candidates for improvement. The IDE panel scored all six items at 3.0, or above (see Table 9). Because all six items scored above 3.0, no changes were made to the Storyboards.

Table 9

Descriptive Statistics for Delphi Survey 08, Task D03

Storyboards (N=6 items)						
Iteration 1						
Item	1	2	3	4	5	6
Mean	3.67	4.00	4.00	4.00	4.00	4.00
Median	4.00	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00	4.00	4.00
SD	0.58	0.00	0.00	0.00	0.00	0.00

Assessment Instruments (Task D04). Following the completion of the targeted content (comprised of four RLOs), the subjects will complete a content knowledge assessment on the topics of NPV and IRR. The assessment instrument is a departmental standard instrument (see Appendix D4). The examination has been in use for approximately five years, and is administered to over 175 students per semester. The department content knowledge assessment is a 30-item, multiple-choice instrument. In order to validate the alignment between the individual items and the objectives of the learning module, the instrument was evaluated by a team of SMEs using the Delphi method.

Delphi 09 for Task D04 (Content Knowledge Assessment Instruments). To determine the face validity for Task D04 (Assessment Instruments), Delphi 09 (N=6 items) was distributed to a panel of SMEs for review (see Appendix E3 for the raw data). A four-point Likert scale, with 4 representing Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree, was used in the survey. Items with a mean of less than 3.0 (out of a total of 4.0) were considered candidates for improvement. The SME panel scored all items at 3.0, or above (see Table 10).

Because all six items scored above 3.0 no changes were made to the content knowledge assessment instrument.

Table 10

Descriptive Statistics for Delphi Survey 09, Task D04

Assessment Instruments (N=6 items)						
Iteration 1						
Item	1	2	3	4	5	6
Mean	4.00	3.67	3.67	4.00	4.00	4.00
Median	4.00	3.00	4.00	4.00	4.00	4.00
Mode	4.00	3.00	4.00	4.00	4.00	4.00
SD	0.00	0.58	0.58	0.00	0.00	0.00

Delphi 10 for Task D04 (Spreadsheet Model Assignment). After completing the targeted content RLOs, the students will complete a spreadsheet modeling assignment that covers NPV and IRR. The spreadsheet modeling assignment and the associated grading rubric are departmental standards and have been in use for a minimum of five years (see Appendix D4). To determine the face validity of Task D04 (Assessment Instruments), Delphi 10 (N=15 items) was distributed to a panel of SMEs for review (see Appendix E3 for the raw data). A four-point Likert scale, with 4 representing Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree, was used. Items with a mean of less than 3.0 (out of a total of 4.0) were considered candidates for improvement (see Table 11). Thirteen items received mean scores of 3.0, or above. Two items received a mean score of 2.67.

Table 11

Descriptive Statistics for Delphi Survey 10, Task D04

							Iteration 1								
Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mean	4.00	4.00	4.00	4.00	4.00	4.00	3.00	2.75	2.75	4.00	4.00	4.00	4.00	4.00	4.00
Median	4.00	4.00	4.00	4.00	4.00	4.00	3.50	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00
SD	0.00	0.00	0.00	0.00	0.00	0.00	1.41	1.26	1.26	0.00	0.00	0.00	0.00	0.00	0.00
							Iteration 2								
Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mean	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Median	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Mode	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
SD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

These items resulted in changes to Task D04. The SMEs indicated that scores on the grading rubric did not appear to be properly weighted. The correct weights and score values were added to the rubric, as a result of this feedback.

Interrater Reliability for Task D04 (Spreadsheet Model Assignment). An Index of Interrater Reliability known as Cohen's Kappa (Landis & Koch, 1977) was calculated for each item in the departmental standard grading rubric for the spreadsheet modeling assignment of IRR and NPV. Cohen's Kappa indicates the measure of agreement between different raters evaluating the same item. Kappa is used to measure interrater reliability when observing qualitative or categorical values. Kappa is considered by some statisticians to be a more accurate measurement than standard percent of agreement between evaluators (Landis & Koch, 1977).

To measure reliability of the grading rubric for the spreadsheet modeling assignment, two SMEs were asked to evaluate spreadsheet models using the grading rubric (N= 21 models). Each model was scored on 15 individual criteria contained in the rubric.

Percent of agreement between the evaluators and Kappa scores were calculated for each of the 15 criteria (see Appendix F1 for the raw data). Kappa values of .40 to .59 are considered to represent moderate levels of agreement, .60 to .79 indicate substantial levels of agreement, and .80 and above represents an outstanding level of agreement between evaluators (Landis & Koch, 1977). Many statisticians insist on a score of .70 or higher to indicate a satisfactory level of agreement (Landis & Koch, 1977). Items in the rubric that resulted in Kappa scores less than .70 were considered candidates for improvement (see Table 12).

Table 12

Percent Agreement and Cohen's Kappa scores for Spreadsheet Grading Rubric

	Iteration 1														
Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
% Agreement	.74	1.00	.95	.76	.90	.90	.95	.95	.95	1.00	1.00	1.00	1.00	.76	.76
Kappa	.60	1.00	.90	.61	.83	.83	.90	.90	.90	1.00	1.00	1.00	1.00	.52	.42
	Iteration 2														
Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
% Agreement	.74	1.00	.95	.76	.90	.90	.95	.95	.95	1.00	1.00	1.00	1.00	1.00	1.00
Kappa	.60	1.00	.90	.61	.83	.83	.90	.90	.90	1.00	1.00	1.00	1.00	1.00	1.00

Eleven items were scored at .70, or higher with four items below .70. Two of the items that scored less than .70 were related to determining whether the spreadsheet correctly calculated the answers to NPV and IRR. After reviewing these items further, the designer modified the rubric to clarify the exact number of time periods that should be included in the calculations of NPV and IRR. Two other items that scored below .70 were related to the appearance of input fields in the model. Clarifying statements were added to the rubric to help evaluators be more consistent in grading these items.

Field Test of Assessment Instruments (Task D05). The content knowledge assessment and the spreadsheet modeling assignment are both departmental standard tests. Since they have been in use by the department prior to this research, these assessment instruments were not field-tested.

Prototype Field Test (RLO) (Task D06). A prototype RLO was built by the instructional designer. The prototype was based on Tasks D01 through D05. The prototype was evaluated by a team of SMEs prior to the implementation of the research project. The SME panel were asked to respond to a four-point Likert-scale survey with 4 representing Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree. Items with a mean of less than 3.0 (out of a total of 4.0) were considered candidates for improvement. In addition, the SMEs were asked to answer several open-ended, essay-style questions regarding improvements to the RLO. The SME panel's feedback did not result in any changes to the RLO.

ADDIE Develop Phase Procedures

In this phase, the researcher created the RLOs for the experimental group. These materials were based on the course objectives developed in the Design phase. The RLOs were installed in the BrainHoney course management system website for the experimental group. As verified by the Delphi panels, all content and evaluation elements conformed to the Design phase tasks.

ADDIE Implement Phase Procedures

The subjects within this study were junior business management students enrolled in the B302 course sections 01 and 02. A total of 78 students (treatment group N=37; control group N=41) were in this study.

A content knowledge pretest was administered to both the control and experimental groups one month prior to the units of instruction. The pretest was administered in a proctored in-class environment. All pretest materials and scores were collected and stored following the administration of the pretest.

The units of instruction were presented to the control group during six classroom hours spanning two weeks. The instruction was presented in a face-to-face environment. During this same time frame, the experimental group was given access to the RLOs via the BrainHoney course management system. The experimental group did not receive any face-to-face instruction; their experience with this unit of instruction was completely in an online environment.

After the instruction was completed, the content knowledge posttests were administered to both groups. Also, both the control and experimental groups were assigned to complete the spreadsheet modeling assignment.

ADDIE Evaluate Phase Procedures

Data Collection and Analysis. Three sets of data were collected: 1) content knowledge pretest scores for both the control and experimental groups; 2) content knowledge posttest scores for both the control and experimental groups; and 3) spreadsheet model scores for both the control and experimental groups. These data will be discussed in Chapter IV.

Summary

In order to answer the four research questions for this research, it was necessary to develop an instructional module with a total of four RLOs. These RLOs were developed using the ADDIE instructional design model.

Each of the 14 tasks in the Analyze phase of the ADDIE model was performed prior to any design work on the RLOs for this research. Additionally, each of the tasks in the Design Phase of the ADDIE model were completed prior to any development work on the RLOs for this project. Data relating to the face and content validity of the RLOs as well as the interrater reliability scores associated with the spreadsheet model assessment tool were discussed. After implementation, the researcher analyzed the collected data in light of the four research questions proposed, which is reported in Chapter IV with conclusions presented in Chapter V.

CHAPTER IV

Results

Purpose of Study

The purpose of this research was to compare the effectiveness of RLOs for teaching NPV and IRR theory and spreadsheet modeling in an online format with a traditional (face-to-face) classroom. To accomplish this, the researcher constructed four RLOs and compared them to the corresponding face-to-face instructional units. The first RLO was designed to cover the topic of NPV theory. The second RLO was designed to instruct the learners on the topic of IRR theory. The third RLO was designed to teach a subject how to build an NPV spreadsheet model. RLO number four was intended to instruct students in building an IRR spreadsheet model.

As discussed in Chapter III of this study, a department standard assessment was used as a pretest and a posttest to measure student achievement related to the RLOs on NPV and IRR theory. This assessment was used to answer the first two research questions in this study. A department standard spreadsheet modeling assignment corresponding to the third and fourth RLOs was used to answer the third and fourth research questions in this study.

This chapter will present a description of the sample used for this study, including a discussion on participants who were excluded. Descriptive statistics relating to this study will be presented followed by results from analysis of the data gathered for each of the four research questions. Raw data corresponding to research questions 1-4 is found in Appendix G. This chapter will conclude with a summary of the results of the study.

Sample Description

The total number of students enrolled in the course targeted by this study was 91 students across two sections of the class. Section number 01 was designated as the control group. Total enrollment in this section was 45 students; however, four students chose not to participate, leaving a total of 41 students in the control group.

Section number 02 was designated as the treatment group. This section initially totaled 46 students, but six students from this section elected not to participate and an additional three students failed to take the pretest and were removed from the study as a result, leaving a total of 37 students. Both treatment and control groups were involved in answering all four research questions.

The subjects in this study were all at least third year (junior) undergraduate college-students. (Freshmen and sophomores are not enrolled in the class since it is a higher division course with a significant number of prerequisites.) All participants completed the same set of prerequisite courses, which includes college algebra, two economics classes, two accounting courses, one statistics class, and a writing course. The majority (79.49%) of the participants were business management majors with smaller numbers spread across other majors. (See Table 13 for the demographic data.)

Table 13

Participant Demographics

	Control (N=41)	Treatment (N=37)	Total (N=78)
Ethnicity			
White	38	35	73 (93.59%)
Hispanic	2	2	3 (3.85%)
Black	1	0	1 (1.28%)
Major			
Business Management	33	29	62 (79.49%)
Automotive Technologies	3	2	5 (6.41%)
Communications	1	1	2 (2.56%)
International Studies	1	1	2 (2.56%)
University Studies	0	1	1 (1.28%)
CIT	0	1	1 (1.28%)
Construction Management	1	0	1 (1.28%)
Horticulture	0	1	1 (1.28%)
Interdisciplinary Studies	0	1	1 (1.28%)
Recreation Leadership	1	0	1 (1.28%)
Web Design	1	0	1 (1.28%)

Those subjects who were not business management majors were required to take the same prerequisite courses as the business management majors. As can be seen from Table 13, the participants were primarily white (93.59%). Hispanics (3.85%) and blacks

(1.28%) represented a relatively small number of the subjects. All participants were competent in English; thus, no supplementary materials in a second language were used.

Research Question One

The following question was addressed by this portion of the study, "Is there a significant difference in net present value analysis achievement for those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus those who receive instruction via an online learning module, as measured by a standardized departmental test?"

Descriptive statistics for both the pretest and posttest scores were calculated for the treatment and control groups. The pretest and posttest were each comprised of ten items and were worth a total of 10 points. Means and standard deviations for pretest and posttest scores are included in Table 14.

Table 14

Descriptive Statistics by Group for Research Question One

	Control	Treatment
Pretest		
N	41	37
Mean	4.74	3.38
Standard Deviation	2.71	1.52
Posttest		
N	41	37
Mean	9.41	9.76
Standard Deviation	.59	.43

As shown in Table 14, both the treatment and control group scores increased from the pretest to the posttest. The treatment group achieved slightly lower scores on the pretest but recorded slightly higher scores on the posttest. Figure 6 contains a visual representation of the differences in each group's pretest and posttest mean scores.

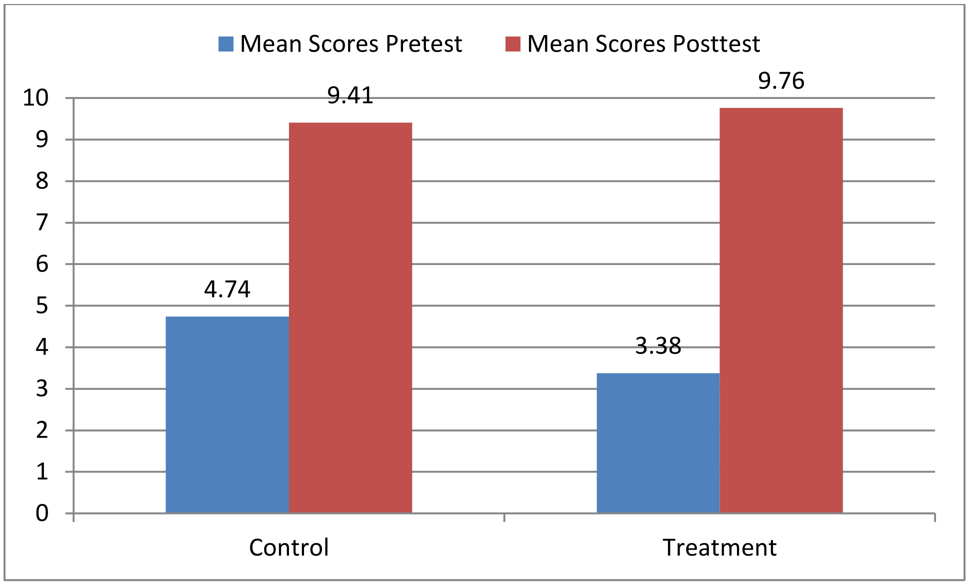

Figure 6. Mean pretest and posttest scores by group – research question 1.

An analysis of covariance (ANCOVA) was completed to check for differences between the achievement levels of the control and treatment groups. The dependent variable (posttest score) was analyzed for differences among groups while controlling for a covariate (pretest score). A test of between-subjects effects showed no violations of the assumption of homogeneity of regression slopes (p>.05). Both the treatment and control group data were subjected to a Kolmogorov-Smirnov test and both sets of data failed the assumption of normality (p<.05). The assumption of homogeneity of variance was checked with a Levene's Test for Equality of Error Variances and the variances were found to be in violation of this assumption (p<.05). Before running a non-parametric test for ANCOVA, the data was checked for a linear relationship between the covariate (pretest) and the independent variable (posttest). A Pearson Correlation was conducted and the analysis indicated there was no linear relationship between the covariate and the dependent variable.

Since the data failed to show a linear relationship between the covariate (pretest) and the dependent variable (posttest) and because the data failed assumptions of normality and homogeneity of variance a Mann Whitney U non-parametric test was used to analyze the data. Significant differences (p = .01) were found to exist between the control and treatment groups' performances, $p < .05$, $z = -2.71$, $A = .35$. The A value .35 corresponds to a small effect (Vargha & Delaney, 2000). A power of .80 was calculated for this analysis. This power of .80 combined with the significant difference and a small effect size indicate it is possible the significant difference is not meaningful.

After checking for differences in performance on the posttest, an independent samples t-test was used to check for differences between the control and treatment groups' pretest scores. The control group had the higher mean (control = 4.74, treatment = 3.38; See Figure 6). Significant differences (p = .01) were found to exist between the control and treatment group's performances on the pretest, $p < .05$, $z = -2.91$.

Research Question Two

The following question was addressed in this portion of the study, "Is there a significant difference in internal rate of return achievement for those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students who receive instruction via an online learning module, as measured by a standardized departmental test?"

Descriptive statistics for both the pretest and posttest scores were calculated for the treatment and control groups. The pretest and posttest were each comprised of ten items and were worth a total of 10 points. Means and standard deviations for pretest and posttest scores are included in Table 15.

Table 15

Descriptive Statistics by Group for Research Question Two

	Control	Treatment
Pretest		
N	41	37
Mean	2.60	3.27
Standard Deviation	1.76	1.84
Posttest		
N	41	37
Mean	8.46	9.27
Standard Deviation	2.06	1.04

As shown in Table 15, both the treatment and control group scores increased from the pretest to the posttest. The treatment group achieved slightly higher scores on both the pretest and posttest. Figure 7 contains a visual representation of the differences in each group's pretest and posttest mean scores.

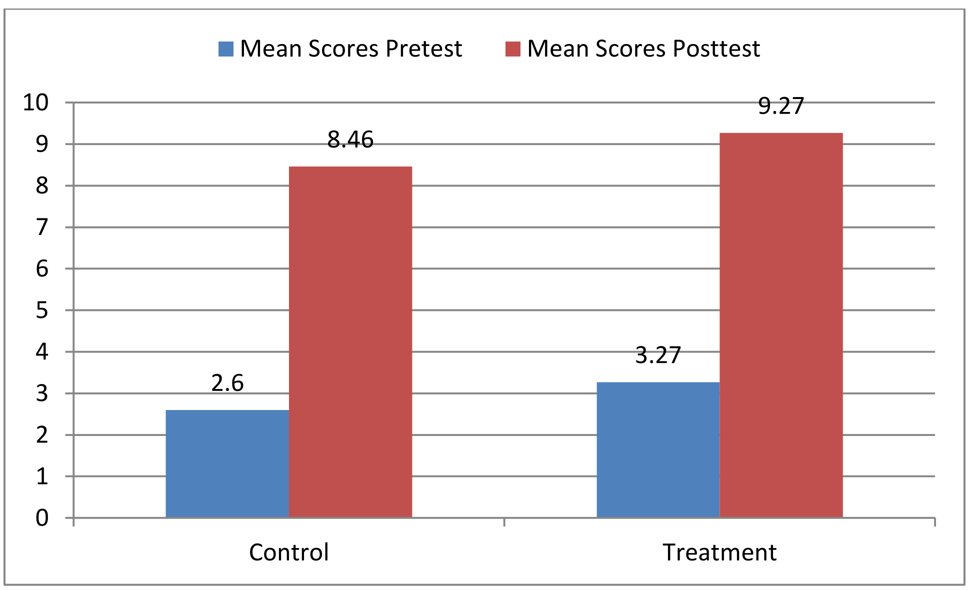

Figure 7. Mean pretest and posttest scores by group – research question 2.

An analysis of covariance (ANCOVA) analysis was completed to check for differences between the achievement levels of the control and treatment groups. The dependent variable (posttest score) was analyzed for differences among groups while controlling for a covariate (pretest score). A test of between-subjects effects showed no violations of the assumption of homogeneity of regression slopes ($p>.05$). Both the treatment and control group data were subjected to a Kolmogorov-Smirnov test and both sets of data failed the assumption of normality ($p<.05$). The assumption of homogeneity of variance was checked with a Levene's Test for Equality of Error Variances and the variances were found to not be homogeneous ($p<.05$). Before running a non-parametric test for ANCOVA, the data was also checked for a linear relationship between the covariate (pretest) and the independent variable (posttest). A Pearson Correlation was conducted and the analysis indicated there was no linear relationship between the covariate and the dependent variable.

Since a linear relationship between the covariate (pretest) and the dependent variable (posttest) could not be proved, a Mann Whitney U non-parametric test was used to analyze the data. No significant difference ($p = .20$) was found to exist between the control and treatment groups' performances, $p > .05$, $z = -1.29$, $A = .42$. The A value .42 corresponds to a small effect (Vargha and Delaney, 2000). A power of .80 was calculated for this analysis. This power of .80 combined with no significant difference and a small effect size indicate it is likely no significant differences exist.

After checking for differences in performance on the posttest, an independent samples t-test was used to check for differences between the control and treatment groups' pretest scores. No significant differences (p = .18) were found to exist between the control and treatment groups' performances on the pretest, $p < .05$, $z = 1.34$.

Research Question Three

The following question was addressed during this portion of the study, "Is there a significant difference in net present value spreadsheet models produced by those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students enrolled in a corporate finance course who receive instruction via an online learning module, as measured by a standardized departmental rubric?"

Descriptive statistics for the spreadsheet modeling rubric scores were calculated for the treatment and control groups. The assessment was comprised of nine items and was worth a total of 34 points. Means and standard deviations for both control and treatment groups are included in Table 16.

Table 16

Descriptive Statistics by Group for Research Question Three

	Control	Treatment
Pretest		
N	41	37
Mean	30.56	30.76
Standard Deviation	3.07	2.55

As shown in Table 16, the treatment group achieved slightly higher scores on the assessment with a slightly lower standard deviation. Figure 8 contains a visual representation of the differences in each group's mean scores and standard deviations.

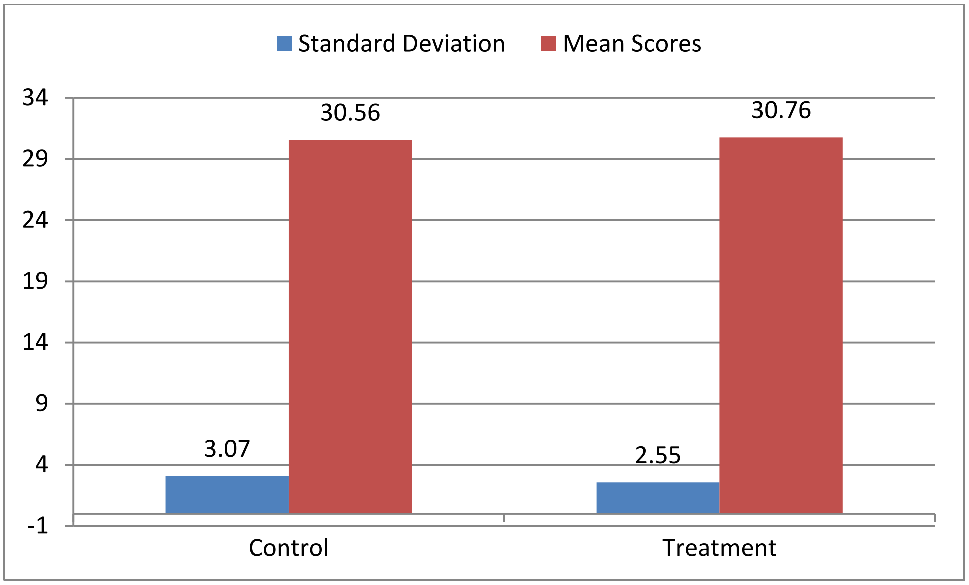

Figure 8. Mean scores and standard deviation by group.

An independent samples *t*-test was conducted to check for differences between the control and treatment groups. The data was tested using a Levene's Test for Equality of Variances and was found to be in violation of the assumption of homogeneity of variances ($p<.05$). The data also failed the Kolmogorov-Smirnov test for normality of data ($p<.05$). Since the data failed both tests of homogeneity of variances and normality, a non-parametric test was conducted to identify differences between the control and treatment groups.

A Mann Whitney U non-parametric test was used to analyze the data. No significant differences ($p = .83$) were found to exist between the control and treatment groups' performances, $p > .05$, $z = -.48$, $A = .47$. The A value .47 corresponds to a small effect (Vargha & Delaney, 2000).

Research Question Four

The following question was addressed by this portion of the study, "Is there a significant difference in internal rate of return spreadsheet models produced by those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students enrolled in a corporate finance course who receive instruction via an online learning module, as measured by a standardized departmental rubric?"

Descriptive statistics for the spreadsheet modeling rubric scores were calculated for the treatment and control groups. The assessment was comprised of seven items and was worth a total of 26 points. Means and standard deviations for both control and treatment groups are included in Table 17.

Table 17

Descriptive Statistics by Group for Research Question Four

	Control	Treatment
Pretest		
N	41	37
Mean	22.59	22.49
Standard Deviation	3.00	2.60

As shown in Table 17, the control group achieved slightly higher scores on the assessment with a slightly higher standard deviation. Figure 9 contains a visual representation of the differences in each group's mean scores and standard deviations.

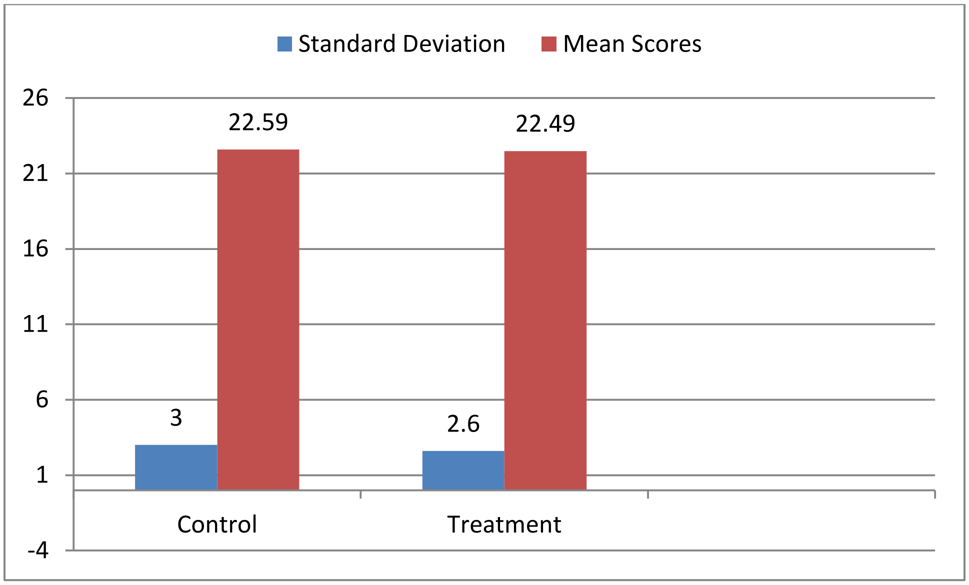

Figure 9. Mean scores and standard deviation by group.

An independent samples *t*-test was conducted to check for differences between the control and treatment groups. The data was tested using a Levene's Test for Equality of Variances and was not found to be in violation of the assumption of homogeneity of variances ($p>.05$). The data did fail the Kolmogorov-Smirnov test for normality of data ($p<.05$). Since the data failed the test of normality, a non-parametric test was conducted to identify differences between the control and treatment groups.

A Mann Whitney U non-parametric test was used to analyze the data. No significant differences ($p=.631$) were found to exist between the control and treatment groups' performances, $p > .05$, $z = -.22$, $A = .49$. The A value .49 corresponds to a small effect (Vargha and Delaney, 2000).

Research Question Five

The following question was evaluated during this part of the study, “What is the instructional design evaluation compliance level for each of the five phases of the ADDIE (Analyze, Design, Develop, Implement, and Evaluate) instructional design model in the creation of four Finance RLOs, as measured by a modified Delphi Technique?”

To address research question five, the researcher designed and executed Delphi surveys focused on the Analyze and Design phases of the ADDIE process used in the creation of the online learning model for this study. Each Delphi survey was given to a panel comprised of Subject Matter Experts (SME), Instructional Design Experts (IDE), or both. Data from the Delphi surveys was analyzed to determine levels of effectiveness of each task within the ADDIE model.

Analyze Phase. The Analyze phase of the ADDIE model is comprised of 14 individual tasks. Five Delphi surveys were conducted for the 14 tasks found in the Analyze phase of the instructional design process (see Figure 2, Chapter III). Data from these Delphi surveys was examined to determine face and content validity for each of the 14 completed tasks.

Each Delphi survey was based on a four-point scale indicating the judge’s agreement with the effectiveness of the individual Analyze phase task. According to this scale, 4 represented Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree. Individual items within each task were evaluated. Any item scoring below 3.0 (Agree) was further examined to determine if changes could be made to increase the effectiveness of the related task. If changes were made to the task, the corresponding Delphi survey was administered a second time to determine whether the changes resulted in stronger agreement among the judging panel as to the effectiveness of the task. If all items scored 3.0 (Agree) or higher during the first iteration of the Delphi survey, then a second iteration was not necessary.

Descriptive statistics for the final round Delphi surveys for the Analyze phase (Delphi 01, Delphi 02, Delphi 03, Delphi 04, and Delphi 05) are contained in Table 18. Means and standard deviations contained in Table 18 represent overall numbers for each Delphi survey (not individual item means and standard deviations).

Table 18

Descriptive Statistics for Final Delphi Surveys 01-05

	Mean	Standard Deviation
Delphi 01	3.97	.10
Delphi 02	3.98	.07
Delphi 03	3.97	.15
Delphi 04	3.89	.30
Delphi 05	4.00	.00

As shown in Table 18, each final Delphi survey resulted in scores above 3.0, indicating agreement within each SME or IDE judging panel as to the effectiveness of the related tasks. Several individual items initially did not result in agreement by the judging panel(s) (see Table 2 and Table 4, Chapter III) and changes were made to the related tasks. After changes were made, the Delphi survey was administered a second time and the judging panel scored each of these items above 3.0, indicating agreement that the task was effective.

Overall results of the Delphi surveys conducted during the Analyze phase of the ADDIE instructional design process indicated that each of the 14 tasks associated with this phase were concluded effectively. Some of the tasks did initially require modifications and the SME and IDE panels did not agree that they were effective until the second iteration(s) of the Delphi surveys which were conducted after the modifications were made to the related tasks.

Design Phase. The Design phase of the ADDIE model is comprised of six individual tasks. Five Delphi surveys were conducted for the six tasks found in the Design phase of the instructional design process (see Figure 4, Chapter III). Data from these Delphi surveys was examined to determine face and content validity for each of the six completed tasks.

Each Delphi survey was based on a four-point scale indicating the judge's agreement with the effectiveness of the individual Design phase task. According to this scale, 4 represented Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree. Individual items within each task were evaluated. Any item scoring below 3.0 (Agree) was further examined to determine if changes could be made to increase the effectiveness of the related task. If changes were made to the task, the corresponding Delphi survey was administered a second time to determine whether the changes resulted in stronger agreement among the judging panel as to the effectiveness of the task. If all items scored 3.0 (Agree) or higher during the first iteration of the Delphi survey, then a second iteration was not necessary.

Descriptive statistics for the final round Delphi surveys for the Design phase (Delphi 06, Delphi 07, Delphi 08, Delphi 09, and Delphi 10) are contained in Table 19. Means and standard deviations contained in Table 19 represent overall numbers for each Delphi survey (not individual item means and standard deviations).

Table 19

Descriptive Statistics for Final Delphi Surveys 06-10

	Mean	Standard Deviation
Delphi 06	3.96	.12
Delphi 07	4.00	.00
Delphi 08	3.95	.13
Delphi 09	3.89	.17
Delphi 10	4.00	.00

As shown in Table 19, each final Delphi survey resulted in scores above 3.0, indicating agreement within each SME or IDE judging panel as to the effectiveness of the related tasks. Several individual items initially did not result in agreement by the judging panel(s) (see Table 6 and Table 11, Chapter III) and changes were made to the related tasks. After changes were made, the Delphi survey was administered a second time and the judging panel scored each of these items above 3.0, indicating agreement that the task was effective.

Overall results of the Delphi surveys conducted during the Design phase of the ADDIE instructional design process indicated that each of the six tasks associated with this phase were concluded effectively. Some of the tasks did initially require modifications and the SME and IDE panels did not agree that they were effective until the second iteration(s) of the Delphi surveys, which were conducted after the modifications, were made to the related tasks.

Summary

The purpose of this research was to compare the effectiveness of RLOs for teaching NPV and IRR theory and spreadsheet modeling in an online format with a traditional (face-to-face) classroom. For each research question, the researcher constructed an RLO and compared it to the corresponding face-to-face instructional units.

Research Question One. The first RLO was designed to cover the topic of NPV theory. Data was collected and analyzed for both the control and treatment groups. The resulting analysis showed a significant difference in achievement between the two groups, with the treatment group achieving the higher mean score.

Research Question Two. The second RLO was designed to instruct the learners on the topic of IRR theory. Data was collected and analyzed for both the control and treatment groups. The resulting analysis showed no significant difference in achievement between the two groups.

Research Question Three. The third RLO was designed to teach participants how to build an NPV spreadsheet model. Data was collected and analyzed for both the control and treatment groups. The resulting analysis indicated no significant difference in achievement between the two groups.

Research Question Four. RLO number four was intended to instruct students in building an IRR spreadsheet model. Data was collected and analyzed for both the control and treatment groups. The resulting analysis showed no significant difference in achievement between the two groups.

Research Question Five. Ten Delphi surveys were administered to SME and IDE judging panels. Data from these Delphi surveys was examined to determine the effectiveness of the tasks found in the Analyze and Design phases of ADDIE as applied to this study. The results of the final round of Delphi surveys indicated that each of the 20 combined tasks found in the Analyze and Design phases were effective.

CHAPTER V

Discussion

This study compared the effectiveness of RLOs for teaching NPV and IRR theory and spreadsheet modeling in an online format with a traditional (face-to-face) classroom. To accomplish this, the researcher constructed four RLOs and compared them to the corresponding face-to-face instructional units. The first RLO was designed to cover the topic of NPV theory. The second RLO was designed to instruct the learners on the topic of IRR theory. The third RLO was designed to teach how to build an NPV spreadsheet model. RLO number four was intended to instruct students in building an IRR spreadsheet model.

A department standard assessment was used as a pretest and a posttest to measure student achievement related to the RLOs on NPV and IRR theory. A department standard spreadsheet modeling assignment was used to measure student achievement related to the third and fourth RLOs.

This study focused on the following research questions:

1) Is there a significant difference in net present value analysis achievement for those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus those who receive instruction via an online learning module, as measured by a standardized departmental test?
2) Is there a significant difference in internal rate of return achievement for those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students who receive instruction via an online learning module, as measured by a standardized departmental test?
3) Is there a significant difference in net present value spreadsheet models produced by those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students enrolled in a corporate finance course who receive instruction via an online learning module, as measured by a standardized departmental rubric.

4) Is there a significant difference in internal rate of return spreadsheet models produced by those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students enrolled in a corporate finance course who receive instruction via an online learning module, as measured by a standardized departmental rubric.

5) What is the instructional design evaluation compliance level for each of the five phases of the ADDIE (Analyze, Design, Develop, Implement, and Evaluate) instructional design model in the creation of four Finance RLOs, as measured by a modified Delphi Technique?

This chapter will provide findings of the study relative to the research questions, as well as conclusions based on the study's findings and recommendations for future study.

Summary

The subjects for this study were selected from students enrolled in a junior-level corporate finance class. The total number of students enrolled in the course targeted by this study was 88 students across two sections of the class. Total enrollment in the control group section was 45 students; however, four students chose not to participate, leaving a total of 41 subjects in the control group.

The treatment group section initially totaled 46 students, but six students from this section elected not to participate. Once the study began, an additional three students failed to take the pretest and were removed from the study, leaving a total of 37 subjects. Both treatment and control groups were involved in answering all four research questions.

All participants completed the same set of prerequisite courses, which includes college algebra, two economics classes, two accounting courses, one statistics class, and a writing course. The majority (79.49%) of the participants were business management majors with smaller numbers spread across other majors.

The data related to research questions 1 and 2 were analyzed using an analysis of covariance (ANCOVA). The data were collected by using a department standard instrument, which was administered as both a pre-test and a posttest. The pre-test was administered prior to the students' receiving the content. The posttest was administered immediately following the completion of the learning experience. Scores for both the control and treatment groups were compared using the ANCOVA. The use of the ANCOVA enabled the researcher to compare the control and treatment groups, while controlling for the pre-test scores. Posttest scores related to questions 1 and 2 for both control and treatment groups were all within acceptable ranges for the subject matter. Department standards for acceptable scores on IRR and NPV content knowledge assessments are at 80 percent. Every group in this study achieved mean scores in excess of the minimum acceptable score for students taking the B302 Finance course.

Data for research questions 3 and 4 were collected from a posttest administered following the instruction. Both control and treatment groups were asked to produce a spreadsheet model for the posttest. The model was scored using a department standard rubric. The data collected were analyzed using a single-sample *t*-test. Spreadsheet model scores related to questions 3 and 4 for both control and treatment groups were all within acceptable ranges for the subject matter. Department standards for acceptable scores on IRR and NPV spreadsheet model assessments are at 80 percent. Every group in this study achieved mean scores in excess of the minimum acceptable score for students taking the B302 Finance course.

Research question 5 was addressed by examining data collected from a series of Delphi surveys. The Delphi surveys were administered to groups of subject matter experts (SME) and instructional design experts (IDE). The researcher analyzed both the SME and the IDE panels' responses, resulting in several significant changes to the study materials.

A significance level of .05 ($\alpha = .05$) was used in the analysis of each of the first four research questions. For each independent research question, this meant that the probability of making a Type I error (rejecting a null hypothesis when it is true) was five percent. For this research, this level of alpha was acceptable. However, the researcher recognized that the overall alpha level in evaluating research questions 1-4 as a group was much higher ($\alpha = .20$) when considering all four questions together. This meant that, overall, the results of this study had a 20 percent chance of being random. This overall probability of a Type I error is much higher than for each of the research questions taken individually.

Findings

Research Question 1

> 1) Is there a significant difference in net present value analysis achievement for those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus those who receive instruction via an online learning module, as measured by a standardized departmental test?

The results of the first research question showed a statistically significant difference in student achievement on NPV content knowledge between the face-to-face (control) group and the students who were enrolled in the RLO (treatment) group. The treatment group (enrolled in the RLO) actually had a statistically significantly higher mean score on the posttest than the control group, though the effect size was relatively small, *A* = .35 (Vargha & Delaney, 2000). Even though the differences between groups were not large, as measured by effect size, this result was still somewhat unexpected, given the findings by Smith, et al. (2008) and Mensch (2010) who earlier concluded that teaching a quantitative concept online is considered to be a difficult task.

Since the data failed key assumptions, the researcher was unable to conduct an ANCOVA to control for differences on the pretest. Therefore, the researcher examined the pretest scores and found that the control group had the higher mean (control = 4.74, treatment = 3.38; see Figure 6). Significant differences ($p = .01$) were found to exist between the control and treatment groups' performances on the pretest. As a result, the researcher acknowledges that differences among the groups may have impacted the posttest scores, although the control group had the significantly higher pretest scores and the treatment group had the significantly higher posttest scores.

These findings were in line with the study by Dunlap, Furtak, and Tucker (2009) which demonstrated that a thoughtfully-designed online learning experience involving a mathematics-based subject can result in student performance that is as good as, or better than, a face-to-face group. Possible explanations for this result may include the fact that the online experience (RLO) was very carefully designed, using the ADDIE instructional systems design model. It is also possible that the treatment group benefitted from the constant availability of all the RLO resources, enabling them to review and receive feedback over an extended period of time, rather than in the compressed timeframes associated with a classroom environment.

The treatment group also may have simply expended more effort, knowing that they were the 'treatment' group, although this attitude was not specifically measured or checked in this study.

Research Question 2

> 2) Is there a significant difference in internal rate of return achievement for those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students who receive instruction via an online learning module, as measured by a standardized departmental test?

The results of the second research question showed no statistically significant differences between the control and treatment groups. This research question focused on student achievement associated with IRR content knowledge. The treatment group (enrolled in the online RLO section) actually had higher pretest scores and higher posttest scores than the control group, but the differences were not significant.

Since the data failed key assumptions, the researcher was unable to conduct an ANCOVA to control for differences on the pretest. After checking for differences in performance on the posttest, an independent samples t-test was used to check for differences between the control and treatment groups' pretest scores. No significant differences ($p = .18$) were found to exist between the control and treatment groups' performances on the pretest, $p < .05$, $z = 1.34$.

As a result, the researcher concluded that since no differences were found among the groups on the pretest, the pretest scores likely did not affect the results of the posttest.

These findings are consistent with those of Buhagiar and Potter (2010), Kotey and Anderson (2006), Terry (2007), Terry et al. (2009), and Watters and Robertson (2009) who all concluded that online and face-to-face students performed equally within the context of various business subjects.

Reasons that the treatment group performed as well as their face-to-face peers in the control group may include the fact that this online experience (RLO) was carefully designed, using the ADDIE of instructional systems design. Also, it is possible that the treatment group benefitted from the constant availability of all the RLO resources, enabling them to review materials and receive feedback over an extended period of time, rather than in the limited time associated with a classroom environment.

Research Questions 3 and 4

> 3) Is there a significant difference in net present value spreadsheet models produced by those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students enrolled in a corporate finance course who receive instruction via an online learning module, as measured by a standardized departmental rubric.

Research question three showed no statistically significant difference between those students in the control group who learned spreadsheet modeling for NPV in a classroom versus those in the treatment group who learned to build NPV spreadsheet models online (RLO). The treatment group had a slightly higher mean score and a slightly lower standard deviation than the control group, but the differences were not significant.

> 4) Is there a significant difference in internal rate of return spreadsheet models produced by those students enrolled in a corporate finance course who receive traditional face-to-face instruction versus students enrolled in a corporate finance course who receive instruction via an online learning module, as measured by a standardized departmental rubric.

Research question four also showed no statistically significant differences between those students in the control group who learned spreadsheet modeling for IRR in a face-to-face setting versus those in the treatment group who learned to build IRR spreadsheet models via an online RLO. The treatment group had a slightly lower mean score and a slightly lower standard deviation than the control group, but the differences were not found to be significant.

Since no published studies could be found on teaching spreadsheet modeling of NPV or IRR via an online medium, the researcher truly had no idea what would happen during this study. The fact that the differences found were not significant is important to the researcher, because of his sponsoring institution's current emphasis on developing online courses in several different disciplines that teach spreadsheet modeling as part of one or more courses within the discipline. Findings from this study will be shared within the institution and will likely influence development efforts of any online courses containing spreadsheet modeling instructions.

Possible explanations for the lack of a statistically significant difference in the performances of the control and treatment groups for research questions 3 and 4 may include the fact that those in the treatment group had on-demand access to videos that demonstrated key spreadsheet concepts, enabling the students to easily retain or re-learn specific spreadsheet techniques after their initial exposure to them. Another possible explanation may be that the feedback mechanisms employed in the RLOs were effective enough to allow the students in the treatment group to perform at a level at least as high as the control group.

Research Question 5

> 5) What is the instructional design evaluation compliance level for each of the five phases of the ADDIE (Analyze, Design, Develop, Implement, and Evaluate) instructional design model in the creation of four Finance RLOs, as measured by a modified Delphi Technique?

To address research question five, the researcher designed and executed Delphi surveys focused on the Analyze and Design phases of the ADDIE process used in the creation of the online learning module for this study. Each Delphi survey was given to a panel comprised of Subject Matter Experts (SME), Instructional Design Experts (IDE), or both. Data from the Delphi surveys was analyzed to determine levels of effectiveness of each task within the two ADDIE phases.

Analyze Phase. The Analyze phase of the ADDIE model is comprised of 14 individual tasks. Five Delphi surveys were conducted for the 14 tasks (see Figure 2, Chapter III). Data from these Delphi surveys were examined to determine face and/or content validity for each of the 14 completed tasks.

Each Delphi survey was based on a four-point scale indicating the judge's agreement with the effectiveness of the individual Analyze phase task. According to this scale, 4 represented Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree. Individual items within each task were evaluated. Any item scoring below 3.0 (Agree) was further examined to determine if changes could be made to increase the effectiveness of the related task. If changes were made to the task, the corresponding Delphi survey was administered a second time to determine whether the changes resulted in stronger agreement among the judging panel as to the effectiveness of the task. If all items scored 3.0 (Agree), or higher during the first iteration of the Delphi survey, then a second iteration was not necessary.

Overall, results of the Delphi surveys conducted during the Analyze phase of the ADDIE instructional design process indicated that each of the 14 tasks associated with this phase were concluded effectively. Some of the tasks did initially require modifications when the SME and IDE panels did not agree and a second iteration was conducted after the modifications were made to the related tasks.

Design Phase. The Design phase of the ADDIE model is comprised of six individual tasks. Five Delphi surveys were conducted for the six tasks (see Figure 4, Chapter III). Data from these Delphi surveys were examined to determine face and/or content validity for each of the six completed tasks.

Each Delphi survey was based on a four-point scale indicating the judge's agreement with the effectiveness of the individual Design phase task. According to this scale, 4 represented Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree. Individual items within each task were evaluated. Any item scoring below 3.0 (Agree) was further examined to determine if changes could be made to increase the effectiveness of the related task. If changes were made to the task, the corresponding Delphi survey was administered a second time to determine whether the changes resulted in stronger agreement among the judging panel as to the effectiveness of the task. If all items scored 3.0 (Agree) or higher during the first iteration of the Delphi survey, then a second iteration was not necessary.

Overall, results of the Delphi surveys conducted during the Design phase of the ADDIE instructional design process indicated that each of the six tasks associated with this phase were concluded effectively. Some of the tasks did initially require modifications when the SME and IDE panels did not agree and a second iteration was conducted after the modifications were made to the related tasks.

Develop, Implement, and Evaluate Phases. In the Develop phase of the ADDIE process, the researcher created the RLOs used in the study, based on the principles outlined and validated by SME and IDE panels during the Design phase of the project. During the Implement and Evaluate phases of the project, the researcher collected and evaluated data from pretest and posttest scores of the NPV and IRR content knowledge modules. The researcher also collected data from the posttest spreadsheet models produced by the subjects during the NPR and IRR spreadsheet modeling units. Based on the materials and the RLOs produced as part of this study as well as the data collected and analyzed during this study, the Analyze, Design, Develop, Implement, and Evaluate phases should all be viewed as compliant with the standards set forth by the ADDIE model of instructional systems design.

Conclusions

In this study, the researcher employed a non-equivalent control group form of quasi-experimental design in order to examine differences in participants' learning achievement of NPV content when learned online (treatment) versus a face-to-face (control) environment. The treatment group's performance was statistically significantly better than the control group on a department standard assessment instrument. Both groups were administered the same pretest and posttest. An ANCOVA was used to control for the pretest. The mean posttest scores for the treatment group were higher than the control group (9.76 vs. 9.41; see Table 15 in Chapter IV). A non-parametric test (Mann-Whitney U) found this difference to be significant (see Chapter IV). However, the effect size was found to be small (see Chapter IV). As a result, the researcher has concluded that NPV content can be learned at least as effectively in an online environment as in a face to face environment, as measured by a department standard assessment.

The same structure was used to study IRR content knowledge, with different results. The participants' learning achievement of IRR content when learned online (treatment) versus a face-to-face (control) environment was examined. No statistically significant differences were found between the groups' performances on a department standard assessment instrument. Both groups were administered the same pretest and posttest. An ANCOVA was used to control for the pretest. The mean posttest scores for the treatment group were higher than the control group (9.27 vs. 8.46; see Table 16 in Chapter IV). A non-parametric test (Mann-Whitney U), however, found no statistically significant differences between the groups (See Chapter IV). Therefore, the researcher concluded that IRR content can be learned at least as effectively in an online environment as in a face to face environment, as measured by a department standard assessment.

In both cases (IRR and NPV content knowledge), the researcher discovered that the online learning module produced results at least as high as the results from a traditional classroom setting, as measured by student achievement. The findings from this data suggest that the effectiveness of the RLOs developed for instruction of both IRR and NPV content knowledge were at least equal to that of a face-to-face learning environment.

The findings from this study are important to the field in the following ways: 1) This study provides evidence that specific financial topics (NPV and IRR) can be taught as effectively online as in a traditional classroom. Other institutions planning online finance or accounting classes should be interested in the results of this study. 2) Researchers in quantitative fields, such as mathematics, statistics, or physics, may benefit from this study, since this study demonstrates it is possible to teach a quantitative subject effectively in an online environment. 3) This study adds to the body of knowledge regarding teaching spreadsheet modeling techniques in an online environment. The literature contains very little on this subject; the results of this study will provide a starting point for other researchers who may be interested in examining the effectiveness of an online learning module for spreadsheet modeling. 4) The importance of combining commonly accepted instructional design practices with the design of RLOs for online instruction was illustrated in this study. The importance of the instructional design element of building RLOs should be of interest to any researcher who is considering building online learning modules.

These findings are also important in light of the fact that the researcher's institution is currently undertaking an effort to make every course offered by the university in the field of Finance available online in the next 12 months. Instructional designers, administrators, and faculty have all expressed concerns to the researcher about whether certain topics (including IRR and NPV) could be taught online as effectively as in a face-to-face environment. This research has demonstrated that it is possible to teach both IRR and NPV online at least as effectively as in a classroom when student achievement is measured with the current department standard assessment instrument.

In order to study the effectiveness of online RLOs in teaching spreadsheet modeling of both IRR and NPV, the researcher employed a static-group comparison form of quasi-experimental design. Both NPV and IRR spreadsheet modeling skills were taught via a face-to-face learning environment (control group) and an RLO (treatment group). To check for differences between the control and treatment groups, two single sample *t*-tests were conducted (one each for IRR and NPV spreadsheet modeling skills).

The researcher examined the data and discovered that for NPV spreadsheet modeling skills, the treatment group achieved a higher mean score than the control group (30.76 versus 30.56) as measured by a department standard assessment instrument. However, a Mann Whitney U non-parametric test indicated no statistically significant differences existed between the two groups (see Chapter IV).

The researcher also studied the data relating to the IRR spreadsheet modeling skills and noted that the control group achieved a slightly higher mean score (22.59 versus 22.49) as measured by a department standard assessment instrument. A Mann Whitney U non-parametric test showed no statistically significant differences between the control and treatment groups (see Chapter IV).

These findings are important to the researcher, since his sponsoring institution is planning on offering seven online courses in the next 12 months in the field of Finance that contain modules on spreadsheet modeling. The administration has indicated they desire the online versions of spreadsheet modeling instruction (for NPV, IRR, and several related topics) to be at least as effective as the classroom version. It is important to the researcher and to his institution to know that it is possible for online learners to achieve results at least equal to their face-to-face peers on the topics of NPV and IRR spreadsheet modeling, as measured by department standard instruments.

Designing RLOs for the online instruction of NPV, IRR, NPV spreadsheet modeling, and IRR spreadsheet modeling takes a significant amount of expertise and resources. However, online students stand to benefit by receiving instruction that allows them to perform on par with their face-to-face peers. This research has taken an important step toward using RLOs to teach specific finance topics as well as specific spreadsheet modeling skills.

The reader should be careful to draw conclusions from this study since results relate only to the specific population of learners included in this study. The reader should be cautioned against applying the results of this study to other student populations who may have different learner characteristics, rendering any comparison with the students in this study inaccurate.

Recommendations for Practitioners

The principal recommendation for practitioners stemming from this study is related to the RLOs. Since all four RLOs (relative to research questions 1 through 4) were shown to produce results at least equal to the in-class experience, practitioners within this specific institution may effectively implement these RLOs in the online version of this course.

The RLOs developed for this research project represent a level of granularity (Wiley, 2000) that allows for flexible re-use in multiple contexts. The RLOs are reusable in several ways: 1) They may be re-used by the instructor for multiple sections of the same course within the same semester. 2) The RLOs may be used by the same instructor(s) over multiple semesters. 3) The RLOs can be used in other courses taught by other instructors for purposes of review or as instructional models for first-time learners who would not enroll in the class targeted for this investigation. 4) The RLOs can be used as pre-requisite modules to be completed by students prior to enrolling in courses taught by other faculty that require NPV and IRR skills. In order to leverage the benefits of the RLOs that have already been developed, the instructional designer(s) should consider converting the remaining units in the planned online course to RLOs using the same instructional design process that was used in this study. At least 10 additional content RLOs and eight more spreadsheet modeling RLOs will be needed in order to allow implementation of the full online version of the course.

Instructors at the researcher's sponsoring institution should consider using the specific RLOs or the associated methodologies described in this study in developing online versions of the seven finance courses (Advanced Corporate Finance, Simulations, Investments, Advanced Investments, Financing New Ventures, Personal Finance, and Banking) that are most closely related to the course which was included in this study.

Instructors in the fields of finance and accounting will be able to identify many topics that are quite similar in origin, content, and methodology to NPV and IRR. These topics would be ideal candidates for online implementation using the methods outlined in this study. These instructors are invited to explore the methods used in this study, with the intent of extending those methods to closely related topics, in order to enable online content instruction.

Spreadsheet modeling skills are representative of a learner's ability to synthesize and apply (Bloom, 1956) underlying financial concepts (such as NPV) in a real-world context. Spreadsheet models are the product of a learning process that begins with the acquisition of knowledge and comprehension of a specific topic (Bloom, 1956).

Instructors in the fields of finance and accounting should consider this study with regard to teaching spreadsheet modeling of related subject matter online. Practitioners are encouraged to identify topics that are either prerequisite or that build upon the concepts of NPV and IRR spreadsheet models. These topics represent a significant opportunity for instructional designers to build RLOs that teach spreadsheet modeling skills closely related to those found in this investigation.

Practitioners in other disciplines should consider this study with regard to their own subject matter. Disciplines that include learning modules involving quantitative analysis may experience results similar to those found here. Instructors of topics such as physics, mathematics, or chemistry may be able to utilize the methods found in this study in converting content of their courses to online formats.

Additionally, instructors and instructional designers in quantitative disciplines other than finance and accounting may be able to produce results similar to this study with regard to teaching spreadsheet modeling skills online. Practitioners are encouraged to carefully examine the methods used here as they consider how they will build their own RLOs for teaching spreadsheet modeling within the context of their specific topics.

Practitioners in many areas, including those outside the finance and accounting majors, can benefit from the instructional design processes applied in this study. Such instructors should consider using instructional design techniques similar to those in this study in building online learning experiences in their respective disciplines. The instructional design processes outlined in this study are beneficial to instructional designers in any field.

Recommendations for Future Research

This study leads to opportunities for further research. Since this study was conducted only once with relatively moderate sample sizes (N=41, control group; N=37, treatment group) additional implementations of the same study would help to further validate the results found here. This same study could be conducted for several semesters using a control and treatment group design, until enough data were collected to provide a much larger sample size.

Future studies should include participants who are selected at random within the control and treatment groups. This will allow researchers to conduct studies using an experimental design, rather than the quasi-experimental design.

Future research should also include studies of a longitudinal nature; enabling the measurement of the effect of the treatment over an extended period of time. In order to judge the continuing value of the content developed in the RLOs for this study's treatment, longer-term investigations should focus part of their efforts on a confirmative evaluation of the RLO content. Continually evaluating the content for worth and applicability over the long term will ensure the stability of the RLOs. This effort may need to include the continual involvement of IDE and SME panels. This type of feedback, combined with other forms of evaluation, such as student feedback, should give the researcher a rich context from which to draw continual improvements to the RLOs.

Since the planned online course contains subjects other than those found in this study, those other subjects may be examined in the same manner as this study to find out whether they can be taught as effectively online as they are in a classroom setting. Some of the other finance topics that could be included in such a study include forecasting, forecasting spreadsheet models, time value of money, time value of money spreadsheet models, cost of capital, cost of capital spreadsheet models, valuation, and valuation spreadsheet models.

Instructional design teams engaged in the process of creating online finance courses are invited to conduct research on the following topics as part of this effort:

Spreadsheet modeling. Further research is needed on the effectiveness of various feedback methods used in teaching spreadsheet modeling skills in an online environment. Besides studying the differences between online and face-to-face environments, the researchers should also take the time to draw comparisons between different feedback methods used in a strictly online environment. Several feedback methods should be studied, including the automated, peer, and instructor feedback methods outlined in this study as well as customizable feedback models as described by Kunzler (2012). Researchers are invited to examine not only the effectiveness of various feedback models in teaching spreadsheet modeling in an online environment, but also the cost-effectiveness of such feedback models.

Spreadsheet modeling as a foundation for case discussions. One method that is commonly employed among the faculty in a traditional classroom setting when teaching upper-division finance courses is to discuss case studies involving large numbers of computations.

Researchers are invited to explore the most effective ways to replicate this learning activity in an online environment. Since this is a relatively complex learning exercise, the research may involve a series of studies focusing on several sub-topics related to the case study method. Methods for applying spreadsheet modeling skills as part of the case study and discussion method are of great interest to the instructional design teams involved in developing case analysis and discussion courses to be offered online at the researcher’s college, but these methods would also be of interest to any institution teaching similar concepts and principles.

Content knowledge. In this study content knowledge was presented to the treatment group as part of an RLO developed based on the ADDIE model of instructional systems design. Some of the components of the RLOs included on-demand instructional video, reading assignments, assessments, and feedback. All of the content contained in the RLOs was delivered via the LMS used by the university. Future research may focus on the effectiveness of other forms of communication, media, and delivery of content outside of the boundaries set by the LMS. Researchers are invited to study the effectiveness of offering content via mobile platforms. Use of social media for collaboration and feedback activities may also be a subject worth examining.

The RLOs produced as part of this research included elements that may be worthy of their own separate studies: 1) In an effort to replicate the type of feedback offered to students in a face-to-face environment, the RLOs offered the subjects feedback on several levels. Automated feedback was given initially to each student while she was completing an assignment. Peer feedback, including the use of online discussion boards, was used as a secondary method for helping participants. Online instructor meetings were offered to the learners as a third method of receiving feedback on their assignments. Future research could involve the study of the effectiveness of these feedback methods within an online environment. 2) The RLOs contained tools students could use to work together on spreadsheet modeling homework. Researchers are invited to investigate the effectiveness of different collaborative online tools in this context.

Summary

This study was conducted to determine whether four specific finance topics could be taught as effectively in an online environment as in a classroom environment.

Several findings were consistent with those of Buhagiar and Potter (2010), Kotey and Anderson (2006), Terry (2007), Terry et al. (2009), and Watters and Robertson (2009) who found that online and face-to-face students performed similarly on various business subjects. This study adds several topics (NPV, IRR, and IRR spreadsheet modeling) to the list of business topics for which the research concluded that no significant differences exist between online and in-class instruction modes.

This study found online instruction of NPV spreadsheet modeling to be more effective than the face-to-face version, further supporting the conclusions by Dunlap, Furtak, and Tucker (2009).

Additionally, because this research involved the implementation of the ADDIE model of instructional design, the results were also found to be in line with the study by Dunlap, Furtak, and Tucker (2009) that concluded a thoughtfully-designed online learning experience involving a mathematics-based subject could result in student performance that is as good as, or better than, a face-to-face group.

These results provide important information to instructors in the fields of finance and accounting. Understanding that certain key finance topics (e.g., IRR and NPV) and their associated spreadsheet modeling skills can be taught online at least as effectively as in a classroom will provide key support to finance faculty and instructional designers who are specifically contemplating designing online instruction of financial subject matter. In addition, researchers and practitioners whose goals include teaching spreadsheet modeling in an online environment will find this study to be helpful as they face the challenges associated with teaching this specific skill. Lastly, instructional designers who focus on other quantitative topics will benefit by this research.

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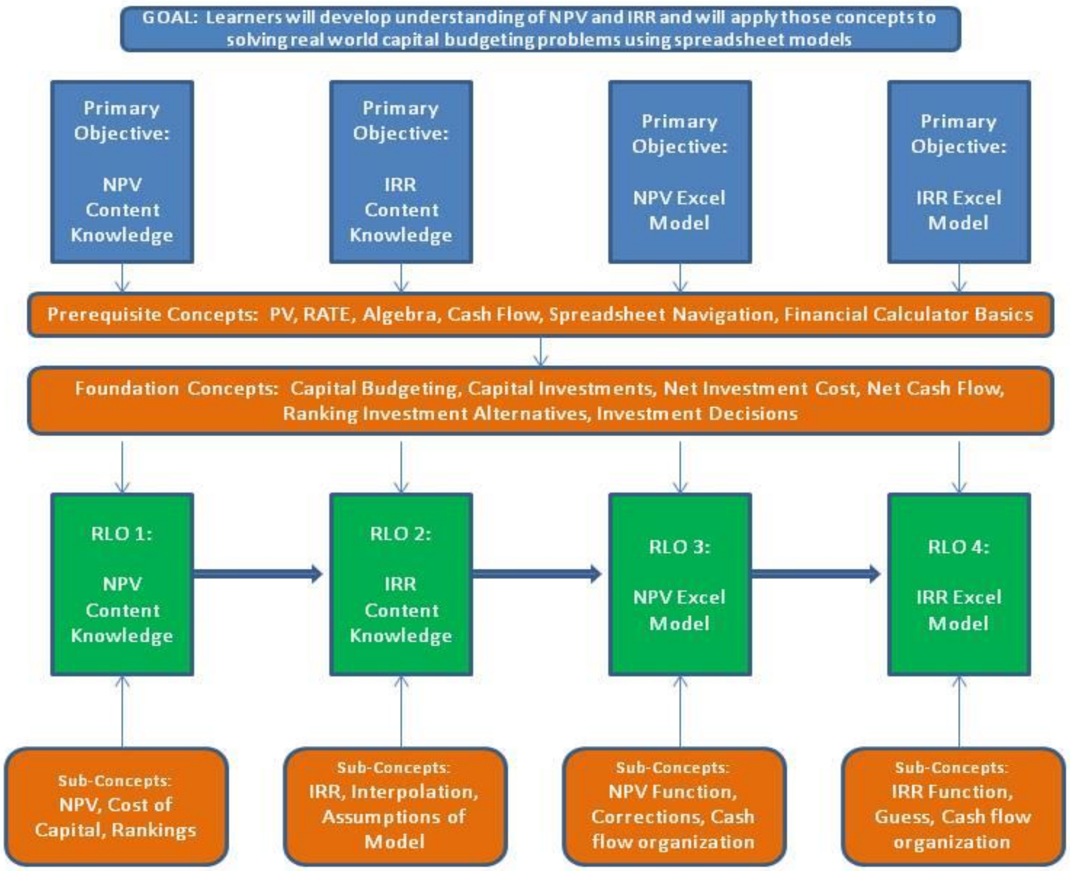
Appendix A1

Task A04: Content Concept Map



Appendix A2

Task A05: Learning Influences Document

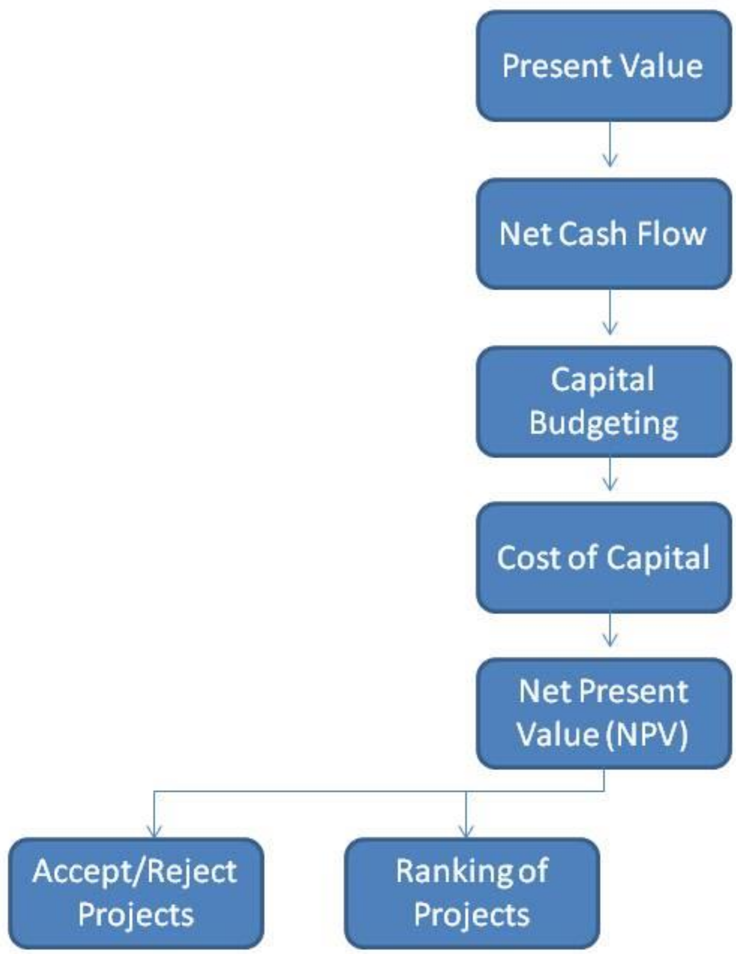
Event	Strategies
1. What events will the instructional designer utilize to gain the learner's attention?	For each topic, the learner will view a video containing a stimulating short story or case example about a company trying to make a simple investment decision. The video will contain an example based on familiar real-world experiences that the learner will easily relate to.
2. What techniques will the instructional designer use to maintain the learner's attention?	The learner will be asked to answer a series of questions via a discussion board contained in the CMS. The questions will relate the material on capital budgeting techniques such as IRR and NPV to the student's own future career. Connections between mastery of capital budgeting techniques and personal career benefits will be referenced throughout the learning units.
3. What events will the instructional designer provide to stimulate recall of prerequisite knowledge?	The learners will be reminded of the difference between net cash flows and net income in both the introductory, attention-grabbing video and during the presentation of the content on NPV and IRR. The learner will be reminded of Time Value of Money techniques as part of the presentation of the content on NPV (during the portion focused on the calculations of the PV of the future cash flow streams).
4. How will the instructional designer communicate the learner's responsibility?	At the beginning of each RLO, the learner will be presented with a list of tasks to be completed. These tasks will include preparation, practice, and assessment items. Due dates will be included. This list will be contained within the CMS and will be visible in the opening sequence of the learner's experience. The learner will be able to access the list of tasks at any time.
5. What techniques will the instructional designer use to inform the learner of expected instructional outcomes?	The learner will be informed of the instructional objectives at the beginning of the RLO. The objectives will be presented within the CMS as part of the introductory and content videos. Additionally, the objectives will remain visible as text items within a side-bar of the CMS. Each activity the learner undertakes will be 'linked' to an objective and the linkage to the text describing the objective will be visible throughout the learner's entire experience.
6. What techniques will the instructional designer employ to produce inquiry?	The instructor will provide the subjects with reading material as an advance organizer. The learners will also be given examples within the assignments and within the content videos which may relate to their future careers. These materials and examples may lead to further inquiry on the part of the students with regard to NPV, IRR, and spreadsheet modeling

Event	Strategies
	of capital budgeting.
7. How will the instructional designer enhance the learner's recall of the material (i.e., short-term memory)?	The content will be organized based on key questions that a business manager may ask about an investment decision. The questions relate to critical information that must be present in order to make an investment decision. The answer to each of these questions is reached by solving for either NPV or IRR. By organizing the content around these key questions, the designer hopes to assist the learners' recall of the material.
8. How will the instructional designer elicit learner participation?	Immediately after the presentation of the content and strategies related to NPV, IRR, and Spreadsheet Modeling the students will be asked to complete assignments within the CMS requiring them to either perform calculations or build spreadsheets relating to the material.
9. How will the instructional designer utilize feedback gathered from the instructional and the practice materials?	Learners will receive feedback after completing assignments in three ways: 1) Automated feedback will be offered via the CMS after they respond to questions about NPV or IRR. Automated feedback will also be offered via the CMS on the accuracy of the students' spreadsheet models. Learners who answer incorrectly will be given feedback and asked to attempt a second problem. 2) Peers will offer feedback if the learner answers incorrectly a second time. The student will then be given a chance to answer a similar problem. 3) The instructor will offer the student feedback if the student answers incorrectly a third time.
10. What learner capabilities will the instructional designer develop as an outcome?	The outcomes tied to this instructional module are primarily intellectual skills, centered on the ability to solve NPV and IRR problems and the ability to create spreadsheets for capital budgeting.
11. How has the instructional designer responded to any particular learning trait?	The learning modules will be presented as both visual and auditory experiences for the learners. The learners will not receive tactile or kinesthetic experiences as part of the online learning module.
12. How will the instructional designer assess learner satisfaction with the instruction?	At this time, no plans exist to measure student attitudes as part of the learning module. The only data collected will come from department standard assessment instruments which measure achievement but do not measure student attitudes towards the material.
13. How will the instructional designer accommodate any learner disability (psychomotor, cognitive, emotional)?	All material presented through the CMS will be ADA 508 compliant. Subjects will be able to access the material either as audio or text. Assistive technologies may be used by any students who desire to use them because the text will be presented in a format that is compatible with assistive technologies.

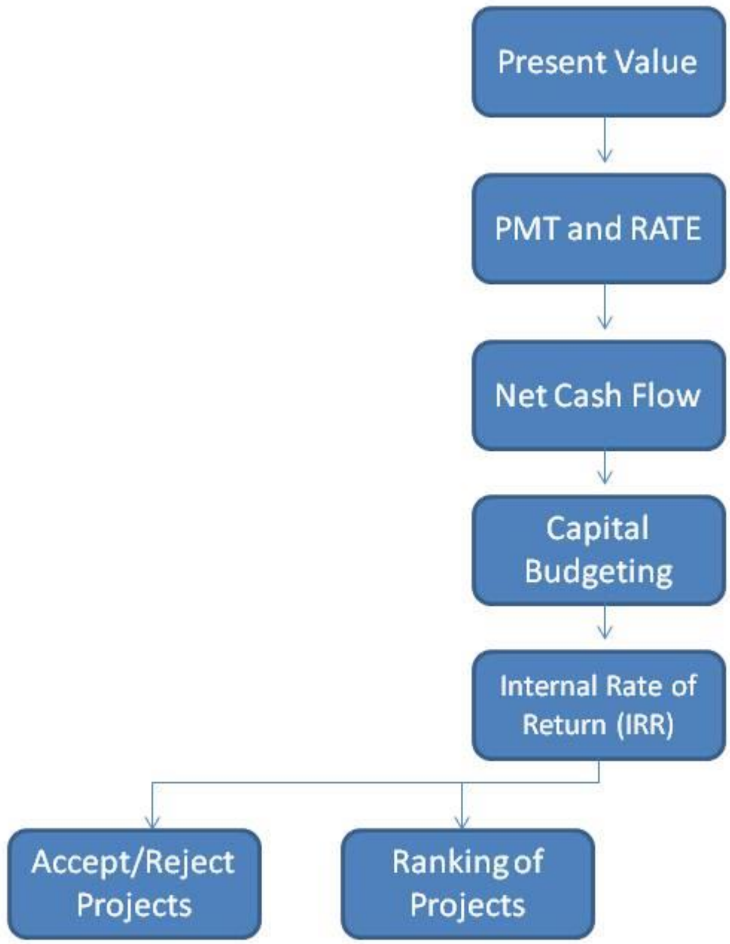
Appendix A3

Task A07: Learning Hierarchy of Prerequisite Skills for NPV Content Knowledge

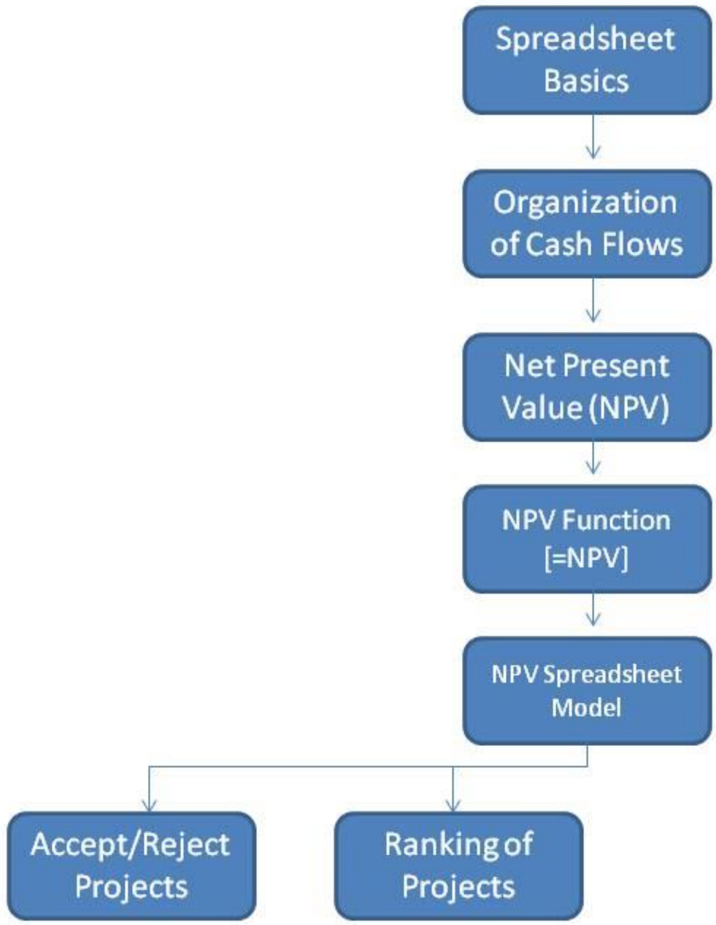
RLO:



Learning Hierarchy of Prerequisite Skills for IRR Content Knowledge RLO:



Learning Hierarchy of Prerequisite Skills for NPV Spreadsheet RLO:



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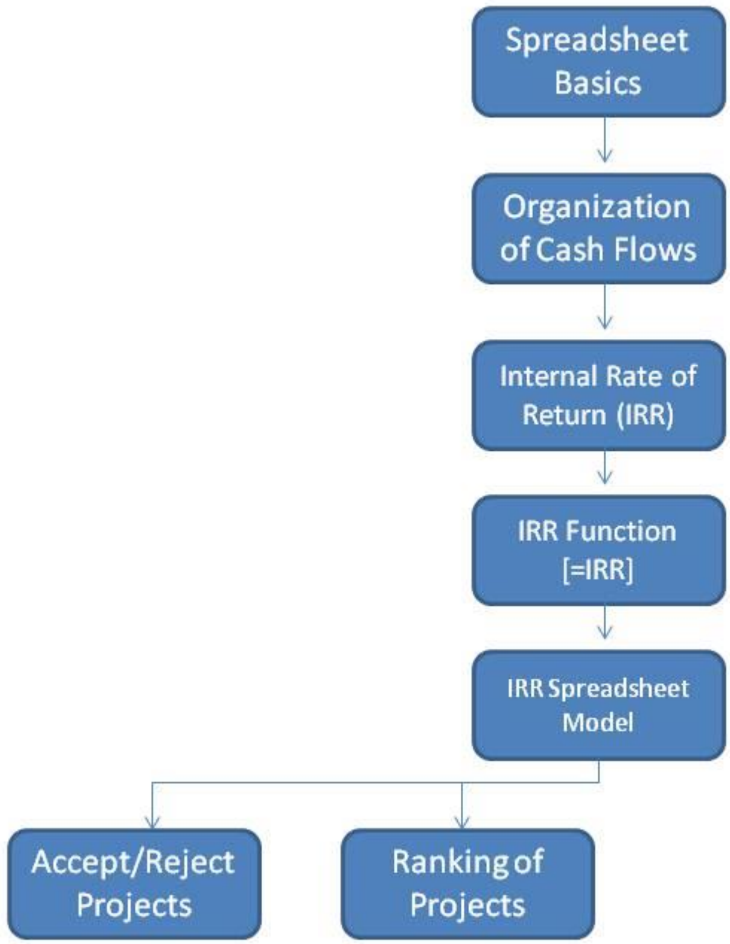
Learning Hierarchy of Prerequisite Skills for IRR Spreadsheet RLO:



Appendix A4

Task A08: Learner Characteristics Profile

GENERAL INFORMATION

	Data	Resources Used
1.0 General Characteristics of the Target Population	Junior-level undergraduate college students; Business Management majors; Full-time students; On-campus.	University Registration Data
1.1 Age Range	Mean = 22.59 years; Range = 19-31 years.	University Registration Data
1.2 Gender Distribution	84.9% Male; 15.1% Female	University Registration Data
1.3 Special Needs	A very small percentage (typically less than 1%) of students each semester are diagnosed with special needs by the university's learning resources center. Most often, the students have special learning needs resulting in needing extra time to complete assignments that may normally be timed exercises. Occasionally, students with hearing or visual impairments are identified. Reasonable accommodations will be made for such students and ADA 508 compliance will be required of any online modules developed as part of this study.	University Registration Data
1.4 Ethnic/Cultural Background	92 percent of the students are natives of the United States or Canada. The next largest group (representing less than five percent) is from Latin America.	University Registration Data
1.5 Language Distribution	All learners are fluent in English with non-native English speakers achieving a standard level of proficiency on the Test of English as a Foreign Language (TOEFL).	University Registration Data

ACADEMIC INFORMATION

		Data	Resources Used
2.0	**What entry behavior(s) is needed for learner success?**	Students must be willing to study and follow instructions independently in an online environment. Students must be able to navigate online and also must be willing to ask for help when it is needed.	Informal Interviews with Instructors
2.1	**What is the attitude toward target content material?**	A small number of students have negative attitudes towards the material because they struggled with similar concepts in Accounting 202. Most students have not formed attitudes towards the material, because they are generally unfamiliar with it. Once the material is introduced, most students seem to react positively towards the material because they understand its usefulness.	Informal Interviews with Instructors
2.2	**What is the learning preference(s) or modality?**	Most students prefer examples and demonstrations. Some of the concepts are difficult to understand, in the absence of examples. Both visual and auditory formats are preferred by most students.	Informal Interviews with Instructors
2.3	**Is it reasonable to expect that the material be cognitively learned by these learners?**	Yes; the material is a natural extension of many of the concepts that precede it.	Informal Interviews with Instructors
2.4	**What is a reasonable time frame for the targeted content to be mastered?**	The material should be mastered in a total of four class sessions spanning a period of 10 days.	Informal Interviews with Instructors, Syllabi
2.5	**What is the motivation for the learner to complete this targeted content?**	Successful completion will result in a higher course grade for the student. Also, the material's impact on a student's skill level as a business manager is apparent to the learner; therefore, she should have a natural motivation to learn the material out of self-interest.	Informal Interviews with Instructors, Syllabi

PRIOR INFORMATION NEEDED

	Data	Resources Used
3.**0 What prior knowledge is needed for learner success?**	Learners must have knowledge of time value of money principles, including Present Value, Rate, Payment, and Annuities. Students must also understand the difference between Net Cash Flow and Net Income. Students must understand basic Algebra. Students must have a working knowledge of Microsoft *Excel* spreadsheet software.	Informal Interviews with Instructors, Syllabi
3.**1 What prerequisite cognitive skills are needed for learner success?**	Students must be able to read at a college sophomore level. Learners must be able to organize, manipulate, and analyze quantitative data. Students must be able to form strategies for solving problems involving choosing among multiple alternatives.	Informal Interviews with Instructors, Syllabi
3.**2 What prerequisite motor skills are needed for learner success?**	Students must be able to manipulate a computer, including its spreadsheet and web browser technologies. Students may do so either through their own physical motor skills or via assistive technologies.	Informal Interviews with Instructors, Syllabi
3.**3 What previous experience would the learner have that would inhibit success?**	The learners may have had negative experiences with math, accounting, economics, or spreadsheets that will make it difficult for them to focus during this module. Some students report extremely negative experiences in prerequisite courses, most often with the accounting courses. If the learners struggle with math or spreadsheets prior to this learning module, they may be predisposed to think that they cannot learn the new material.	Informal Interviews with Instructors, Syllabi

Appendix A5

Task A14: Analysis Timeline Document

Task	Task Detail	Time (in weeks)	Comments
Analysis Phase:			
1	**Create A01**: Project Rationale	1 week	
2	**Create A02**: Instructional goal(s) for the project	1 weeks	
3	**Create A03**: Project Objectives	1 weeks	
4	Delphi Survey A01: Send to SME panel	1 week	
5	Delphi Survey A01: Feedback from SME panel	1 week	
6	Delphi Survey A01:Survey data analysis	1 week	If the results are acceptable, produce the final version of Tasks A01 through A03. If results are not acceptable, then repeat the process.
7	**Create A04**: Project Concept Map	1 week	
8	**Create A05**: Project Learning Influence document	1 week	
9	**Create A06**: Project Learning Statement	1 week	
10	**Create A07**: Project Learning Hierarchy	1 week	
11	Delphi Survey A02: Send to SME panel	1 week	
12	Delphi Survey A02: Feedback from SME panel	1 week	
13	Delphi Survey A02: Survey data analysis	1 week	If the results are acceptable, produce the final version of Tasks A04 through A07 If results are not acceptable, then repeat the process.
14	**Create A08**: Project Learning Environment Statement	1 week	
15	**Create A09**: Project Delivery Option Statement	1 week	Note: Environment Related & Management Related tasks are combined in one instrument (Delphi 03); see detail under Management Related Tasks section
16	**Create A10**: Project Learner Characteristics Profile	1 week	
17	**Create A11**: Project Target Audience Statement	1 week	
18	**Create A12**: Project Learner Constraints Statement	1 week	
19	**Create A13**: Project Learner Pedagogical Considerations Statement	1 week	
20	Delphi Survey A03: Send to SME panel	1 week	
21	Delphi Survey A03: Feedback from SME panel	1 week	
22	Delphi Survey A03:Survey data analysis	1 week	If the results are acceptable, produce the final version of Tasks A10 through A13. If results are not acceptable, then repeat the process.
23	**Create A14**: Project Timeline	1 week	

24	Delphi Survey A04: Send to SME panel	1 week	
25	Delphi Survey A04: Feedback from SME panel	1 week	

Appendix B

Summary of B302 Course Re-Design Process

In Fall 2008, the B301 course went through a re-design process, in preparation for converting the course to an online course. The following key elements relate specifically to this project:

Team:

Two SMEs from the Business Management Department

Two IDEs from the Faculty Technology Center

One technology student assistant

Steps completed:

Analyze. Completed a phase substantially similar to the Analyze phase described by Gagne, Wager, Golas, and Keller (2005). Steps were not formally documented by the university team, but rather were 'checked off' on a task management sheet. Informal notes on progress were kept by the IDE in charge of the project. These notes were inserted into a project binder kept by the IDE.

Design. Work was completed primarily by one SME and one IDE working together. Design work related to content was checked periodically by the other SME.

Develop. Development work was done mainly by a single SME. Course materials and redesigned activities were field tested in a single section of B301 during Fall semester of 2008.

Implement. Course was implemented in Winter 2009 semester.

Evaluate. Feedback was collected from SMEs and IDEs during the Design and Develop phases. Feedback from students was collected during the field test conducted in Fall 2008. During the first semester of implementation, Winter 2009, student feedback was collected. Numerous changes were made to the course content and structure as a result of this feedback.

Documentation:

The Faculty Technology Center published a process complete with project checklists and process documentation. These materials are contained in a physical binder. Notes and data related to this specific project were placed in the binder. Other notes and documentation were kept online as part of the development process. The materials are all stored in the Faculty Technology Center offices on campus.

Appendix C1

The following survey was administered to a group of SMEs via an online Google Document™ form (see Appendix C6). Each SME received copies of the appropriate sections of the Analyze phase document prior to responding to the survey. The online survey was worded exactly as presented here:

Delphi Survey A01
ADDIE Analyze Phase
Task A01 - A03: Rationale/Goal/Objectives

1. Carefully review the documents attached related to the project's rationale, the goal, and the objectives.
2. Mark the rating that most represents your expert evaluation for each item in the survey based on the following:
   1—Strongly Disagree
   2—Disagree
   3—Agree
   4—Strongly Agree
3. Please complete the survey within three days.

Item	**Strongly Disagree 1**	**Disagree 2**	**Agree 3**	**Strongly Agree 4**
Project Rationale:				
1. The benefit of this project to the institution or organization is clearly stated.				
2. The benefit of this project to the targeted learners is clearly stated.				
3. The need for this project is clearly stated.				
4. The geographical scope for this project is clearly stated.				
5. The project's subject matter is clearly stated.				
6. The project's approach to the problem is clearly stated.				
7. The project's expected outcome is clearly stated.				
Project Goal(s):				
8. The goal(s) of this project is clearly stated.				
9. The goal(s) of this project states what the project is to accomplish.				
10. The goal(s) of this project clearly indicates how the success will be indicated.				
11. The goal(s) of this project appears to be achievable				

Item	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
12. The goal(s) of this project appears to be significant to the field of knowledge indicated by the rationale.				
13. The goal(s) of this project appears to be measurable.				
14. Considering the target population, the goal(s) of this project appears to be realistic.				
15. The outcomes of the project appear to be obtainable.				
Project Objectives:				
16. Each objective of this project module is aligned to the goal statement.				
17. Each objective of this project module contains a behavior/action verb that is measureable.				
18. Each objective of this project module has an identified audience.				
19. Each objective of this project module contains a degree/constraint that is clearly stated.				
20. Each objective of this project module contains a condition/situation that is clearly stated.				
21. Each objective of this project is aligned to the identified audience.				

Appendix C2

The following survey was administered to a group of SMEs via an online Google Document™ form. Each SME received copies of the appropriate sections of the Analyze phase document prior to responding to the survey. The online survey was worded exactly as presented here:

Delphi Survey A02
ADDIE Analyze Phase
Task A04 – A07: Concept Map/Learning Influence/ Learning Outcome/Learning Hierarchy

1. Carefully review the documents attached related to the project's rationale, the goal, and the objectives.
2. Mark the rating that <u>most</u> represents your expert evaluation for each item in the survey based on the following:
   1—Strongly Disagree
   2—Disagree
   3—Agree
   4—Strongly Agree
3. Please complete the survey within three days.

Item	**Strongly Disagree 1**	**Disagree 2**	**Agree 3**	**Strongly Agree 4**
Concept Map document (Task A04):				
1. It appears the concept map accurately presents each goal of the project. (Refer to Task A02 for the goal(s), if needed.)				
2. It appears the concept map accurately presents each of the primary objectives. (Refer to Task A03 for the objectives, if needed.)				
3. Using the project goal(s) and the project objectives [Task A02 and Task A03] as references, it appears the concept map accurately links each goal with its corresponding primary objective(s).				
4. Using the project objectives as reference, it appears the concept map accurately presents each of the secondary objectives.				
5. Using the project objectives as reference, it appears the concept map accurately links each of the secondary objectives to its corresponding primary objective.				

Item	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
6. The total concept map presents an accurate depiction of the project.				
7. The total concept map displays appropriate linkages among all elements.				
Learner Influence document (Task A05):				
8. There is an accurate description for gaining the learner's attention within each RLO/Module.				
9. There is an accurate description for maintaining the learner's attention within each RLO/Module.				
10. There is an accurate description for assessing the learner's satisfaction within the instruction for each RLO/Module.				
11. There is an accurate description of how each RLO will include a focus on specific learner capabilities.				
12. There is an accurate description of how each RLO will stimulate the learner's prerequisite knowledge (or skills).				
13. There is an accurate description of how each RLO will accommodate identified learner disabilities.				
14. There is an accurate description of how each RLO will respond to a participant's particular learning traits.				
Learning Outcome document (Task A06):				
15. There is an accurate description of the short-term learning effect for each of the objectives for each RLO.				
16. There is an accurate description of the long-term learning effect for each of the objectives for each RLO.				
17. There is an accurate description of how the learner is expected to change as a result of each objective.				
18. There is an accurate description of what is expected to change as a result of the instruction.				
Learning Hierarchy Statement (Task A07):				
19. The essential prerequisite learner knowledge/skills to achieve the objectives are identified.				
20. The hierarchal map provides accurate graphical representation of the prerequisite knowledge/skills the learner is to achieve before commencing work on this project's objectives.				

Appendix C3

The following survey was administered to a group of SMEs via an online Google Document™ form. Each SME received copies of the appropriate sections of the Analyze phase document prior to responding to the survey. The online survey was worded exactly as presented here:

Delphi Survey A03
ADDIE Analyze Phase
Task A08 – A11: Learner Characteristics/Target Audience/Learner Constraints/ Pedagogical Considerations

1. Carefully review the documents attached related to the project's rationale, the goal, and the objectives.
2. Mark the rating that most represents your expert evaluation for each item in the survey based on the following:
   1—Strongly Disagree
   2—Disagree
   3—Agree
   4—Strongly Agree
3. Please complete the survey within three days.

Item	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
Learner Characteristics document (Task A08):				
1. It appears the general characteristics accurately describe the target population of the project.				
2. It appears the age range accurately represents the target population of the project				
3. It appears the gender distribution accurately represents the target population of the project				
4. It appears the ethnic/cultural distribution accurately represents the target population of the project				
5. It appears the language distribution accurately represents the target population of the project				
6. It appears the entry behavior is appropriate for the target population of the project				

Item	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
7. It appears the time frame for completion is reasonable for the target population of the project				
8. It appears the list of prior knowledge needed for completion of the project is complete.				
9. It appears the statement of prerequisite cognitive skills for completion of the project is complete.				
10. It appears the statement of prerequisite motor skills for completion of the project is complete.				
Target Audience document (Task A09):				
11. It appears the description of the learners accurately represents the target population of the project.				
12. It appears the description of the location accurately represents the intent of the project.				
13. It appears the description of the time allotment for assessment and instruction accurately represents the intent of the project.				
Learner Constraints document (Task A10):				
14. It appears the learner constraints have been reasonably addressed for the target population of the project.				
15. It appears the learner constraints regarding ADA considerations have been reasonably addressed for the target population of the project.				
16. It appears the learner constraints regarding network software have been reasonably addressed for the target population of the project.				
Pedagogical Considerations document (Task A11):				
17. It appears that the Pedagogical Considerations Statement has addressed issues regarding instructional sequencing.				
18. It appears that the Pedagogical Considerations Statement has addressed issues regarding instructional motivation.				
19. It appears that the Pedagogical Considerations Statement has addressed issues student-centered learning.				
20. It appears that the Pedagogical Considerations Statement has addressed issues regarding use of an advance organizer or some system to clarify the instructional goals and objectives of the project/				

Appendix C4

The following survey was administered to a group of SMEs via an online Google Document™ form. Each SME received copies of the appropriate sections of the Analyze phase document prior to responding to the survey. The online survey was worded exactly as presented here:

Delphi Survey A04
ADDIE Analyze Phase
Task A12 & A13: Learning Environment/Delivery Options

1. Carefully review the documents attached related to the project's rationale, the goal, and the objectives.
2. Mark the rating that most represents your expert evaluation for each item in the survey based on the following:
   1—Strongly Disagree
   2—Disagree
   3—Agree
   4—Strongly Agree
3. Please complete the survey within three days.

Item	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
Learning Environment Statement (Task A12):				
1. It appears the specific hardware requirements have been accurately described for the project.				
2. It appears the specific requirements to navigate the content materials have been accurately described for the project.				
3. It appears the specific software requirements have been accurately described for the project.				
4. It appears the specific learner requirements have been accurately described for the project.				
5. It appears the specific learner requirements for students with physical disabilities have been accurately described for the project.				
6. It appears the specific learner requirements for students with English as a second language have been accurately described for the project.				
7. It appears the specific learner requirements for students with cognitive disabilities have been accurately described for the project.				

Delivery Options Statement (Task A13):				
8. 8. It appears the specific delivery plan for content assignments has been accurately described for the project.				
9. 9. It appears the specific delivery plan for content activities has been accurately described for the project.				
10. 10. It appears the specific delivery plan for content assessments has been accurately described for the project.				
11. 11. It appears the specific delivery plan for content assessment feedback has been accurately described for the project.				
12. 12. It appears the specific delivery plan for student-to-instructor communication has been accurately described for the project.				

Appendix C5

The following survey was administered to a group of IDEs via an online Google Document™ form. Each IDE received copies of the appropriate sections of the Analyze phase document prior to responding to the survey. The online survey was worded exactly as presented here:

Delphi Survey A05
ADDIE Analyze Phase
Task A14: Project Timeline

1. Carefully review the documents attached related to the project's rationale, the goal, and the objectives.
2. Mark the rating that most represents your expert evaluation for each item in the survey based on the following:
   1—Strongly Disagree
   2—Disagree
   3—Agree
   4—Strongly Agree
3. Please complete the survey within three days.

Item	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
Project Timeline Statement (Task A14):				
1. It appears the project timeline addresses the tasks with a reasonable time for creation of materials for the project. (weeks/days)				
2. It appears the project timeline addresses the appropriate amount of time for Delphi01 solicitation and feedback. (weeks/days)				
3. It appears the project timeline addresses the appropriate amount of time for Delphi01 data analysis and feedback to the panel members. (weeks/days)				
4. It appears the project timeline addresses the appropriate amount of time for Delphi02 solicitation and feedback. (weeks/days)				
5. It appears the project timeline addresses the appropriate amount of time for Delphi02 data analysis and feedback to the panel members. (weeks/days)				
6. It appears the project timeline addresses the appropriate amount of time for Delphi03 solicitation and feedback. (wkees/days)				
7. It appears the project timeline addresses the appropriate amount of time for Delphi03 data analysis and feedback to the panel members. (weeks/days)				
8. It appears the project timeline addresses the appropriate amount of time for Delphi04 solicitation and feedback. (weeks/days)				

9. It appears the project timeline addresses the appropriate amount of time for Delphi04 data analysis and feedback to the panel members. (weeks/days)				

Appendix C6

Delphi Surveys A01-A05: Online Google Document™ Forms

The following are the online forms used to present Delphi surveys A01-A05. The surveys are worded in exactly the same manner as those found in Appendices C1-C5 but differ slightly in format. Use of the online Google Document™ forms allowed the researcher to collect data directly to a spreadsheet.

Delphi Survey A01--Tasks A01-A03 (Rationale/Goal/Objectives)

1--Carefully review the documents you were given labeled as "Delphi Survey A01--Tasks A01-A03 Rationale/Goal/Objectives."

2--Mark the rating that MOST represents your expert evaluation for each item using the following scale:

1=Strongly Disagree
2=Disagree
3=Agree
4=Strongly Agree

3--Please complete this survey within three days.

---

* Required

Rationale * The benefit of this project to the institution is clearly stated

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Rationale * The benefit of this project to the targeted learners is clearly stated

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Rationale * The need for this project is clearly stated

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Rationale * The geographical scope for this project is clearly stated

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Rationale * The project's subject matter is clearly stated

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Rationale * The project's approach to the problem is clearly stated

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Rationale * The project's expected outcome is clearly stated

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Goals * The goal(s) of this project is clearly stated

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Goals * The goal(s) of this project states what the project is to accomplish

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Goals * The goal(s) of this project clearly states how success will be indicated

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Goals * The goal(s) of this project appears to be achievable

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Goals * The goal(s) of this project appears to significant to the field of knowledge indicated by the rationale

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Goals * The goal(s) of this project appears to be measurable

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Goals * Considering the target population, the goal(s) of this project appears to be realistic

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Goals * The outcomes of the project appear to be obtainable

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Objectives * Each objective of the project is aligned to the goal statement

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Objectives * Each objective of the project contains a behavior/action verb that is measurable

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Objectives * Each objective of the project has an identified audience

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Objectives * Each objective of the project contains a degree/constraint that is clearly stated

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Objectives * Each objective of the project is aligned to the identified audience

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

0

Submit

Delphi Survey A02--Tasks A04-A07--Concept Map/Learning Influences/Learning Outcomes/Learning Hierarchy

1--Carefully review the documents you were given related to the project's concept map, learning influences, learning outcomes, and learning hierarchy.
2--Mark the rating that MOST closely represents your expert evaluation of each item on the survey, based on the following scale:

1--Strongly Disagree
2--Disagree
3--Agree
4--Strongly Agree

3--Please complete this survey within the next three days.

---

* Required

Concept Map * It appears that the concept map accurately presents each goal of the project (refer to Task A02 for the goal(s), if needed)

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Concept Map * It appears that the concept map accurately presents each of the primary objectives (refer to Task A03 for the objectives, if needed)

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Concept Map * Using the project goal(s) and the project objectives (Task A02 and Task A03) as references, it appears the concept map accurately links each goal with its corresponding primary objective(s)

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Concept Map * Using the project objectives as a reference, it appears the concept map accurately presents each of the secondary objectives

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Concept Map * Using the project objectives as a reference, it appears the concept map accurately links each of the secondary objectives to its corresponding primary objective

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Concept Map * The total concept map presents an accurate depiction of the project

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Concept Map * The total concept map displays appropriate linkages among all elements

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Learner Influence Document * There is an accurate description for gaining the learner's attention within each RLO

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Learner Influence Document * There is an accurate description for maintaining the learner's attention within each RLO

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Learner Influence Document * There is an accurate description for assessing the learner's satisfaction within the instruction fo reach RLO

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Learner Influence Document * There is an accurate description of how each RLO will include a focus on specific learner capabilities

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Learner Influence Document * There is an accurate description of how each RLO will stimulate the learner's prerequisite knowledge (or skills)

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Learner Influence Document * There is an accurate description of how each RLO will accommodate identified learner disabilities

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

Learner Influence Document * There is an accurate description of how each RLO will respond to a participant's particular learning traits

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

Learner Outcome Document * There is an accurate description of the short-term learningn effect for each of the objectives for each RLO

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

Learner Outcome Document * There is an accurate description of the long-term learningn effect for each of the objectives for each RLO

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

Learner Outcome Document * There is an accurate description of how the learner is expected to change as a result of each objective

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

Learner Outcome Document * There is an accurate description of what is expected to change as a result of the instruction

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

Learning Hierarchy Statement * The essential prerequisite learner knowledge/skills to achieve the objectives are identified

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

Learning Hierarchy Statement * The hierarchal map provides accurate graphical representation of the prerequisite knowledge/skills the learner is to achieve before commencing work on this project's objectives

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

0

Submit

Delphi Survey A03--Tasks A08-A11--Learner Characteristics/Target Audience/Learner Constraints/Pedagogical Considerations

1--Carefully review the documents attached related to the project's targeted learner characteristics, audience, constraints, and pedagogical considerations.
2--Mark the rating that MOST represents your expert evaluation for each item in the survey based on the following:

1--Strongly Disagree
2--Disagree
3--Agree
4--Strongly Agree

3--Please complete this survey within three days.

---

* Required

Learner Characteristics Document * It appears the general characteristics accurately describe the target population of the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Learner Characteristics Document * It appears the age range accurately represents the target population of the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Learner Characteristics Document * It appears the gender distribution accurately represents the target population of the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Learner Characteristics Document * It appears the ethnic/cultural distribution accurately represents the target population of the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Learner Characteristics Document * It appears the language distribution accurately represents the target population of the project

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Learner Characteristics Document * It appears the entry behavior is appropriate for the target population of the project

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Learner Characteristics Document * It appears the time frame for completion is reasonable for the target population of the project

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Learner Characteristics Document * It appears the list of prior knowledge needed for completion of the project is complete

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Learner Characteristics Document * It appears the statement of prerequisite cognitive skills for completion of the project is complete

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Learner Characteristics Document * It appears the statement of prerequisite motor skills for completion of the project is complete

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Target Audience Document * It appears the description of the learners accurately represents the target population of the project

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Target Audience Document * It appears the description of the location accurately represents intent of the project

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Target Audience Document * It appears the description of the time allotment for assessment and instruction accurately represents intent of the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Learner Constraints Document * It appears the learner constraints have been reasonably addressed for the target population of the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Learner Constraints Document * It appears the learner constraints regarding ADA considerations have been reasonably addressed for the target population of the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Learner Constraints Document * It appears the learner constraints regarding computers and Internet technology have been reasonably addressed for the target population of the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Pedagogical Considerations Document * It appears the pedagogical considerations statement has addressed issues regarding instructional sequencing

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Pedagogical Considerations Document * It appears the pedagogical considerations statement has addressed issues regarding instructional motivation

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Pedagogical Considerations Document * It appears the pedagogical considerations statement has addressed issues regarding student-centered learning

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Pedagogical Considerations Document * It appears the pedagogical considerations statement has addressed issues regarding use of an advance organizer or some system to clarify the instructional goals and objectives of the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

0

Submit

Delphi Survey A04--Tasks A12-A13--Learning Environment/Delivery Options

1--Carefully review the documents attached related to the project's learning environment and delivery options.
2--Mark the rating that MOST represents your expert evaluation for each item in the survey based on the following:

1--Strongly Disagree
2--Disagree
3--Agree
4--Strongly Agree

3--Please complete this survey within three days.

---

* Required

Learning Environment Statement * It appears the specific hardware requirements have been accurately described for the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Learning Environment Statement * It appears the specific requirements to navigate the content materials have been accurately described for the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Learning Environment Statement * It appears the specific software requirements have been accurately described for the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Learning Environment Statement * It appears the specific learner requirements have been accurately described for the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Learning Environment Statement * It appears the specific learner requirements for students with physical disabilities have been accurately described for the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Learning Environment Statement * It appears the specific learner requirements for students with English as a second language have been accurately described for the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Learning Environment Statement * It appears the specific learner requirements for students with cognitive disabilities have been accurately described for the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Delivery Options Statement * It appears the specific delivery plan for content assignments has been accurately described for the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Delivery Options Statement * It appears the specific delivery plan for content activities has been accurately described for the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Delivery Options Statement * It appears the specific delivery plan for content assessments has been accurately described for the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Delivery Options Statement * It appears the specific delivery plan for content assessment feedback has been accurately described for the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Delivery Options Statement * It appears the specific delivery plan for student-to-instructor communication has been accurately described for the project

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

0	

Submit

Delphi Survey A05--Task A14--Project Timeline

1--Carefully review the documents attached related to the project timeline.
2--Mark the rating that MOST represents your expert evaluation for each item in the survey based on the following:

1--Strongly Disagree
2--Disagree
3--Agree
4--Strongly Agree

3--Please complete this survey within three days.

---

* Required

Project Timeline Statement * It appears the project timeline addresses the tasks with a reasonable time for creation of materials for the project (weeks/days)

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Project Timeline Statement * It appears the project timeline addresses the approprite amount of time for Delphi A01 solicitation and feedback (weeks/days)

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Project Timeline Statement * It appears the project timeline addresses the approprite amount of time for Delphi A01 data analysis and feedback to the panel members (weeks/days)

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Project Timeline Statement * It appears the project timeline addresses the approprite amount of time for Delphi A02 solicitation and feedback to the panel members (weeks/days)

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Project Timeline Statement * It appears the project timeline addresses the approprite amount of time for Delphi A02 data analysis and feedback to the panel members (weeks/days)

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Project Timeline Statement * It appears the project timeline addresses the approprite amount of time for Delphi A03 solicitation and feedback to the panel members (weeks/days)

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Project Timeline Statement * It appears the project timeline addresses the approprite amount of time for Delphi A03 data analysis and feedback to the panel members (weeks/days)

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Project Timeline Statement * It appears the project timeline addresses the approprite amount of time for Delphi A04 solicitation and feedback to the panel members (weeks/days)

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

Project Timeline Statement * It appears the project timeline addresses the approprite amount of time for Delphi A04 data analysis and feedback to the panel members (weeks/days)

1 2 3 4

Strongly Disagree ○ ○ ○ ○ Strongly Agree

0

Submit

Appendix C7

Analyze Phase Tasks A01-A14 Delphi Survey Results

Tasks A01 through A14 of the Analyze phase were evaluated by three SMEs. Their feedback was gathered via a series of five Delphi surveys (see Appendices C1-C6). Items with a mean score of less than 3.0 (out of a total of 4.0) were considered as candidates for improvement. Recommended changes were made to any items that scored less than 3.0. The data collected from the surveys resulted in several modifications to Tasks A01 through A14. Survey data and the resulting changes to the Analyze phase documentation are presented here.

Delphi Survey A01 (Tasks A01-A03: Rationale, Goal, Objectives). All but two of the survey questions received mean scores of 4.0. Two items received mean scores of 3.67. Since no items received mean scores less than 3.0, no changes were made to any of the documentation for Analyze Phase tasks A01, A02, or A03.

Table X (number?). Delphi Survey 01 Descriptive Statistics.

	Iteration 1				**Iteration 2**			
Item	**Mean**	**Median**	**Mode**	**SD**	**Mean**	**Median**	**Mode**	**SD**
1	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
2	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
3	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
4	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
5	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
6	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
7	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A

8	3.67	4.00	4.00	0.58	N/A	N/A	N/A	N/A
9	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
10	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
11	3.67	4.00	4.00	0.58	N/A	N/A	N/A	N/A
12	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
13	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
14	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
15	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
16	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
17	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
18	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
19	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
20	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
21	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A

Changes made to Tasks A01-A03 as a result of Delphi Survey 01. No changes were made to the documentation produced for Tasks A01, A02, or A03.

Delphi Survey A02 (Tasks A04-A07:Concept Map, Learning Influence, Learning Outcome, Learning Hierarchy). All but two of the survey questions received mean scores greater than 3.0 (see Table X for descriptive statistics). Two items received mean scores of 2.33. The two items that received mean scores less than 3.0 resulted in changes made to the Concept Map documentation for Analyze Phase Task A04.

Table X (number?). Delphi Survey 02 Descriptive Statistics.

	Iteration 1				Iteration 2			
Item	**Mean**	**Median**	**Mode**	**SD**	**Mean**	**Median**	**Mode**	**SD**
1	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
2	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
3	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
4	2.33	2.00	N/A	1.53	3.67	4.00	4.00	0.58
5	2.33	2.00	N/A	1.53	4.00	4.00	4.00	0.00
6	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
7	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
8	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
9	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
10	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
11	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
12	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
13	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
14	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
15	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
16	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
17	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
18	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
19	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
20	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00

CHANGES: The SMEs indicated that the Concept Map did not present the reader with any information regarding secondary learning objectives. Item 4 in the survey received a mean score of 2.33 from the SMEs. Further feedback from the SMEs showed that the Concept Map simply was inadequate in its construct; it did not explain the secondary objectives to reader in a way that was easily understood. The researcher created a new concept map that identified both primary and secondary objectives. After this change was made to the concept map, the survey was taken again by the SMEs. Iteration 2 of the survey resulted in a mean score of 3.67 for item number 4, indicating that the SMEs were in agreement that the secondary objectives were now clearly identified.

Item number 5 of the survey received a mean score of 2.33, indicating that the SMEs did not agree that the concept map demonstrated a linkage between the primary and secondary learning objectives. The researcher created these links in the new version of the concept map that he built to address problems identified in item number 4. Iteration 2 of the survey resulted in a mean score of 4.00 for item number 5, indicating that the SMEs were in agreement that the secondary objectives were now clearly linked to the primary objectives on the concept map.

Delphi Survey A03 (Tasks A08-A11:Learner Characteristics, Target Audience, Learner Constraints, Pedagogical Considerations). All but one of the survey questions received mean scores equal to 4.0. One item (item number 15) received a mean score of 3.33. Since no items received mean scores less than 3.0 no changes were made to the documentation for Analyze Phase Tasks A08-A11.

	Iteration 1				Iteration 2			
Item	**Mean**	**Median**	**Mode**	**SD**	**Mean**	**Median**	**Mode**	**SD**
1	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
2	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
3	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
4	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
5	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
6	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
7	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
8	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
9	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
10	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
11	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
12	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
13	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
14	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
15	3.33	4.00	4.00	1.15	N/A	N/A	N/A	N/A
16	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
17	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
18	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
19	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
20	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A

Delphi Survey A04 (Tasks A12-A13:Learning Environment, Delivery Options). All but one of the survey questions received a mean score of 3.0 or greater. One item received a mean scores of 2.67. The item that received a mean score of less than 3.0 resulted in changes to the documentation for Analyze Phase Task A12. On this item, the SMEs indicated that specific learner requirements for students with cognitive disabilities had not been accurately described for the project. Changes: A clarifying statement was added to Learning Environment Task A12, indicating that the students would be expected to utilize existing University resources to help students with cognitive disabilities (the Student Learning Center and the Center for Students with Disabilities).

	Iteration 1				**Iteration 2**			
Item	**Mean**	**Median**	**Mode**	**SD**	**Mean**	**Median**	**Mode**	**SD**
1	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
2	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
3	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
4	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
5	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
6	3.00	3.00	N/A	1.00	3.00	3.00	N/A	1.00
7	2.67	3.00	3.00	0.58	4.00	4.00	4.00	0.00
8	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
9	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
10	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
11	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
12	3.67	4.00	4.00	0.00	3.67	4.00	4.00	0.00

Delphi Survey A05 (Task A14: Project Timeline). All of the survey questions received mean scores greater than 3.0. No changes were recommended by the IDEs for Task A14.

	Iteration 1				Iteration 2			
Item	**Mean**	**Median**	**Mode**	**SD**	**Mean**	**Median**	**Mode**	**SD**
1	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
2	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
3	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
4	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
5	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
6	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
7	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
8	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
9	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
10	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
11	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
12	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A

Appendix D1

Task Analysis (Task D01)

Task Analysis
Type of task: □ Procedural √ Learning
Page: __1__ of __4__ Date: ___Dec_26_2011_____

Task	Value of Task Characteristics (**H**igh,**M**edium,**L**ow)					**Environmental Factors (Y/N)**			**Domain (Select from below)**				**Is there a pre-requisite task required?**		**Is the task required?**		
NPV Content Knowledge RLO: Objective: Given a specific word problem simulating a real-life capital budgeting situation, the learner will calculate the answers to an NPV problem using a set of algebraic expressions, a financial calculator, or an Excel spreadsheet at the criterion level of 70 percent.	**Importance**	**Difficulty**	**Frequency**	**Consequences**	**Duration**	**Time Constraint**	**Additional Equipment**	**Physical Conditions?**	**Cognitive**	**Motor**	**Affective**	**Motivation**	Yes	No	**Yes**	**No**	**Maybe**
1. Read assigned material online (advance organizer)	H	M	L	M	M	N	N	N	X					X	X		
2. View case study video (attention)	H	M	M	M	M	N	N	N	X				X		X		
3. Respond to online question: "Should you invest?" (attention)	M	L	L	L	L	Y	N	N	X				X		X		
4. View video on goals/objectives (objectives)	H	M	M	M	M	N	N	N	X				X		X		
5. View video on prior concepts (prior learning)	H	M	M	M	M	N	N	N	X				X		X		
6. View video on content NPV	H	M	M	M	M	N	N	N	X				X		X		

definition (content)																	
7. View video on NPV example (guidance)	H	M	M	M	M	N	N	N	X				X		X		
8. View video on NPV calculation methods (content)	H	M	M	M	M	N	N	N	X				X		X		
9. View video on NPV calculation example (guidance)	H	M	M	M	M	N	N	N	X				X		X		
10. Complete online homework problems (practice)	H	M	L	H	M	Y	N	N	X				X		X		
11. Review appropriate levels of feedback on graded practice problems and complete necessary additional attempts (feedback)	H	M	M	H	M	Y	N	N	X				X		X		
12. Complete online Quiz (assessment)	H	M	L	H	M	Y	N	N	X				X		X		
13. View concluding video (retention)	H	M	L	H	M	Y	N	N	X				X		X		

Task Analysis
Type of task: □ Procedural √ Learning
Page: __2__ of __4__ Date: ___Dec_26_2011_____

Task	Value of Task Characteristics (**H**igh,**M**edium,**L**ow)					**Environmental Factors (Y/N)**			**Domain (Select from below)**				**Is there a pre-requisite task required?**		**Is the task required?**		
IRR Content Knowledge RLO: Objective: Given a specific word problem simulating a real-life capital budgeting situation, the learner will calculate the answers to an IRR problem using a set of algebraic expressions, a financial calculator, or an Excel spreadsheet at the criterion level of 70 percent.	**Importance**	**Difficulty**	**Frequency**	**Consequences**	**Duration**	**Time Constraint**	**Additional Equipment**	**Physical Conditions?**	**Cognitive**	**Motor**	**Affective**	**Motivation**	Yes	No	**Yes**	**No**	**Maybe**
1. Read assigned material online (advance organizer)	H	M	L	M	M	N	N	N	X					X	X		
2. View case study video (attention)	H	M	M	M	M	N	N	N	X				X		X		
3. Respond to online question: "Should you invest?" (attention)	M	L	L	L	L	Y	N	N	X				X		X		
4. View video on goals/objectives (objectives)	H	M	M	M	M	N	N	N	X				X		X		
5. View video on prior concepts (prior learning)	H	M	M	M	M	N	N	N	X				X		X		
6. View video on content IRR definition (content)	H	M	M	M	M	N	N	N	X				X		X		

7. View video on IRR example (guidance)	H	M	M	M	M	N	N	N	X				X		X		
8. View video on IRR calculation methods (content)	H	M	M	M	M	N	N	N	X				X		X		
9. View video on IRR calculation example (guidance)	H	M	M	M	M	N	N	N	X				X		X		
10. Complete online homework problems (practice)	H	M	L	H	M	Y	N	N	X				X		X		
11. Review appropriate levels of feedback on graded practice problems and complete necessary additional attempts (feedback)	H	M	M	H	M	Y	N	N	X				X		X		
12. Complete online Quiz (assessment)	H	M	L	H	M	Y	N	N	X				X		X		
13. View concluding video (retention)	H	M	L	H	M	Y	N	N	X				X		X		

Task Analysis
Type of task: □ Procedural √ Learning
Page: __3__ of __4__ Date: ___Dec_26_2011_____

Task	Value of Task Characteristics (**H**igh,**M**edium,**L**ow)					**Environmental Factors** **(Y/N)**			**Domain** **(Select from below)**				**Is there a pre-requisite task required?**		**Is the task required?**		
NPV Spreadsheet Model RLO: Objective: Given a specific word problem simulating a real-life capital budgeting situation, the learner will build a spreadsheet model that will calculate the project's NPV using an Excel spreadsheet at the criterion level of 70 percent.	**Importance**	**Difficulty**	**Frequency**	**Consequences**	**Duration**	**Time Constraint**	**Additional Equipment**	**Physical Conditions?**	**Cognitive**	**Motor**	**Affective**	**Motivation**	Yes	No	**Yes**	**No**	**Maybe**
1. Read assigned material online (advance organizer)	H	M	L	M	M	N	N	N	X					X	X		
2. View case study video (attention)	H	M	M	M	M	N	N	N	X				X		X		
3. Respond to online question: (attention)	M	L	L	L	L	Y	N	N	X				X		X		
4. View video on goals/objectives (objectives)	H	M	M	M	M	N	N	N	X				X		X		
5. View video on prior concepts (prior learning)	H	M	M	M	M	N	N	N	X				X		X		
6. View video on content cash flows for NPV(content)	H	M	M	M	M	N	N	N	X				X		X		
7. View video on cash flow example (guidance)	H	M	M	M	M	N	N	N	X				X		X		
8. View video on NPV function	H	M	M	M	M	N	N	N	X				X		X		

(content)																	
9. View video on sample spreadsheet example (guidance)	H	M	M	M	M	N	N	N	X				X		X		
10. Complete online homework –Build a Model (practice)	H	M	L	H	M	Y	N	N	X				X		X		
11. Review appropriate levels of feedback on graded practice problems and complete necessary additional attempts (feedback)	H	M	M	H	M	Y	N	N	X				X		X		
12. Submit NPV model (assessment)	H	M	L	H	M	Y	N	N	X				X		X		
13. View concluding video (retention)	H	M	L	H	M	Y	N	N	X				X		X		

Task Analysis
Type of task: □ Procedural √ Learning
Page: __4__ of __4__ Date: ___Dec_26_2011_____

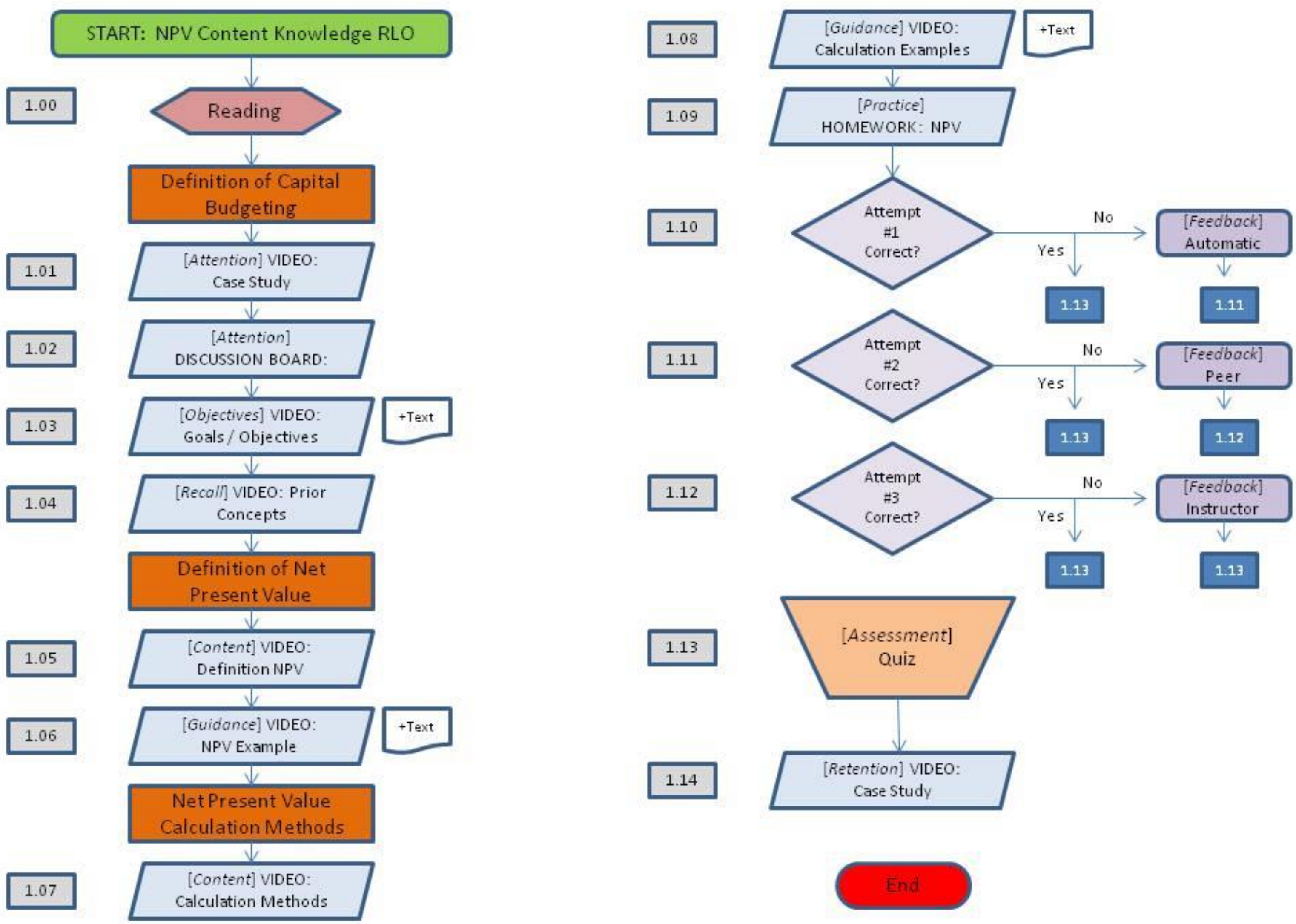
Task	Value of Task Characteristics (**H**igh,**M**edium,**L**ow)					**Environmental Factors (Y/N)**			**Domain (Select from below)**				**Is there a pre-requisite task required?**		**Is the task required?**		
IRR Spreadsheet Model RLO: Objective: Given a specific word problem simulating a real-life capital budgeting situation, the learner will build a spreadsheet model that will correctly calculate the project's IRR using an Excel spreadsheet at the criterion level of 70 percent.	**Importance**	**Difficulty**	**Frequency**	**Consequences**	**Duration**	**Time Constraint**	**Additional Equipment**	**Physical Conditions?**	**Cognitive**	**Motor**	**Affective**	**Motivation**	Yes	No	**Yes**	**No**	**Maybe**
1. Read assigned material online (advance organizer)	H	M	L	M	M	N	N	N	X					X	X		
2. View case study video (attention)	H	M	M	M	M	N	N	N	X				X		X		
3. Respond to online question: (attention)	M	L	L	L	L	Y	N	N	X				X		X		
4. View video on goals/objectives (objectives)	H	M	M	M	M	N	N	N	X				X		X		
5. View video on prior concepts (prior learning)	H	M	M	M	M	N	N	N	X				X		X		
6. View video on content cash flows for IRR(content)	H	M	M	M	M	N	N	N	X				X		X		
7. View video on cash flow example (guidance)	H	M	M	M	M	N	N	N	X				X		X		

8. View video on IRR function (content)	H	M	M	M	M	N	N	N	X				X		X		
9. View video on sample spreadsheet example (guidance)	H	M	M	M	M	N	N	N	X				X		X		
10. Complete online homework –Build a Model (practice)	H	M	L	H	M	Y	N	N	X				X		X		
11. Review appropriate levels of feedback on graded practice problems and complete necessary additional attempts (feedback)	H	M	M	H	M	Y	N	N	X				X		X		
12. Submit IRR model (assessment)	H	M	L	H	M	Y	N	N	X				X		X		
13. View concluding video (retention)	H	M	L	H	M	Y	N	N	X				X		X		

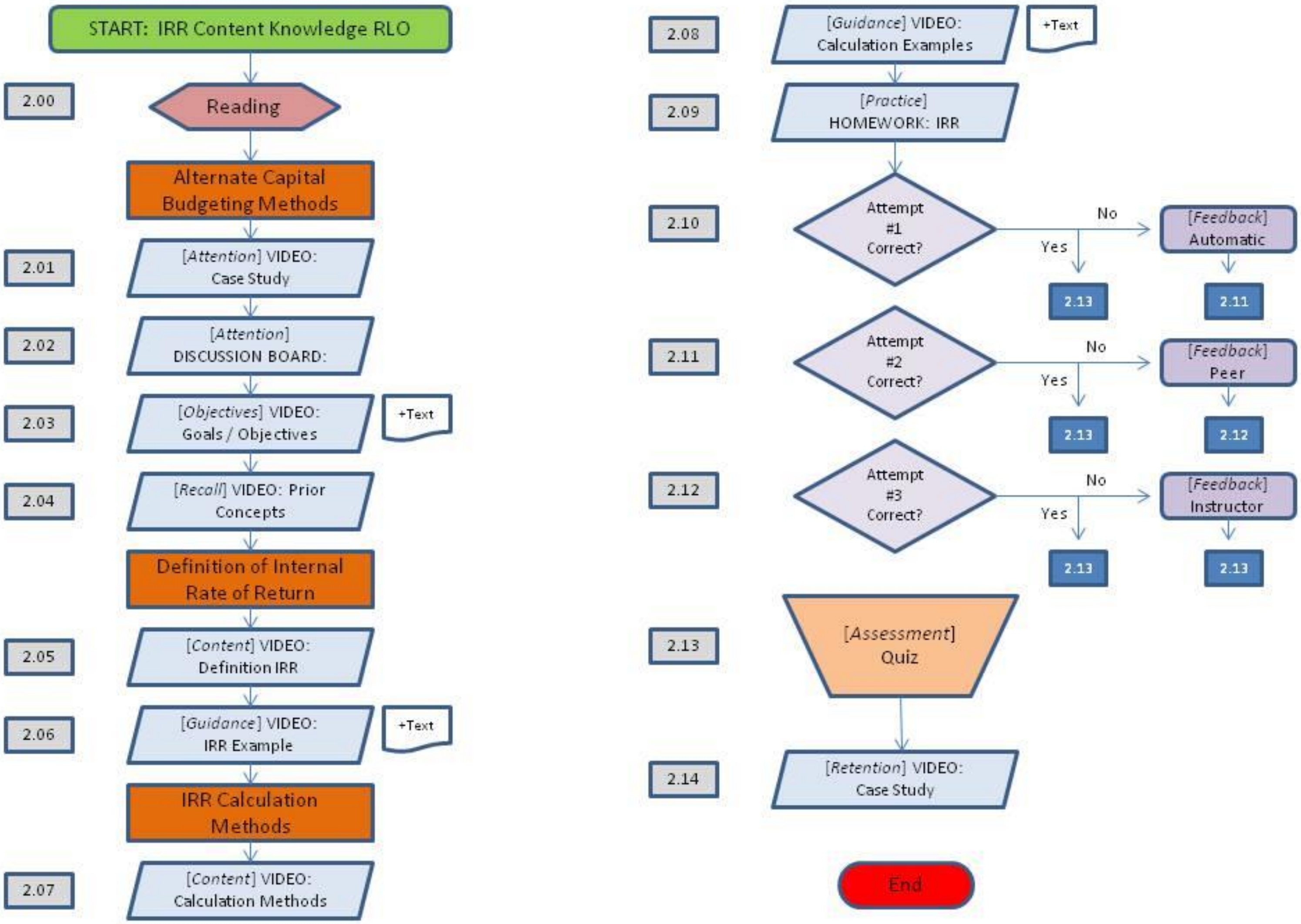
Appendix D2

Flowcharts (Task D02)

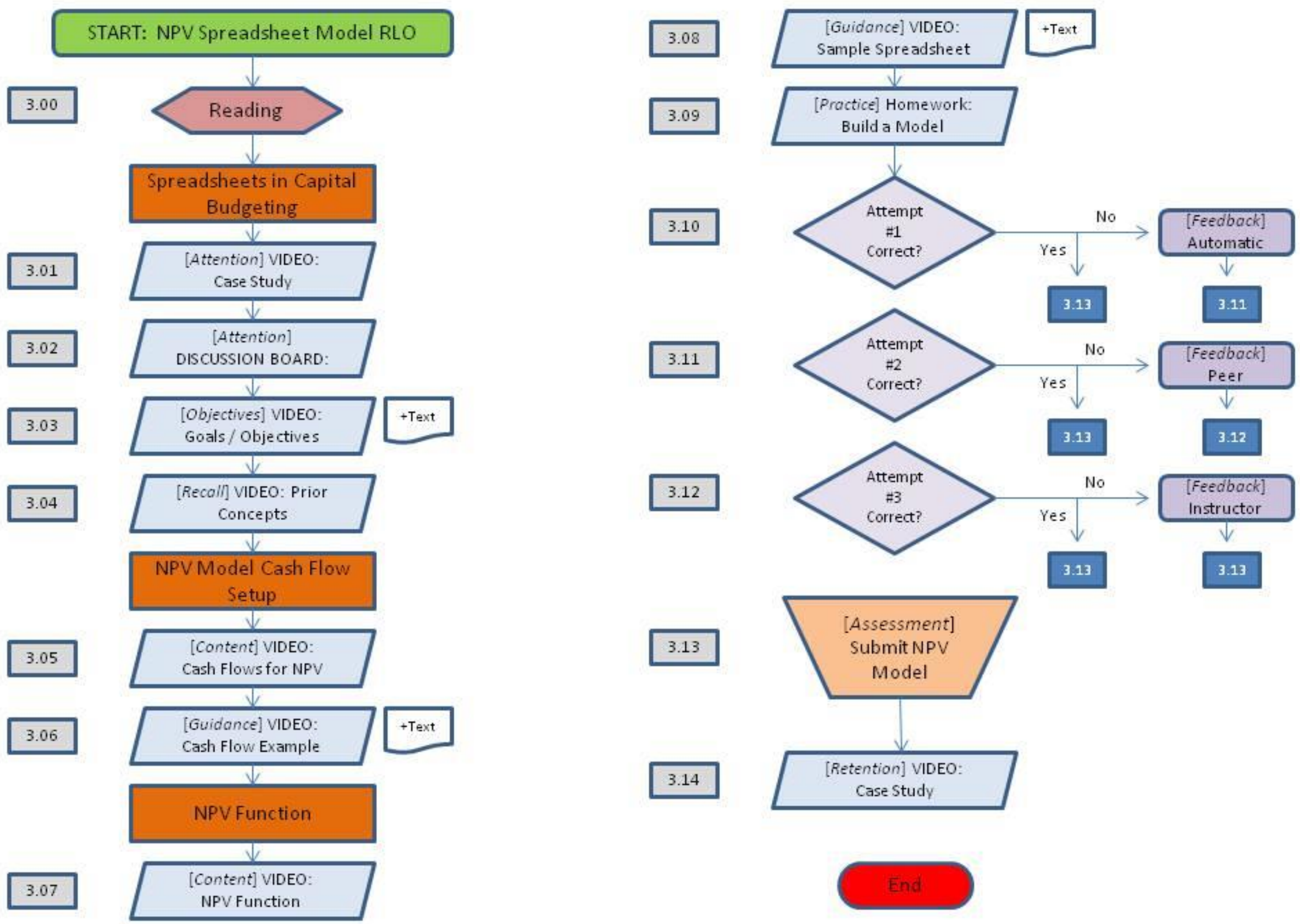
NPV Content RLO Flowchart



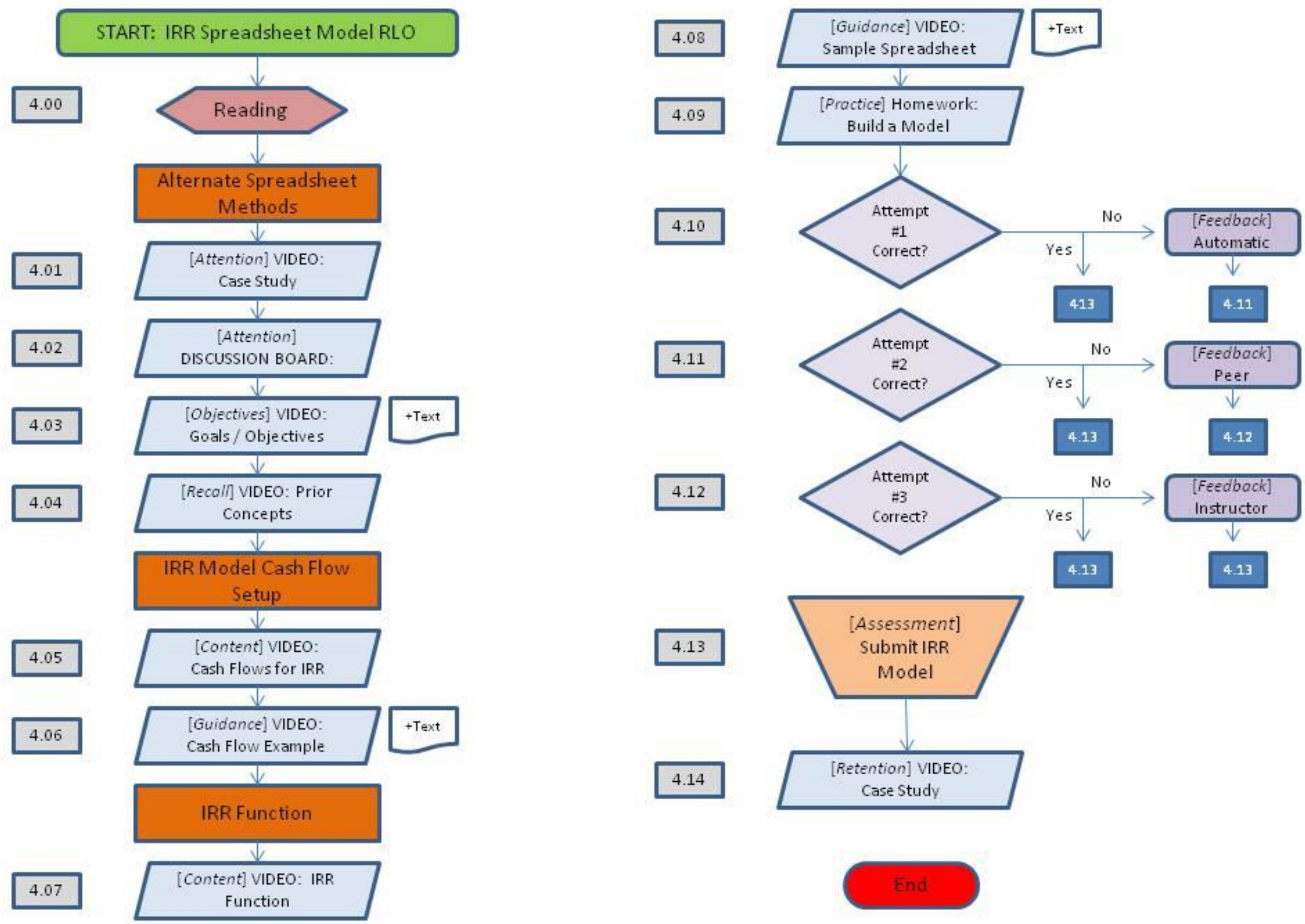
IRR Content RLO Flowchart



NPV Spreadsheet RLO Flowchart



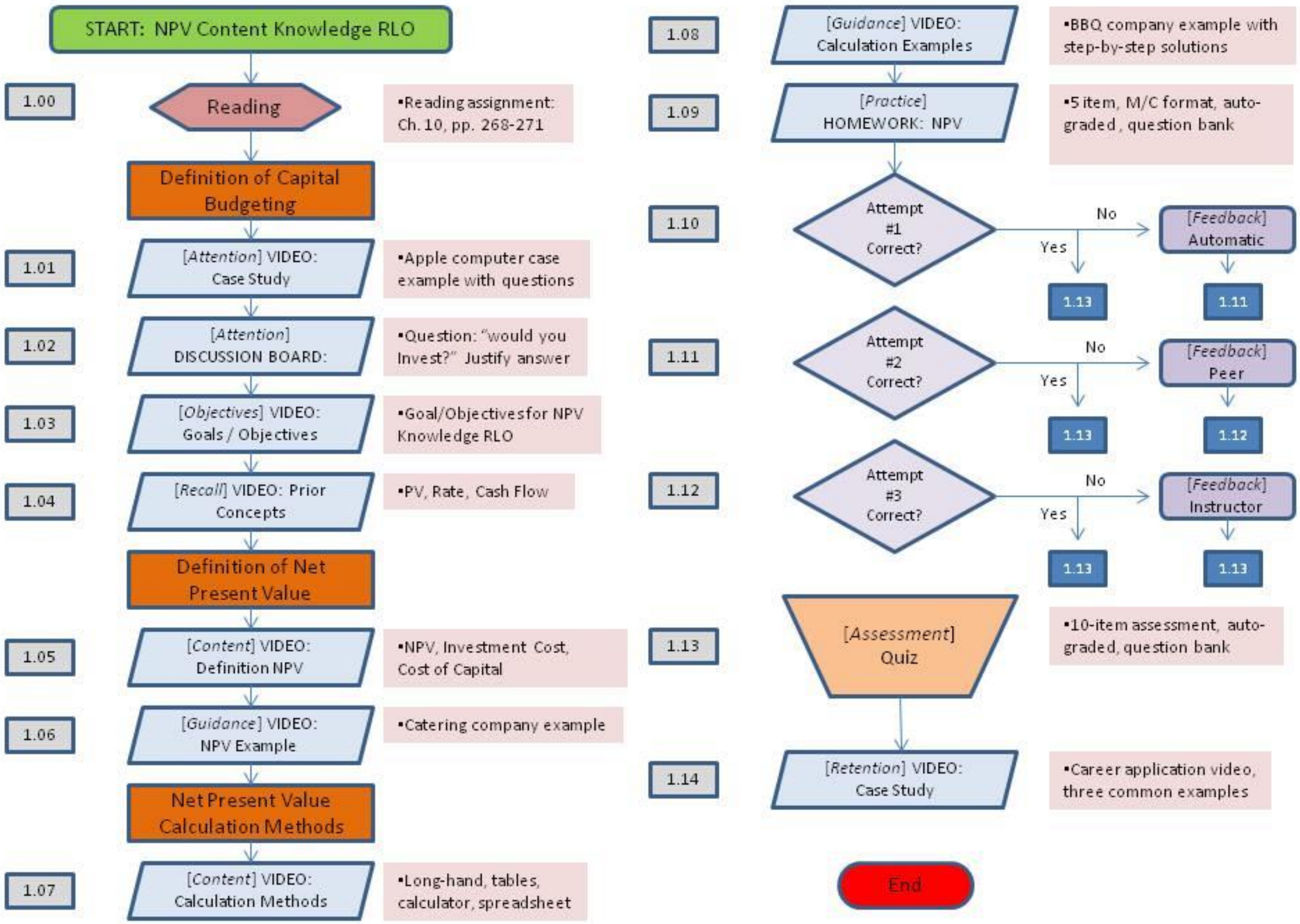
IRR Spreadsheet RLO Flowchart



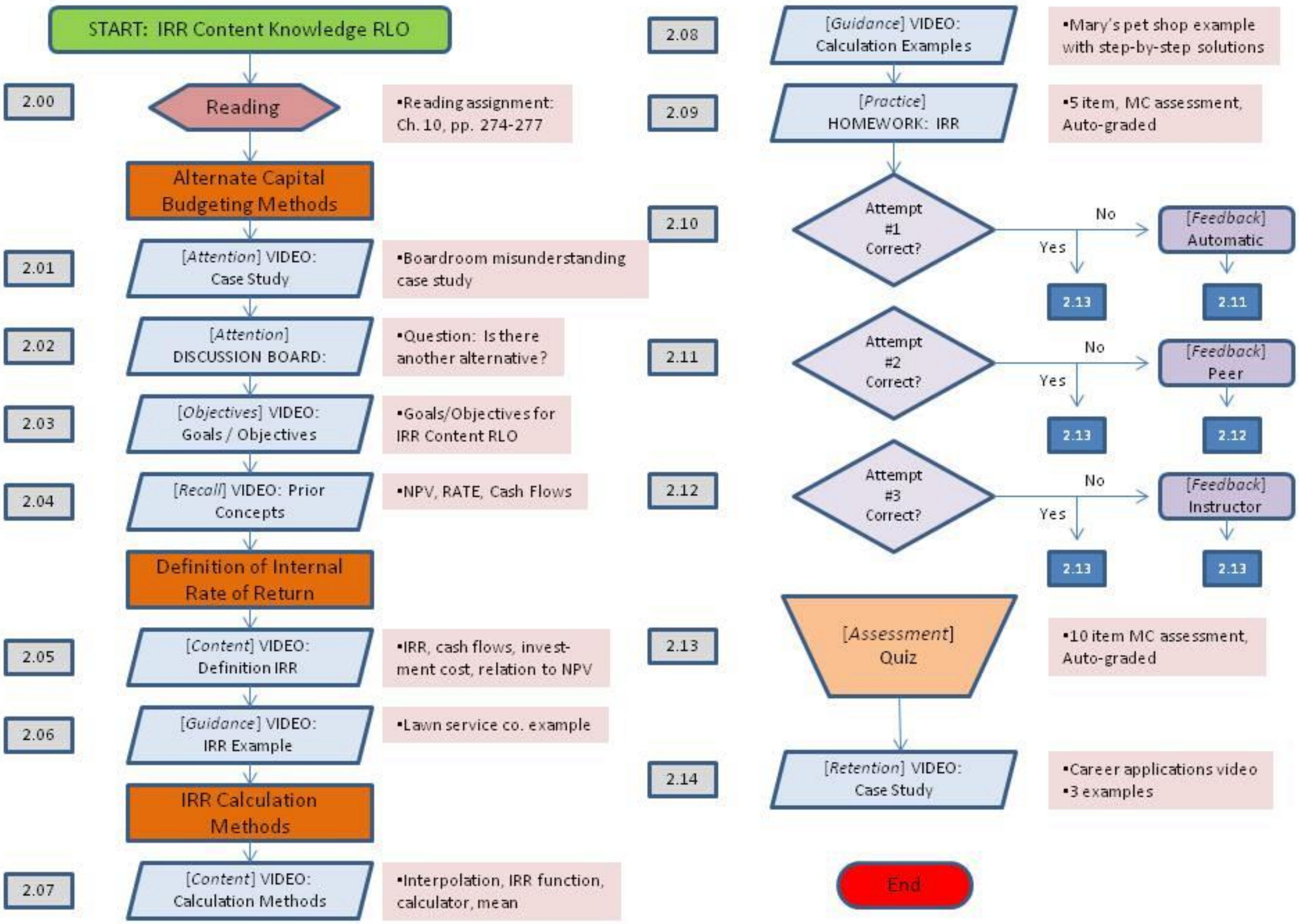
Appendix D2

Flowcharts with Content (Task D03)

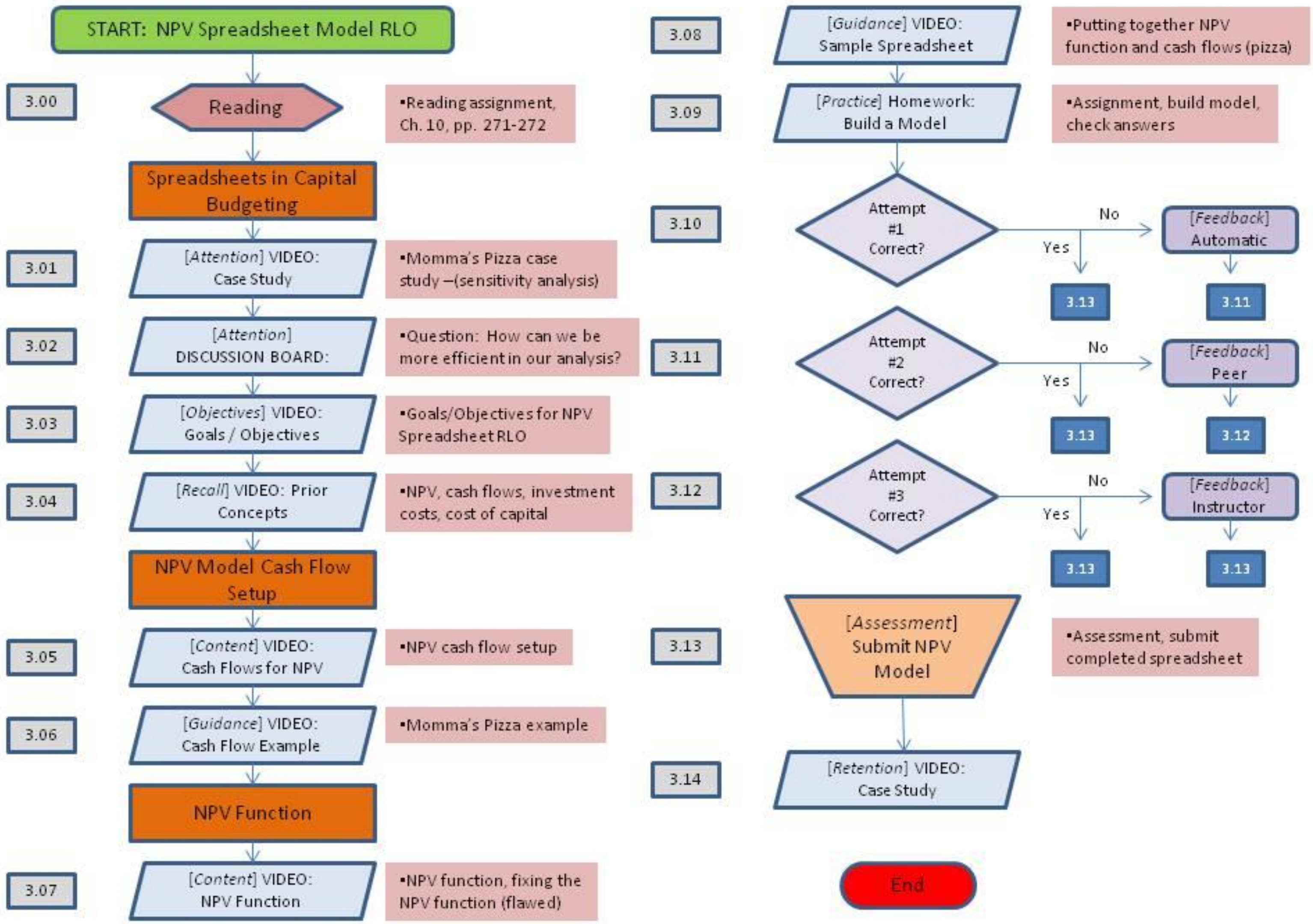
Flowcharts with Content, NPV Content Knowledge RLO



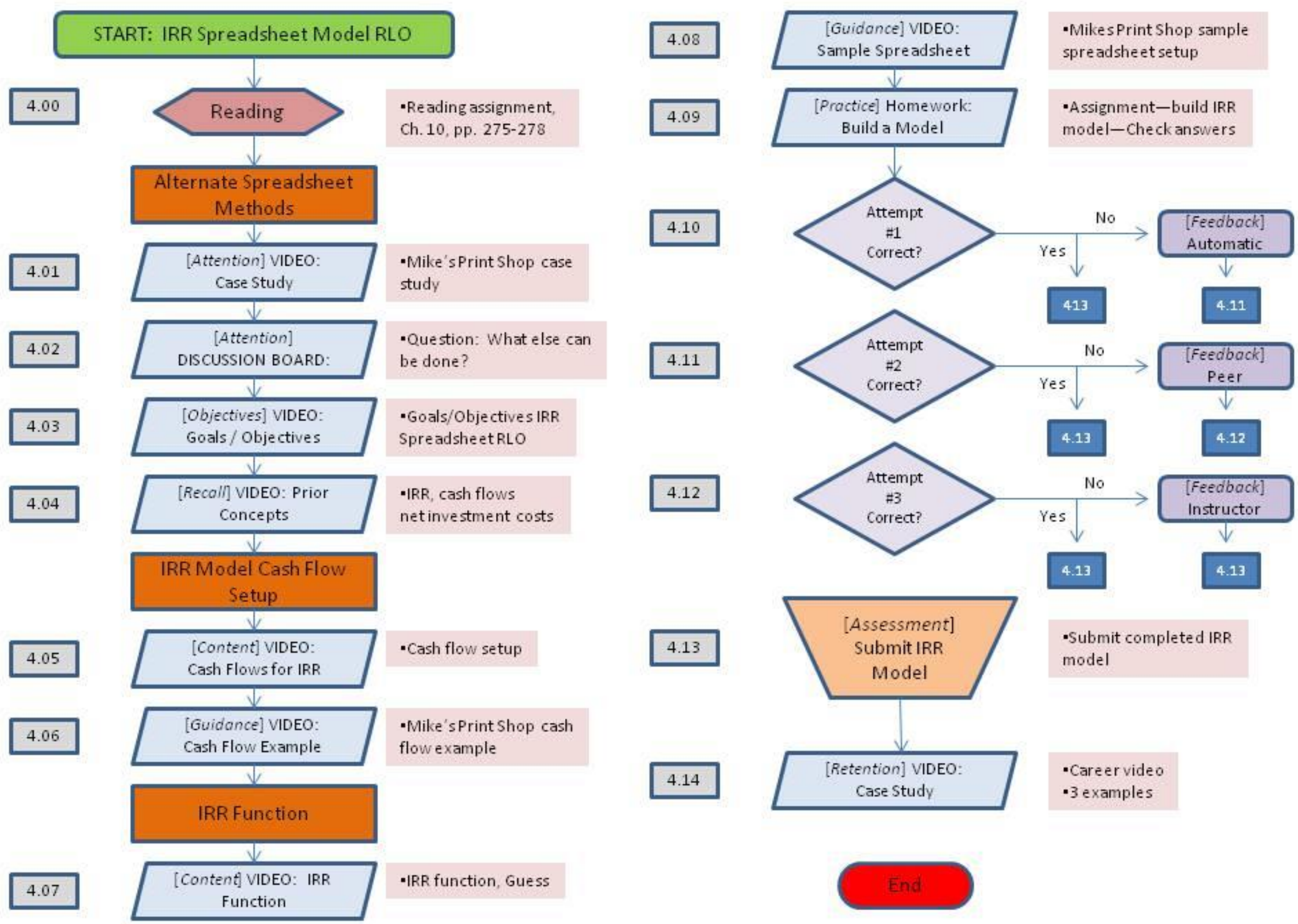
Flowcharts with Content, IRR Content Knowledge RLO



Flowcharts with Content, NPV Spreadsheet RLO



Flowcharts with Content, IRR Spreadsheet RLO



Appendix D3

Storyboards

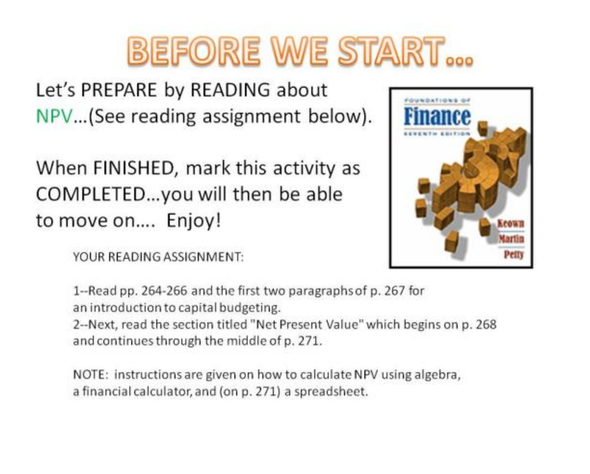
NPV Content Knowledge RLO

Storyboard 1.00

Storyboard Title: Reading Assignment .

Developer(s): Chris S. Andrews .

Storyboard Image and Text



Storyboard Description / Text

--After launching the CMS course module titled: "NPV," prompts user to complete a reading assignment.
--Prompts user to "mark as completed" once the reading assignment is done.
--Once user marks "completed," launches next learning event within the RLO.

[TEXT: Times New Roman, 12pt, bold, left]

Navigation / Controls / Buttons

Name	Action	Destination
"Completed" button	Marks activity as completed, launches next event	1.02: Video (attention grabber)
Standard CMS controls	(Found on every CMS page: Home, Courses, Dashboard, Calendar, Communicate, Logout)	(CMS homepage, course list, dashboard, calendar of assignments due, email instructor)

Graphics / Hypertext / Multimedia

Name	Purpose / Description
JPEG—Splash page for reading assignment	Prompts user to complete reading assignment before beginning the RLO.

NPV Content Knowledge RLO

Storyboard 1.01

Storyboard Title: Video: Case Study .

Developer(s): Chris S. Andrews .

Storyboard Image and Text

Storyboard Description / Text

After completing reading assignment, this screen launches an attention-grabbing video case study.

Allows user to navigate to next event (1.02) after viewing video for minimum of two minutes.

Once user has viewed video, allows user to open discussion forum found at 1.02.
[TEXT: Times New Roman, 12pt, bold, left]

Navigation / Controls / Buttons

Name	Action	Destination
“Play” button	Launches video	1.02: Video (attention grabber)
“Pause” button	Pauses video	
“Thumbnail” button	Allows user to fast forward or rewind video in progress	
Standard CMS controls	(Found on every CMS page: Home, Courses, Dashboard, Calendar, Communicate, Logout)	(CMS homepage, course list, dashboard, calendar of assignments due, email instructor)

Graphics / Hypertext / Multimedia

Name	Purpose / Description
.MP4/Quicktime file	Launches .mp4 video within Quicktime player

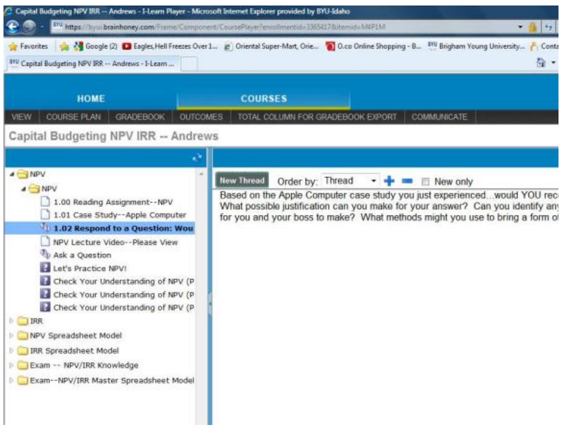
NPV Content Knowledge RLO

Storyboard 1.02

Storyboard Title: Discussion Board: Question: “Would you invest?” .

Developer(s): Chris S. Andrews .

Storyboard Image and Text



Storyboard Description / Text

After viewing the case study video this screen launches a discussion forum. Prompts user to answer and exploratory question about infvestments.

Allows user to navigate to next event (1.03) after posting response.

[TEXT: Times New Roman, 12pt, bold, left]

Navigation / Controls / Buttons

Name	Action	Destination
“New Thread” button	Allows user to launch new discussion forum thread	Discussion Forum
Standard CMS controls	(Found on every CMS page: Home, Courses, Dashboard, Calendar, Communicate, Logout)	(CMS homepage, course list, dashboard, calendar of assignments due, email instructor)

Graphics / Hypertext / Multimedia

Name	Purpose / Description
Discussion Forum Link	Launches discussion forum tool within the CMS

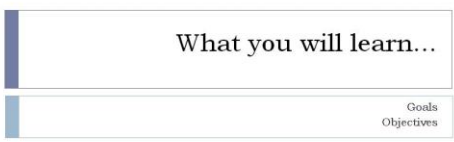
NPV Content Knowledge RLO

Storyboard 1.03

Storyboard Title: Video: Goals/Objectives .

Developer(s): Chris S. Andrews .

Storyboard Image and Text



Storyboard Description / Text

After completing the discussion forum, this screen launches a video that outlines the goals and objectives of the RLO.

Allows user to navigate to next event (1.04) after viewing video for minimum of one minute.

[TEXT: Times New Roman, 12pt, bold, left]

Navigation / Controls / Buttons

Name	Action	Destination
"Play" button	Launches video	1.03: Video (goals/objectives)
"Pause" button	Pauses video	
"Thumbnail" button	Allows user to fast forward or rewind video in progress	
Standard CMS controls	(Found on every CMS page: Home, Courses, Dashboard, Calendar, Communicate, Logout)	(CMS homepage, course list, dashboard, calendar of assignments due, email instructor)

Graphics / Hypertext / Multimedia

Name	Purpose / Description
.MP4/Quicktime file	Launches .mp4 video within Quicktime player

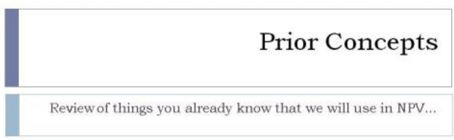
NPV Content Knowledge RLO

Storyboard 1.04

Storyboard Title: Video: Prior Concepts .

Developer(s): Chris S. Andrews .

Storyboard Image and Text



Storyboard Description / Text

After viewing video 1.03, this screen launches a video 1.04 (prior concepts). This video explains the prerequisite concepts of the RLO.

Allows user to navigate to next event (1.05) after viewing video for minimum of one minute.

[TEXT: Times New Roman, 12pt, bold, left]

Navigation / Controls / Buttons

Name	Action	Destination
“Play” button	Launches video	1.04: Video (prior concepts)
“Pause” button	Pauses video	
“Thumbnail” button	Allows user to fast forward or rewind video in progress	
Standard CMS controls	(Found on every CMS page: Home, Courses, Dashboard, Calendar, Communicate, Logout)	(CMS homepage, course list, dashboard, calendar of assignments due, email instructor)

Graphics / Hypertext / Multimedia

Name	Purpose / Description
.MP4/Quicktime file	Launches .mp4 video within Quicktime player

NPV Content Knowledge RLO

Storyboard 1.05

Storyboard Title: Video: NPV Definition .

Developer(s): Chris S. Andrews .

Storyboard Image and Text

Storyboard Description / Text

This screen launches a video that delivers definition of NPV.

Allows user to navigate to next event (1.06) after viewing video for minimum of two minutes.

[TEXT: Times New Roman, 12pt, bold, left]

Navigation / Controls / Buttons

Name	Action	Destination
"Play" button	Launches video	1.05: Video (NPV Definition)
"Pause" button	Pauses video	
"Thumbnail" button	Allows user to fast forward or rewind video in progress	
Standard CMS controls	(Found on every CMS page: Home, Courses, Dashboard, Calendar, Communicate, Logout)	(CMS homepage, course list, dashboard, calendar of assignments due, email instructor)

Graphics / Hypertext / Multimedia

Name	Purpose / Description
.MP4/Quicktime file	Launches .mp4 video within Quicktime player

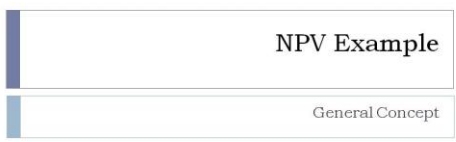
NPV Content Knowledge RLO

Storyboard 1.06

Storyboard Title: Video: NPV Example .

Developer(s): Chris S. Andrews .

Storyboard Image and Text



Storyboard Description / Text

This screen launches a video that reviews an NPV example.

Allows user to navigate to next event (1.07) after viewing video for minimum of two minutes.

[TEXT: Times New Roman, 12pt, bold, left]

Navigation / Controls / Buttons

Name	Action	Destination
“Play” button	Launches video	1.06: Video (NPV Example)
“Pause” button	Pauses video	
“Thumbnail” button	Allows user to fast forward or rewind video in progress	
Standard CMS controls	(Found on every CMS page: Home, Courses, Dashboard, Calendar, Communicate, Logout)	(CMS homepage, course list, dashboard, calendar of assignments due, email instructor)

Graphics / Hypertext / Multimedia

Name	Purpose / Description
.MP4/Quicktime file	Launches .mp4 video within Quicktime player

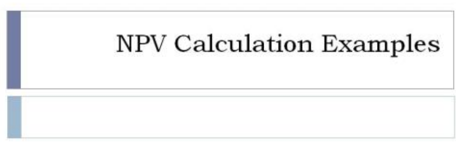
NPV Content Knowledge RLO

Storyboard 1.08=

Storyboard Title: Video: Calculation Examples .

Developer(s): Chris S. Andrews .

Storyboard Image and Text



Storyboard Description / Text

This screen launches a video that shows several examples of NPV calculations.

Allows user to navigate to next event (1.09) after viewing video for minimum of two minutes.

[TEXT: Times New Roman, 12pt, bold, left]

Navigation / Controls / Buttons

Name	Action	Destination
“Play” button	Launches video	1.08: Video (calculation examples)
“Pause” button	Pauses video	
“Thumbnail” button	Allows user to fast forward or rewind video in progress	
Standard CMS controls	(Found on every CMS page: Home, Courses, Dashboard, Calendar, Communicate, Logout)	(CMS homepage, course list, dashboard, calendar of assignments due, email instructor)

Graphics / Hypertext / Multimedia

Name	Purpose / Description
.MP4/Quicktime file	Launches .mp4 video within Quicktime player

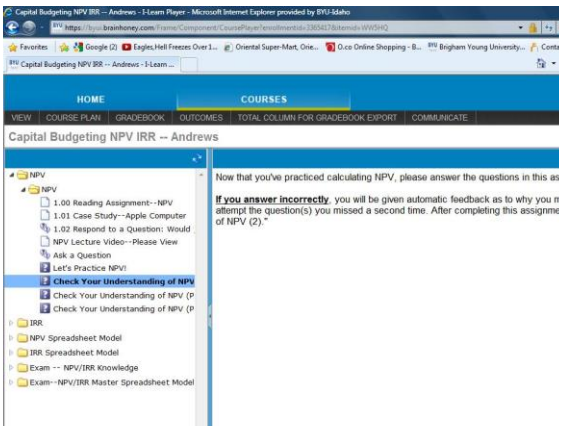
NPV Content Knowledge RLO

Storyboard 1.09-1.12

Storyboard Title: Assignment: NPV Homework .

Developer(s): Chris S. Andrews .

Storyboard Image and Text



Storyboard Description / Text

Launches a CMS-based assessment tool (m/c format). The student will have two attempts each for three separate sets of questions.

Provides auto-feedback for first set of incorrect answers, directs user to navigation tool (discussion forum) enabling peer feedback for second-round failure, directs student to faculty contact for third round failure.
[TEXT: Times New Roman, 12pt, bold, left]

Navigation / Controls / Buttons

Name	Action	Destination
"Start" button	Launches assessment tool (CMS)	1.10: assessment
"Start" button	2nd round assessment tool	1.11 assessment
"Start" button	3rd round assessment tool	1.12 assessment
Standard CMS controls	(Found on every CMS page: Home, Courses, Dashboard, Calendar, Communicate, Logout)	(CMS homepage, course list, dashboard, calendar of assignments due, email instructor)

Graphics / Hypertext / Multimedia

Name	Purpose / Description
Automated feedback	Provides automated feedback (within CMS) to student for 1st set of wrong answers
Peer feedback	Launches discussion forum for students to get peer feeback, based on 2nd round of incorrect responses
Faculty feedback	Directs students to email professor for faculty individual help, based on third incorrect response.

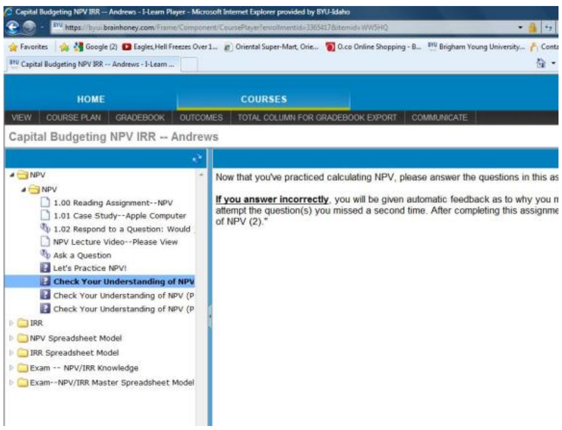
NPV Content Knowledge RLO

Storyboard 1.13

Storyboard Title: Assessment: Quiz .

Developer(s): Chris S. Andrews .

Storyboard Image and Text



Storyboard Description / Text

Launches a CMS-based assessment tool (m/c format). Students will have one attempt. Format is a unit quiz.

Users will be directed to activity 1.14 (Retention) video case study when this Quiz is complete.

[TEXT: Times New Roman, 12pt, bold, left]

Navigation / Controls / Buttons

Name	Action	Destination
“Start” button	Launches quiz (CMS)	1.13: assessment
Standard CMS controls	(Found on every CMS page: Home, Courses, Dashboard, Calendar, Communicate, Logout)	(CMS homepage, course list, dashboard, calendar of assignments due, email instructor)

Graphics / Hypertext / Multimedia

Name	Purpose / Description
Video LINK	Links to 1.14 (retention video) to end the RLO

NPV Content Knowledge RLO

Storyboard 1.14

Storyboard Title: Video: Case Study (Retention) .

Developer(s): Chris S. Andrews .

Storyboard Image and Text

Storyboard Description / Text

This screen launches a video that shows several examples of NPV method used in the real world. Examples include likely careers for students in the course.

Allows user to navigate to next event (RLO 2.0) after viewing video for minimum of two minutes.

[TEXT: Times New Roman, 12pt, bold, left]

Navigation / Controls / Buttons

Name	Action	Destination
"Play" button	Launches video	1.14: Video (calculation examples)
"Pause" button	Pauses video	
"Thumbnail" button	Allows user to fast forward or rewind video in progress	
Standard CMS controls	(Found on every CMS page: Home, Courses, Dashboard, Calendar, Communicate, Logout)	(CMS homepage, course list, dashboard, calendar of assignments due, email instructor)

Graphics / Hypertext / Multimedia

Name	Purpose / Description
.MP4/Quicktime file	Launches .mp4 video within Quicktime player

Appendix D4

Assessment Instruments

Content/Knowledge Assessment

RLOs 1 and 2 (NPV and IRR)

1. Which of the following questions is central to the concept of solving for internal rate of return (IRR)? **[Objective 2]**
   a. "How long until the project pays the investment money back?"
   b. "Does the project earn at least ___% return?" (Where "___%" equals the cost of capital)
   c. "Exactly what rate of return does the project earn?" (In annual percentage rates)
   d. "Does the project have positive net incremental cash flows each year?" (not counting the investment period)
2. Your company's cost of capital is 17% for new investment projects. You have just analyzed a new potential investment and found it to have an IRR of 18%. Which of the following statements is most correct? **[Objective 2]**
   a. The project is acceptable because the IRR > Cost of Capital.
   b. The IRR is not a reliable capital budgeting strategy.
   c. The IRR must be lower than the cost of capital for the investment to be acceptable.
   d. An IRR of 0.00% means that the project has an acceptable NPV.
3. Which of the following questions is central to the concept of solving for net present value (NPV)? **[Objective 1]**
   a. "How long until the project pays the investment money back?"
   b. "Does the project earn at least ___% return?" (Where "___%" equals the cost of capital)
   c. "Exactly what rate of return does the project earn?" (In annual percentage rates)
   d. "Does the project have positive net incremental cash flows each year?" (not counting the investment period)
4. You are evaluating a project with a net investment cost of $100,000. In setting up your cash flows to calculate an IRR, where should you place the $100,000? **[Objective 2]**
   a. In year 1 as a positive number.
   b. In year 0 (zero) as a positive number.
   c. In year 0 (zero) as a negative number.
   d. In year 1 as a negative number.
5. NPV analysis involves which of the following steps? **[Objective 1]**
   a. Calculating the PV of some of the future cash flows.
   b. Adding the positive net cost of the investment to the cash flows
   c. Calculating the PV of the net investment cost in time period zero and converting it to a positive number.

   d. **Comparing the PV of the future cash flows to the net investment cost by subtracting the investment amount from the PV.**

6. You are considering an investment in a machine that will cut your company's costs significantly. The projected cash flows are as follows: Investment amount: $100,000. Cash flows: Year 1: $25,000; Year 2: $45,000; Year 3: $50,000; Year 4: $60,000; Year 5: $75,000. Calculate the IRR of the project. **[Objective 2]**
   a. **34.21%**
   b. 21.22%
   c. 27.63%
   d. 38.99%
7. Your company's cost of capital is 17% for new investment projects. You have just analyzed a new potential investment and found it to have a NPV of $0.00. Which of the following statements is most correct? **[Objective 1]**
   a. The project fails to earn at least 17%.
   b. **The project earns at least 17%.**
   c. The project earns 0.00%
   d. The project earns -17% (negative 17%).
8. Your company has established a cost of capital of 15%. You just analyzed a new investment alternative. The new investment project is showing a NPV of -$200.00 (negative $200), based on the company's cost of capital. Which of the following is true? **[Objective 1]**
   a. **The project should be rejected because it fails to meet your company's minimum requirements for investment.**
   b. The project earns at least 15%.
   c. The project earns more than 15% and should be accepted.
   d. The project loses $200.00
9. Your company says that new investments must meet or exceed a minimum of 20% return, in order to be acceptable. You evaluate a new investment and it has a positive net present value (NPV) of $3,000.00 (+$3,000). Which of the following is true? **[Objective 1]**
   a. **The project is projected to earn more than a 20% return.**
   b. The project earns $3,000.00
   c. The project should be rejected because it fails to earn at least a 20% return.
   d. The project earns a return of exactly 20%.
10. You work for a large high technology company. Your company is considering investing in a small manufacturing facility to produce electronic parts for smartphones. The manufacturing facility will cost $25 million. The company considers this project risky and will NOT invest unless the project earns at least a 25% return. The projected cash flows from the investment are: Year 1: $5 million; Year 2: $8 million; Year 3: $7 million; Year 4: $15 million; Year 5: $17 million. What is the NPV of this project? **[Objective 1]**

a. $24,418,560.00
b. ($581,440)
c. $25,581,440.00
d. $25,000,000.00

11. For the following cash flows, calculate the IRR: Investment of $25,000. Year 1: $11,000; Year 2: $7,000; Year 3: ($3,000) (negative); Year 4: $19,000; Year 5: $4,000. **[Objective 2]**
    a. 13.33%
    b. 16.29%
    c. 17.24%
    d. No solution, because cash flow in year 3 is negative (this is not allowed).
12. You work at a food processing plant. The plant management is considering investing in a new sorting machine that will cost $250,000. The machine will create efficiencies that will result in the following cash flows to your company: Year 1: $50,000; Year 2: $75,000; Year 3: $85,000; Year 4: $95,000; Year 5: $110,000. Assuming a 16.5% cost of capital, what is the NPV of this project? **[Objective 1]**
    a. ($4,766.90)
    b. $4,766.90
    c. $254,766.90
    d. $245,233.10
13. You work for an orange juice bottling company. Your company is planning to upgrade its bottling machinery by investing in a new machine. The machine will cost $2 million. The projected cash flows related to this investment are: Year 1: $250,000; Year 2: $400,000; Year 3: $1,000,000; Year 4: $350,000; Year 5: $1,600,000. Calculate the correct IRR. **[Objective 2]**
14. Your company sells pizza. You are considering investing in a new pizza oven. The cost of the oven is $150,000. The cash flows are projected to be: Year 1: $25,000; Year 2: $35,000; Year 3: $45,000; Year 4: $55,000; Year 5: $65,000. What is the IRR of this project? **[Objective 2]**
    a. 12.94%
    b. 15.28%
    c. 13.97%
    d. 22.04%
15. In a job interview, you are asked to evaluate the following investment that the company is considering: A new laser cutting machine for the company's factory that will cost $188,000. The company tells you that they must earn at least 17% on the project. The projected cash flows are: Year 1: $35,000; Year 2: $75,000; Year 3: $45,000; Year 4: $100,000; Year 5: $56,000. The interviewer asks you to calculate the NPV of this project….if you get it right, you get the job! What is the NPV? **[Objective 1]**
    a. $184,293.05

b. $191,706.95
c. ($3,706.95)
d. $3,706.95

16. Your delivery company needs more delivery trucks. You have been asked to figure out whether the company will benefit by buying a new truck. The cost of the truck is estimated at $58,000. The added rental revenue you are anticipating will result in the following cash flows: Year 1: $17,000; Year 2: $18,000; Year 3: $22,000; Year 4: $15,000; Year 5: $10,000. What is the IRR of this project? **[Objective 2]**
    a. 12.08%
    b. 14.33%
    c. 13.76%
    d. 15.29%
17. You own a small business selling ice cream. You are considering an investment in a new piece of equipment that will cost your business $10,000. The cash flows that you expect from this investment are: Year 1: $5,000; Year 2: $2,000; Year 3: $1,000; Year 4: $3,000; Year 5: $2,000. What is the IRR of this project? **[Objective 2]**
    a. 11.10%
    b. 13.27%
    c. 12.83%
    d. 15.00%
18. You work for a soft drink bottling company. Your company is planning to upgrade its bottling machinery by investing in a new machine. The machine will cost $1 million. The projected cash flows (from lower costs) related to this investment are: Year 1: $250,000; Year 2: $400,000; Year 3: $250,000; Year 4: $350,000; Year 5: $600,000. Your company insists on a 13% cost of capital for projects like this. Calculate the correct NPV. **[Objective 1]**
    a. $1,248,077.67
    b. $248,077.67
    c. $751,922.33
    d. $1,000,000
19. Your company sells doughnuts. You are considering investing in a new doughnut machine. The cost of the machine is $150,000. You have to earn at least 15% return on the project, in order to justify it to your company's management team. The cash flows are projected to be: Year 1: $25,000; Year 2: $35,000; Year 3: $45,000; Year 4: $55,000; Year 5: $65,000. What is the NPV of this project? **[Objective 1]**
    a. $141,555.31
    b. $158,444.69
    c. $76,158.18
    d. (8,444.69)

20. You work at a potato processing plant. The plant management is considering investing in a new sorting machine that will cost $250,000. The machine will create efficiencies that will result in the following cash flows to your company: Year 1: $50,000; Year 2: $75,000; Year 3: $85,000; Year 4: $95,000; Year 5: $110,000. What is the IRR of this project? **[Objective 2]**
    a. 15.85%
    b. 17.22%
    c. 13.91%
    d. 14.33%

Spreadsheet Model Assessment

NPV and IRR Combined Model

1. Build a spreadsheet model that allows the user to correctly organize cash flows and other necessary data associated with an investment project. Based on the information entered by the spreadsheet user, the model should correctly calculate the project's internal rate of return (IRR) and net present value (NPV).
2. The spreadsheet model should correctly organize and account for the following:
    a. All of the cash flows associated with the project.
    b. The net cost of the investment.
    c. The project's stated cost of capital.
    d. The project's NPV.
    e. The project's IRR.
3. The spreadsheet model will be graded based on the following criteria:
    a. Correct organization of cash flows.
    b. Inclusion of all necessary data / input fields.
    c. Accurate calculation of the project's NPV.
    d. Accurate calculation of the project's IRR.
    e. Correct use of spreadsheet functions associated with this model.
    f. User interface/Ease of use of the spreadsheet.
    g. Professional appearance (organized with data inputs at top and outputs at bottom).
4. Build the spreadsheet model based on the following data (and leave the data in place on the spreadsheet when you submit it for grading):
    a. Six (6) year project analysis period.
    b. A corporate cost of capital of 15.25% per year.

c. A total net investment cost of $675,552.00
d. Other cash flows as follows:
    i. Year 1: ($14,567)
    ii. Year 2: $250,600
    iii. Year 3: $588,434
    iv. Year 4: $489,200
    v. Year 5: ($113,250)
    vi. Year 6: $258,359
    vii. Year 7: $287,765
    viii. Year 8: $350,000 (salvage value)
e. The user(s) expect to see at least two decimal places for percentages and currency formatting for fields representing dollar amounts.

Combined NPV/IRR Spreadsheet Model Grading Rubric

Objective: *Students will build a spreadsheet model that will correctly calculate the investment project's NPV and IRR*		**Outstanding**	**Effective**	**Adequate**	**Ineffective**	**Not Acceptable**
Presentation (40%)		**4**	**3**	**2**	**1**	**0**
	Overall appearance of the model: Is it organized in sequential fashion? (Data at the top leading to outputs at the bottom of the page)					
	Are the cash flows for NPV easily interpreted/understood? (NPV)					
	Are the cash flows for IRR easily interpreted/understood? (IRR)					
	Is the data entry field for cost of capital obvious to the user? (NPV)					
	Does the NPV result stand out visibly from the rest of the model? (NPV)					
	Does the IRR result stand out visibly from the rest of the model? (IRR)					

	Complete & Correct	1 element missing or incorrect	2 elements missing or incorrect	3 elements missing or incorrect	Not Acceptable
Spreadsheet Organization (40%)	**4**	**3**	**2**	**1**	**0**
Cash flows for NPV: Are the cash flows organized properly to enable correct calculation of NPV for 6 time periods, including proper placement of net cost of investment? (NPV)					
Cost of Capital: Is the cost of capital data entry field located near the cash flows (visible on the same page) and properly formatted as an annual rate of return? (NPV)					
NPV Output: Is the NPV output field properly labeled and formatted as currency? (NPV)					
NPV Output: Does the NPV output field correctly use the NPV function, including properly subtracting the net cost of the investment? (NPV)					
Cash flows for IRR: Are the cash flows organized properly to enable correct calculation of IRR for 6 time periods, including the proper placement of net cost of the investment? (IRR)					
IRR Output: Is the IRR output field correctly labeled and formatted as an annual percentage? (IRR)					
IRR Output: Does the IRR output field correctly use the IRR function, including properly including the net cost of the investment in the calculation? (IRR)					
	Correct	**Incorrect by <0.10%**	**Incorrect by .10 - .50%**	**Incorrect by 0.50% - 1.00%**	**Incorrect by > 1.00%**
Accuracy of Model (20%)	**4**	**3**	**2**	**1**	**0**
IRR: Does the model correctly calculate the IRR, to within two decimal places? (IRR)					
	Correct	**Incorrect by < $1.00**	**Incorrect by $1.00 - $20.00**	**Incorrect by $20-$100**	**Incorrect by > $100**
	4	**3**	**2**	**1**	**0**

	NPV: Does the model correctly calculate the NPV, rounding for currency (2 decimal places)? (NPV)					

Appendix E1

ADDIE Design Phase

Delphi Survey Instruments

ADDIE Design Phase
Delphi Survey 06: Task D01 (Task Analysis)

The following surveys were administered to a group of SMEs and IDEs via an online Google Document™ form (see Appendix E2). Each SME received copies of the appropriate sections of the Design phase document prior to responding to the survey. The online survey was worded exactly as presented here:

Delphi Survey 06
ADDIE Design Phase
Task D01: Task Analysis

1. Carefully review the documents attached related to the project's task analysis.
2. Mark the rating that most represents your expert evaluation for each item in the survey based on the following:
   1—Strongly Disagree
   2—Disagree
   3—Agree
   4—Strongly Agree
3. Please complete the survey within three days.

Item	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
1. The Objective for the task is clearly stated.				
Project Tasks:				
2. Each task is aligned with the Objective.				
3. The Knowledge identification type is aligned with each task.				
4. The Prerequisite decision (Y/N) is aligned with each task.				
5. The Environmental Factor(s) identified for each task is aligned.				
6. The Domain Type is aligned with each task.				
7. The Importance level is aligned with each task.				
8. The Difficulty level is aligned with each task.				
Project Subtasks (if included):				
9. The listed sub-task(s) is aligned with each task.				
10. The Knowledge identification type is aligned with each subtask.				
11. The Prerequisite decision (Y/N) is aligned with each subtask.				
12. The Environmental Factor(s) identified with each subtask is aligned.				
13. The Domain Type is aligned with each subtask.				
14. The Importance level is aligned with each subtask.				
15. The Difficulty level is aligned with each subtask.				

Delphi Survey 07
ADDIE Design Phase
Task D02: Flowcharts with Content

1. Carefully review the documents attached related to the project's flowcharts with content.
2. Mark the rating that <u>most</u> represents your expert evaluation for each item in the survey based on the following:
   1—Strongly Disagree
   2—Disagree
   3—Agree
   4—Strongly Agree
3. Please complete the survey within three days.

Item	**Strongly Disagree 1**	**Disagree 2**	**Agree 3**	**Strongly Agree 4**
1. RLO 1 contains content that is aligned with each task described in RLO 01.				
2. RLO 2 contains content that is aligned with each task described in RLO 02.				
3. RLO 3 contains content that is aligned with each task described in RLO 03.				
4. RLO 4 contains content that is aligned with each task described in RLO 04.				

Delphi Survey 08
ADDIE Design Phase
Task D03: Storyboards

1. Carefully review the documents attached related to the project's storyboards.
2. Mark the rating that most represents your expert evaluation for each item in the survey based on the following:
   1—Strongly Disagree
   2—Disagree
   3—Agree
   4—Strongly Agree
3. Please complete the survey within three days.

Item	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
1. There is a series Storyboards for RLO 1 that are aligned with RLO 1 Task D02 (Flowcharts) and Task D03 (Content-Flowcharts).				
2. All of RLO 1 storyboards use the prescribed storyboard template.				
3. All of RLO 1 storyboards have a graphic inserted in the correct location on the storyboard template.				
4. All of RLO 1 storyboards have text content (where needed) inserted in the correct location on the storyboard template.				
5. All of RLO 1 storyboards have the necessary text specifications (i.e., font, size, style, and alignment) in the correct location on the storyboard template.				
6. All of RLO 1 storyboards have hypertext links (where needed) inserted in the correct location on the storyboard template.				
7. All of RLO 1 storyboards have button links (where needed) inserted in the correct location on the storyboard template.				

Delphi Survey 09
ADDIE Design Phase
Task D04 (Knowledge Content Assessment Instruments)

1. Carefully review the documents attached related to the project's knowledge content assessment instruments.
2. Mark the rating that <u>most</u> represents your expert evaluation for each item in the survey based on the following:
   1—Strongly Disagree
   2—Disagree
   3—Agree
   4—Strongly Agree
3. Please complete the survey within three days.

Item	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
1. The multiple-choice assessment Knowledge Pretest/Posttest appears to have item (question) stems related to the RLO Objectives.				
2. The multiple-choice assessment Knowledge Pretest/Posttest appears to have logical distractors for each item related to the RLO Objectives.				
3. The multiple-choice assessment Knowledge Pretest appears to be composed of identical items with random distribution, as expected, in the Posttest.				
4. The multiple-choice assessment Knowledge Pretest/Posttest appears to be correctly formatted.				
5. The assessment Knowledge Pretest/Posttest appears to contain a sufficient number of items related to Objective 1.				
6. The assessment Knowledge Pretest/Posttest appears to contain a sufficient number of items related to Objective 2.				

Delphi Survey 10
ADDIE Design Phase
Task D04 (Spreadsheet Model Assessment Instruments)

1. Carefully review the documents attached related to the project's spreadsheet model assessment instruments.
2. Mark the rating that <u>most</u> represents your expert evaluation for each item in the survey based on the following:
   - 1—Strongly Disagree
   - 2—Disagree
   - 3—Agree
   - 4—Strongly Agree
3. Please complete the survey within three days.

1. The assessment Spreadsheet Modeling Assignment appears to have items related to the RLO 3 Objectives				
2. The assessment Spreadsheet Modeling Assignment appears to contain a sufficient number of items related to Objective 3.				
3. The assessment Spreadsheet Modeling Assignment Grading Rubric appears to have items related to the RLO 3 Objectives.				
4. The assessment Spreadsheet Modeling Assignment Grading Rubric appears to contain a sufficient number of items related to the RLO 3 Objectives.				

Appendix E2

Delphi Surveys D06-D10: Online Google Document™ Forms

The following are the online forms used to present Delphi surveys D01-D03. The surveys are worded in exactly the same manner as those found in Appendices E1-E4, but differ slightly in format. Use of the online Google Document™ forms allowed the researcher to collect data directly to a spreadsheet.

Delphi Survey 06--ADDIE Design Phase--Task Analysis

1. Carefully review the documents attached related to the project's task analysis.
2. Mark the rating that most represents your expert evaluation for each item in the survey based on the following:
   1—Strongly Disagree
   2—Disagree
   3—Agree
   4—Strongly Agree
3. Please complete the survey within three days.

---

* Required

The objective for the task is clearly stated *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Each task is aligned with the objective *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

The knowledge identification type is aligned with each task *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

The prerequisite decision is aligned with each task *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

The environmental factor(s) identified for each task is aligned *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

The domain type is aligned with each task *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

The importance level is aligned with each task *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

The difficulty level is aligned with each task *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Sample Question 2

0

Submit

Delphi Survey 07--ADDIE Design Phase--Flowcharts with Content

1. Carefully review the documents attached related to the project's flowcharts with content.
2. Mark the rating that most represents your expert evaluation for each item in the survey based on the following:
   1—Strongly Disagree
   2—Disagree
   3—Agree
   4—Strongly Agree
3. Please complete the survey within three days.

---

* Required

RLO1 contains content that is aligned with each task described in RLO1 *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

RLO2 contains content that is aligned with each task described in RLO2 *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

RLO3 contains content that is aligned with each task described in RL03 *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

RLO4 contains content that is aligned with each task described in RL04 *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Sample Question 2 [ ]

[0] [ ]

Submit

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Delphi Survey 08--ADDIE Design Phase--Storyboards

1. Carefully review the documents attached related to the project's storyboards.
2. Mark the rating that most represents your expert evaluation for each item in the survey based on the following:
    1—Strongly Disagree
    2—Disagree
    3—Agree
    4—Strongly Agree
3. Please complete the survey within three days.

---

* Required

There is a series of storyboards for RLO1 that are aligned with RLO1 Task D02 (Flowcharts) and Task D03 (Content-Flowcharts). *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

All of RLO1 storyboards use the prescribed storyboard template *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

All of RLO1 storyboards have a graphic inserted in the correct location on the storyboard template. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

All of RLO1 storyboards have text content (where needed) inserted into the correct location on the storyboard template. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

All of RLO1 storyboards have the necessary text specifications (font, size, style, and alignment) in the correct location on the storyboard template. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

All of RLO1 storyboards have button links (where needed) inserted in teh correct location on the storyboard template. *

1 2 3 4

Strongly Disagree Strongly Agree

Sample Question 2

0

Submit

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Delphi Survey 09 -- Assessments

1--Carefully review the documents you received (the pretest/posttest and the objectives statement). 2--Mark the rating that most represents your expert evaluation for each item in the survey based on the following scale: 1--Strongly Disagree 2--Disagree 3--Agree 4--Strongly Disagree 3--Please complete this instrument within three days.

* Required

The multiple-choice assessment knowledge pretest/posttest appears to have item (question) stems related to the RLO objectives *

1 2 3 4

Strongly Disagree Strongly Agree

The multiple-choice assessment knowledge pretest/posttest appears to have logical distractors for each item related to the RLO objectives *

1 2 3 4

Strongly Disagree Strongly Agree

The multiple-choice assessment knowledge Pretest appears to be composed of identical items with random distribution, as expected, in the Posttest. *

1 2 3 4

Strongly Disagree Strongly Agree

The multiple-choice assessment knowledge pretest/posttest appears to be correctly formatted *

1 2 3 4

Strongly Disagree ◯ ◯ ◯ ◯ Strongly Agree

The multiple-choice assessment knowledge pretest/posttest appears to contain a sufficient number of items related to Objective 1 *

1 2 3 4

Strongly Disagree ◯ ◯ ◯ ◯ Strongly Agree

The multiple-choice assessment knowledge pretest/posttest appears to contain a sufficient number of items related to Objective 2 *

1 2 3 4

Strongly Disagree ◯ ◯ ◯ ◯ Strongly Agree

Submit

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Delphi Survey 10 -- Spreadsheet Assessment Rubric

1--Carefully review the documents you received (the objectives statement, the assignment, and the grading rubric). 2--Mark the rating that most represents your expert evaluation for each item in the survey based on the following scale: 1--Strongly Disagree 2--Disagree 3--Agree 4--Strongly Disagree 3--Please complete this instrument within three days.

* Required

The spreadsheet model assignment appears to have items that relate to Objective 3. *

1 2 3 4

Strongly Disagree ◯ ◯ ◯ ◯ Strongly Agree

The spreadsheet model assignment Rubric appears to have items that relate to Objective 3. *

1 2 3 4

Strongly Disagree ◯ ◯ ◯ ◯ Strongly Agree

The spreadsheet model assignment appears to have items that relate to Objective 4. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

The spreadsheet model assignment Rubric appears to have items that relate to Objective 4. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

The spreadsheet model assignment Rubric "Presentation" scores appear to be properly weighted. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

The spreadsheet model assignment Rubric "Spreadsheet Organization" scores appear to be properly weighted. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

The spreadsheet model assignment Rubric "Accuracy of Model" scores appear to be properly weighted. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

The spreadsheet model assignment Rubric appears to contain the correct number of items relative to Objective 3. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

The spreadsheet model assignment Rubric appears to contain the correct number of items relative to Objective 4. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Submit

Appendix E3

ADDIE Design Phase

Delphi Survey 06-Delphi Survey 10 Results

Delphi Survey 06 (Task D01; Task Analysis). All but two of the survey questions received a mean score of 3.0 or greater. Two items received mean scores of 2.33 each. Item 1, which received a score of 2.33 resulted in a change to the Task Analysis documents for all four planned RLOs. The SME panel discovered that the objectives were not clearly identified within the Task Analysis. The researcher changed the Task Analysis document so that the objective of the RLO was prominently displayed at the beginning of the document. Item 2, which also received a score of 2.33 received a low score because of the problem that was found with Item 1. Item 2 asked whether the SMEs thought that the tasks were aligned with the objective. Since the objective was not visible, the SMEs agreed that it was difficult to ascertain the alignment. The researcher changed the Task Analysis document so that the alignment between objectives and tasks was more obvious. After making changes to the Task Analysis the SMEs were given a second iteration of the Delphi survey. Iteration 2 indicated that the SMEs were now in agreement with items 1 and 2.

	Iteration 1				**Iteration 2**			
Item	**Mean**	**Median**	**Mode**	**SD**	**Mean**	**Median**	**Mode**	**SD**
1	2.33	2.00	N/A	1.53	4.00	4.00	4.00	0.00
2	2.33	2.00	N/A	1.53	4.00	4.00	4.00	0.00
3	3.67	4.00	4.00	0.58	3.67	4.00	4.00	0.58
4	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
5	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
6	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
7	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00

8	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00

Delphi Survey 07 (Task D02; Flowcharts with Content). All of the survey questions received a mean score of 3.0 or greater. Because all of the items received mean scores higher than 3.0 (indicating agreement among the IDE and SME panel) no changes were made to the materials for task D02 and a second iteration of the Delphi survey was not conducted.

	Iteration 1				**Iteration 2**			
Item	**Mean**	**Median**	**Mode**	**SD**	**Mean**	**Median**	**Mode**	**SD**
1	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
2	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
3	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
4	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A

Delphi Survey 08 (Task D03; Storyboards). All of the survey questions received a mean score of 3.0 or greater. Because all of the items received mean scores higher than 3.0 (indicating agreement among the IDE panel) no changes were made to the materials for task D03 and a second iteration of the Delphi survey was not conducted.

	Iteration 1				**Iteration 2**			
Item	**Mean**	**Median**	**Mode**	**SD**	**Mean**	**Median**	**Mode**	**SD**
1	3.67	4.00	4.00	0.58	N/A	N/A	N/A	N/A
2	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
3	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
4	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
5	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A

6	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A

Delphi Survey 09 (Task D04;Content Knowledge Assessment Instrument). To determine the face validity for Task D04 (Assessment Instruments), Delphi 09 was distributed to a panel of SMEs for review. Items with a mean of less than 3.0 (out of a total of 4.0) were considered candidates for improvement. The SME panel scored all items at 3.0, or above. Because all six items scored above 3.0 no changes were made to the content knowledge assessment instrument.

	Iteration 1				**Iteration 2**			
Item	**Mean**	**Median**	**Mode**	**SD**	**Mean**	**Median**	**Mode**	**SD**
1	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
2	3.67	3.00	3.00	0.58	N/A	N/A	N/A	N/A
3	3.67	4.00	4.00	0.58	N/A	N/A	N/A	N/A
4	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
5	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A
6	4.00	4.00	4.00	0.00	N/A	N/A	N/A	N/A

Delphi 10 for Task D04 (Spreadsheet Model Assignment). To determine the face validity of Task D04 (Assessment Instruments), Delphi 10 (N=15 items) was distributed to a panel of SMEs for review. A four-point Likert scale, with 4 representing Strongly Agree, 3 Agree, 2 Disagree, and 1 Strongly Disagree, was used. Items with a mean of less than 3.0 (out of a total of 4.0) were considered candidates for improvement. Thirteen items received mean scores of 3.0, or above. Two items received a mean score of 2.67.

These items resulted in changes to Task D04. The SMEs indicated that scores on the grading rubric did not appear to be properly weighted. The correct weights and score values were added to the rubric, as a result of this feedback.

	Iteration 1				Iteration 2			
Item	**Mean**	**Median**	**Mode**	**SD**	**Mean**	**Median**	**Mode**	**SD**
1	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
2	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
3	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
4	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
5	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
6	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
7	3.00	3.50	4.00	1.41	4.00	4.00	4.00	0.00
8	2.75	3.00	3.00	1.26	4.00	4.00	4.00	0.00
9	2.75	3.00	3.00	1.26	4.00	4.00	4.00	0.00
10	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
11	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
12	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
13	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
14	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00
15	4.00	4.00	4.00	0.00	4.00	4.00	4.00	0.00

Appendix F1

ADDIE Design Phase

Spreadsheet Model Grading Rubric (*Task D04*) Interrater Reliability Test Results

An Index of Interrater Reliability known as Cohen's Kappa (Landis and Koch, 1977) was calculated for each item in the departmental standard grading rubric for the spreadsheet modeling assignment of IRR and NPV. Cohen's Kappa indicates the measure of agreement between different raters evaluating the same item. Kappa is used to measure interrater reliability when observing qualitative or categorical values. To measure reliability of the grading rubric for the spreadsheet modeling assignment, two SMEs were asked to evaluate spreadsheet models using the grading rubric (N= 21 models). Each model was scored on fifteen (15) individual criteria contained in the rubric.

Percent of agreement between the evaluators and Kappa scores were calculated for each of the fifteen criteria found in the rubric Items in the rubric that resulted in Kappa scores less than .70 were considered candidates for improvement. Eleven items scored .70 or higher. Four items scored below .70. Two of the items that scored less than .70 were related to determining whether the spreadsheet correctly calculated the answers to NPV and IRR. After reviewing these items further, the designer modified the rubric to clarify the exact number of time periods that should be included in the calculations of NPV and IRR. The designer also changed the wording on the rubric to more precisely represent the level of accuracy corresponding to specific scores. Two other items that scored below .70 were related to the appearance of input fields in the model. Clarifying statements were added to the rubric to help evaluators be more consistent in grading these items.

Iteration 1
Section 1 (Presentation)

(Key: outstanding = "o" effective = "e" adequate = "a" ineffective = "I" not acceptable = "na")							
Section 1 Item 1	Overall Appearance of the model, is it professional in appearance?						
	Rater 1						
Rater 2	"o"	"e"	"a"	"I"	"na"	**row totals**	
"o"	4	1				**5**	
"e"		8	4			**12**	
"a"			5	1		**6**	
"I"						**0**	
"na"						**0**	
column totals	**4**	**9**	**9**	**1**	**0**		
overall total: 23							
total number of agreements: 17							
Percentage agreement: 73.91%							

Expected frequencies of agreement by chance					
Section 1 Item 1	**Rater 1**				
Rater 2	"o"	"e"	"a"	"I"	"na"
"o"	0.869565				

"e"		4.695652174			
"a"			2.347826087		
"I"				0	
"na"					0
sum of expected frequencies of agreement by chance:					7.913043
Kappa: 0.602305 "Substantial agreement"					
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).					

(Key: outstanding = "o" effective = "e" adequate = "a" ineffective = "I" not acceptable = "na")							
Section 1 Item 2	Are the cash flows for NPV easily interpreted/understood?						
	Rater 1						
Rater 2	"o"	"e"	"a"	"I"	"na"	**row totals**	
"o"	13					**13**	
"e"		7				**7**	
"a"			1			**1**	
"I"						**0**	
"na"						**0**	
column totals	**13**	**7**	**1**	**0**	**0**		
overall total: 21							

total number of agreements: 21
Percentage agreement: 100.00%

Expected frequencies of agreement by chance					
Section 1 Item 2	**Rater 1**				
Rater 2	"o"	"e"	"a"	"I"	"na"
"o"	8.047619				
"e"		2.333333333			
"a"			0.047619048		
"I"				0	
"na"					0
sum of expected frequencies of agreement by chance: 10.42857					
Kappa: 1.00 "Outstanding agreement"					
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).					

(Key: outstanding = "o" effective = "e" adequate = "a" ineffective = "I" not acceptable = "na")		
Section 1 Item 3	Are the cash flows for IRR easily interpreted/understood?	
	Rater 1	

Rater 2	"o"	"e"	"a"	"I"	"na"	row totals	
"o"	12	1				**13**	
"e"		8				**8**	
"a"						**0**	
"I"						**0**	
"na"						**0**	
column totals	**12**	**9**	**0**	**0**	**0**		
overall total: 21							
total number of agreements: 20							
Percentage agreement: 95.24%							

Expected frequencies of agreement by chance					
Section 1 Item 3	**Rater 1**				
Rater 2	"o"	"e"	"a"	"I"	"na"
"o"	7.428571				
"e"		3.428571429			
"a"			0		
"I"				0	
"na"					0
sum of expected frequencies of agreement by chance: 10.85714					
Kappa: 0.90 "Outstanding agreement"					

Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).

(Key: outstanding = "o" effective = "e" adequate = "a" ineffective = "I" not acceptable = "na")							
Section 1 Item 4	Is the data entry field for cost of capital obvious to the user?						
	Rater 1						
Rater 2	"o"	"e"	"a"	"I"	"na"	**row totals**	
"o"	8	4				**12**	
"e"		7				**7**	
"a"			1	1		**2**	
"I"						**0**	
"na"						**0**	
column totals	**8**	**11**	**1**	**1**	**0**		
overall total: 21							
total number of agreements: 16							
Percentage agreement: 76.19%							

Expected frequencies of agreement by chance	
Section 1 Item 4	**Rater 1**

Rater 2	"o"	"e"	"a"	"I"	"na"
"o"	4.571429				
"e"		3.666666667			
"a"			0.095238095		
"I"				0	
"na"					0
sum of expected frequencies of agreement by chance: 8.333333					
Kappa: 0.61 "Substantial Agreement"					
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).					

(Key: outstanding = "o" effective = "e" adequate = "a" ineffective = "I" not acceptable = "na")							
Section 1 Item 5	Does the NPV result stand out visibly from the rest of the model?						
	Rater 1						
Rater 2	"o"	"e"	"a"	"I"	"na"	**row totals**	
"o"	10	1				**11**	
"e"		9				**9**	
"a"				1		**1**	
"I"						**0**	
"na"						**0**	
column totals	**10**	**10**	**0**	**1**	**0**		

overall total: 21
total number of agreements: 19
Percentage agreement: 90.48%

Expected frequencies of agreement by chance					
Section 1 Item 5	**Rater 1**				
Rater 2	"o"	"e"	"a"	"I"	"na"
"o"	5.238095				
"e"		4.285714286			
"a"			0		
"I"				0	
"na"					0
sum of expected frequencies of agreement by chance:					9.52381
Kappa: 0.83 "Outstanding Agreement"					
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).					

(Key: outstanding = "o" effective = "e" adequate = "a" ineffective = "I" not acceptable = "na")	
Section 1 Item 6	Does the IRR result stand out visibly from the rest of the model?

	Rater 1						
Rater 2	"o"	"e"	"a"	"I"	"na"	**row totals**	
"o"	9	2				**11**	
"e"		9				**9**	
"a"			1			**1**	
"I"						**0**	
"na"						**0**	
column totals	**9**	**11**	**1**	**0**	**0**		
overall total: 21							
total number of agreements: 19							
Percentage agreement: 90.48%							

Expected frequencies of agreement by chance					
Section 1 Item 6	**Rater 1**				
Rater 2	"o"	"e"	"a"	"I"	"na"
"o"	4.714286				
"e"		4.714285714			
"a"			0.047619048		
"I"				0	
"na"					0
sum of expected frequencies of agreement by chance: 9.47619					
Kappa: 0.83 "Outstanding Agreement"					

Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).

Section 2 (Spreadsheet Organization)

(Key: complete = "c" 1 missing element = "1" 2 missing = "2" 3 missing = "3" not acceptable = "na")							
Section 2 Item 7	Cash flows for NPV: Are the cash flows organized properly?...						
	Rater 1						
Rater 2	"c"	"1"	"2"	"3"	"na"	**row totals**	
"c"	13	1				**14**	
"1"		7				**7**	
"2"						**0**	
"3"						**0**	
"na"						**0**	
column totals	**13**	**8**	**0**	**0**	**0**		
overall total: 21							
total number of agreements: 20							
Percentage agreement: 95.24%							

Expected frequencies of agreement by chance	
Section	**Rater 1**

2 Item 7					
Rater 2	"c"	"1"	"2"	"3"	"na"
"c"	8.666667				
"1"		2.666666667			
"2"			0		
"3"				0	
"na"					0
sum of expected frequencies of agreement by chance:					11.33333
Kappa: 0.90 "Outstanding Agreement"					
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).					

(Key: complete = "c" 1 missing element = "1" 2 missing = "2" 3 missing = "3" not acceptable = "na")							
Section 2 Item 8	Cost of Capital: Is the cost of capital data entry field visible/formatted?						
	Rater 1						
Rater 2	"c"	"1"	"2"	"3"	"na"	**row totals**	
"c"	10	1				**11**	
"1"		10				**10**	
"2"						**0**	
"3"						**0**	

"na"						**0**	
column totals	**10**	**11**	**0**	**0**	**0**		
overall total: 21							
total number of agreements: 20							
Percentage agreement: 95.24%							

Expected frequencies of agreement by chance					
Section 2 Item 8	**Rater 1**				
Rater 2	"c"	"1"	"2"	"3"	"na"
"c"	5.238095				
"1"		5.238095238			
"2"			0		
"3"				0	
"na"					0
sum of expected frequencies of agreement by chance: 10.47619					
Kappa: 0.90 "Outstanding Agreement"					
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).					

(Key: complete = "c" 1 missing element = "1" 2 missing = "2" 3 missing = "3" not acceptable =

"na")							
Section 2 Item 9	NPV Output: is the output field properly labeled and formatted as currency?						
	Rater 1						
Rater 2	"c"	"1"	"2"	"3"	"na"	**row totals**	
"c"	20	1				21	
"1"						0	
"2"						0	
"3"						0	
"na"						0	
column totals	20	1	0	0	0		
overall total: 21							
total number of agreements: 20							
Percentage agreement: 95.24%							

Expected frequencies of agreement by chance					
Section 2 Item 9	**Rater 1**				
Rater 2	"c"	"1"	"2"	"3"	"na"
"c"	20				
"1"		0			
"2"			0		
"3"				0	
"na"					0
sum of expected frequencies of agreement by chance: 20					

Kappa: 0.90 "Outstanding Agreement"
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).

(Key: complete = "c" 1 missing element = "1" 2 missing = "2" 3 missing = "3" not acceptable = "na")							
Section 2 Item 10	NPV Output: Does the NPV output field correctly use the NPV function?...						
	Rater 1						
Rater 2	"c"	"1"	"2"	"3"	"na"	**row totals**	
"c"	19					19	
"1"		2				2	
"2"						0	
"3"						0	
"na"						0	
column totals	19	2	0	0	0		
overall total: 21							
total number of agreements: 21							
Percentage agreement: 100.00%							

Expected frequencies of agreement by chance					
Section 2 Item 10	**Rater 1**				
Rater 2	"c"	"1"	"2"	"3"	"na"
"c"	17.19048				
"1"		0.19047619			
"2"			0		
"3"				0	
"na"					0
sum of expected frequencies of agreement by chance: 17.38095					
Kappa: 1.00 "Outstanding Agreement"					
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).					

(Key: complete = "c" 1 missing element = "1" 2 missing = "2" 3 missing = "3" not acceptable = "na")							
Section 2 Item 11	Cash Flows for IRR: Organized? Correct net cost placement?						
	Rater 1						
Rater 2	"c"	"1"	"2"	"3"	"na"	**row totals**	
"c"	20					20	
"1"		1				1	
"2"						0	

"3"						0	
"na"						0	
column totals	20	1	0	0	0		
overall total: 21							
total number of agreements: 21							
Percentage agreement: 100.00%							

Expected frequencies of agreement by chance					
Section 2 Item 11	**Rater 1**				
Rater 2	"c"	"1"	"2"	"3"	"na"
"c"	19.04762				
"1"		0.047619048			
"2"			0		
"3"				0	
"na"					0
sum of expected frequencies of agreement by chance: 19.09524					
Kappa: 1.00 "Outstanding Agreement"					
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).					

(Key: complete = "c" 1 missing element = "1" 2 missing = "2" 3 missing = "3" not acceptable = "na")							
Section 2 Item 12	IRR Output: Is the IRR output field correctly labled and formatted as %?						
	Rater 1						
Rater 2	"c"	"1"	"2"	"3"	"na"	**row totals**	
"c"	20					**20**	
"1"						**0**	
"2"			1			**1**	
"3"						**0**	
"na"						**0**	
column totals	**20**	**0**	**1**	**0**	**0**		
overall total: 21							
total number of agreements: 21							
Percentage agreement: 100.00%							

Expected frequencies of agreement by chance					
Section 2 Item 12	**Rater 1**				
Rater 2	"c"	"1"	"2"	"3"	"na"
"c"	19.04762				
"1"		0			
"2"			0.047619048		
"3"				0	
"na"					0

sum of expected frequencies of agreement by chance: 19.09524
Kappa: 1.00 "Outstanding Agreement"
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).

(Key: complete = "c" 1 missing element = "1" 2 missing = "2" 3 missing = "3" not acceptable = "na")							
Section 2 Item 13	IRR Output: Does the IRR output field correctly use the IRR function?						
	Rater 1						
Rater 2	"c"	"1"	"2"	"3"	"na"	**row totals**	
"c"	19					19	
"1"		2				2	
"2"						0	
"3"						0	
"na"						0	
column totals	19	2	0	0	0		
overall total: 21							
total number of agreements: 21							
Percentage agreement: 100.00%							

Expected frequencies of agreement by chance					
Section 2 Item 13	**Rater 1**				
Rater 2	"c"	"1"	"2"	"3"	"na"
"c"	17.19048				
"1"		0.19047619			
"2"			0		
"3"				0	
"na"					0
sum of expected frequencies of agreement by chance:					17.38095
Kappa: 1.00 "Outstanding Agreement"					
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).					

Section 3 (Accuracy of Model)

(Key: correct = "c" Minor error = "m" Carrover error = "co" Other error = "o" Not acceptable = "na")							
Section 3 Item 14	IRR: Does the model correctly calculate IRR?						
	Rater 1						
Rater 2	"c"	"m"	"co"	"o"	"na"	**row totals**	
"c"	13	1	2			16	
"m"		2		1		3	

"co"				1		1	
"o"						0	
"na"					1	1	
column totals	13	3	2	2	1		
overall total: 21							
total number of agreements: 16							
Percentage agreement: 76.19%							

Expected frequencies of agreement by chance					
Section 3 Item 14	**Rater 1**				
	"c"	"m"	"co"	"o"	"na"
Rater 2	9.904762				
"c"		0.428571429			
"m"			0.095238095		
"c"				0	
"o"					0.047619
"na"					
Sum of expected frequencies of agreement by chance: 10.48					
Kappa: 0.52 "Moderate Agreement"					
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).					

(Key: correct = "c" Minor error = "m" Carrover error = "co" Other error = "o" Not acceptable = "na")							
Section 3 Item 15	NPV: Does the model correctly calculate NPV?						
	Rater 1						
Rater 2	"c"	"m"	"co"	"o"	"na"	**row totals**	
"c"	14	1	3			**18**	
"m"		1				**1**	
"co"		1				**1**	
"o"				1		**1**	
"na"						**0**	
column totals	**14**	**3**	**3**	**1**	**0**		
overall total: 21							
total number of agreements: 16							
Percentage agreement: 76.19%							

Expected frequencies of agreement by chance					
Section 3 Item 15	**Rater 1**				
	"c"	"m"	"co"	"o"	"na"
Rater 2	12				
"c"		0.142857143			
"m"			0.142857143		
"c"				0.047619048	
"o"					0

"na"					
sum of expected frequencies of agreement by chance: 12.33333					
Kappa: 0.42 "Moderate Agreement"					
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).					

<u>Iteration 2</u>

Iteration 2 Interrater reliability data (Kappa score calculations) for items scoring below Kappa 0.70 in Iteration 1:
Section 1 (Presentation)

(Key: outstanding = "o" effective = "e" adequate = "a" ineffective = "I" not acceptable = "na")							
Section 1 Item 1 Iteration 2	Appearance: Is data at top and outputs at bottom?						
	<u>Rater 1</u>						
<u>Rater 2</u>	"o"	"e"	"a"	"I"	"na"	**row totals**	
"o"	5					**5**	
"e"		8	2			**10**	
"a"			6			**6**	
"I"						**0**	
"na"						**0**	
column totals	**5**	**8**	**8**	**0**	**0**		
overall total: 21							
total number of agreements: 19							

Percentage agreement: 90.48%

Expected frequencies of agreement by chance						
Section 1 Item 1 Iteration 2	**Rater 1**					
Rater 2	"o"	"e"	"a"	"I"	"na"	
"o"	1.086957					
"e"		4.173913				
"a"			2.608696			
"I"				0		
"na"					0	
sum of expected frequencies of agreement by chance: 7.869565						
Kappa: 0.735632 "Substantial agreement"						
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).						

(Key: outstanding = "o" effective = "e" adequate = "a" ineffective = "I" not acceptable = "na")							
Section 1 Item 4 Iteration 2	Is the data entry field for cost of capital located near cash flows?						
	Rater 1						
Rater 2	"o"	"e"	"a"	"I"	"na"	**row totals**	
"o"	9	3				**12**	
"e"		7				**7**	
"a"			2			**2**	
"I"						**0**	
"na"						**0**	
column totals	**9**	**10**	**2**	**0**	**0**		
overall total: 21							
total number of agreements: 18							
Percentage agreement: 85.71%							

Expected frequencies of agreement by chance						
Section 1 Item 4 Iteration 2			**Rater 1**			
Rater 2	"o"	"e"	"a"	"I"	"na"	
"o"	5.142857					
"e"		3.333333				
"a"			0.190476			
"I"				0		

"na"					0	
sum of expected frequencies of agreement by chance: 8.666667						
Kappa: 0.76 "Substantial Agreement"						
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).						

(Key: “c”=correct, “<.10%=incorrect by <.10%, “.10-.50%”=incorrect by .10-.50%, “.5-1.0%”=incorrect by .5-1.0%, “>1.0%=incorrect by >1.0%)							
Section 3 Item 14 Iteration 2	IRR: Does the model correctly calculate IRR?						
	Rater 1						
Rater 2	"c"	"<.10%"	".10-.50%"	".5-1.0%"	">1.0%"	**row totals**	
"c"	13					**13**	
"<.10%"		5				**5**	
".10-.50%"						**0**	
".5-1.0%"				2		**2**	
">1.0%"					1	**1**	
column totals	**13**	**5**	**0**	**2**	**1**		
overall total: 21							
total number of agreements: 21							
Percentage agreement: 100.00%							

Expected frequencies of agreement by chance						
Section 3 Item 14 Iteration 2	**Rater 1**					
	"c"	"<.10%"	".10-.50%"	".5-1.0%"	">1.0%"	
Rater 2	8.047619					
"c"		1.190476				
"<.10%"			0			
".10-.50%"				0.190476		
".5-1.0%"					0.047619	
">1.0%"						
sum of expected frequencies of agreement by chance: 9.47619						
Kappa: 1.00 "Outstanding Agreement"						
Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).						

(Key: “c”=correct, “<$1=incorrect by <$1, “$1-$20”=incorrect by $1-20, “$20-100”=incorrect by $20-100%, “>$100=incorrect by >$100)							
Section 3 Item 15 Iteration 2	IRR: Does the model correctly calculate NPV?						
	Rater 1						
Rater 2	"c"	"<$1"	"$1-$20"	"20-	">$100"	**row totals**	

				$100"			
"c"	14					14	
"<$1"		3				3	
"$1-$20"			3			3	
"$20-100"				1		1	
">$100"						0	
column totals	14	3	3	1	0		
overall total: 21							
total number of agreements: 21							
Percentage agreement: 100.00%							

Expected frequencies of agreement by chance						
Section 3 Item 15 Iteration 2	**<u>Rater 1</u>**					
	"c"	"<$1"	"$1-$20"	"20- $100"	">$100"	
<u>Rater 2</u>	9.333333					
"c"		0.428571				
"<$1"			0.428571			
"$1-$20"				0.047619		
"$20-100"					0	
">$100"						
sum of expected frequencies of agreement by chance: 10.2381						
Kappa: 1.00 "Outstanding Agreement"						

Kappa > 0.70 indicates a satisfactory level of inter-rater reliability Kappa < 0.70 indicates the level of inter-rater reliability is not satisfactory Cohen's Kappa is a statistical measure of interrater reliability Values of .40 to .59 are considered moderate, .60 to .79 substantial, and .80 oustanding (Landis and Koch, 1977).

Appendix G

Raw Data

NPV Content Knowledge POSTTEST Comparison of control and treatment groups

ANCOVA

```
GET DATA /TYPE=XLSX
  /FILE='F:\Chris_Andrews_PhD_Dissertation_2010_2011\Defense\DATA\Raw Data Dissertation Sep 11 2013.xlsx'
  /SHEET=name 'NPV Content Knowledge Test'
  /CELLRANGE=full
  /READNAMES=on
  /ASSUMEDSTRWIDTH=32767.
EXECUTE.
DATASET NAME DataSet1 WINDOW=FRONT.
EXAMINE VARIABLES=POSTTEST BY Condition
  /PLOT BOXPLOT STEMLEAF NPPLOT
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.
```

Explore

Notes

Output Created		11-SEP-2013 14:32:15
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.

Syntax		EXAMINE VARIABLES=POSTTEST BY Condition /PLOT BOXPLOT STEMLEAF NPPLOT /COMPARE GROUPS /STATISTICS DESCRIPTIVES /CINTERVAL 95 /MISSING LISTWISE /NOTOTAL.
Resources	Processor Time	00:00:01.31
	Elapsed Time	00:00:01.33

[DataSet1]

Warnings

Text: Condition Command: EXAMINE This procedure cannot use string variables longer than 8 bytes. The values will be truncated.

Condition

Case Processing Summary

	Condition	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
POSTTEST	Control	41	100.0%	0	0.0%	41	100.0%
	Treatmen	37	100.0%	0	0.0%	37	100.0%

Descriptives

	Condition			Statistic	Std. Error
POSTTEST	Control	Mean		9.41	.092
		95% Confidence Interval for Mean	Lower Bound	9.23	
			Upper Bound	9.60	
		5% Trimmed Mean		9.46	
		Median		9.00	
		Variance		.349	
		Std. Deviation		.591	
		Minimum		8	
		Maximum		10	
		Range		2	

				Statistic	Std. Error
		Interquartile Range		1	
		Skewness		-.418	.369
		Kurtosis		-.652	.724
	Treatmen	Mean		9.76	.072
		95% Confidence Interval for Mean	Lower Bound	9.61	
			Upper Bound	9.90	
		5% Trimmed Mean		9.79	
		Median		10.00	
		Variance		.189	
		Std. Deviation		.435	
		Minimum		9	
		Maximum		10	
		Range		1	
		Interquartile Range		1	
		Skewness		-1.248	.388
		Kurtosis		-.471	.759

Tests of Normality

	Condition	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.

POSTTEST	Control	.303	41	.000	.734	41	.000
	Treatmen	.469	37	.000	.534	37	.000

a. Lilliefors Significance Correction

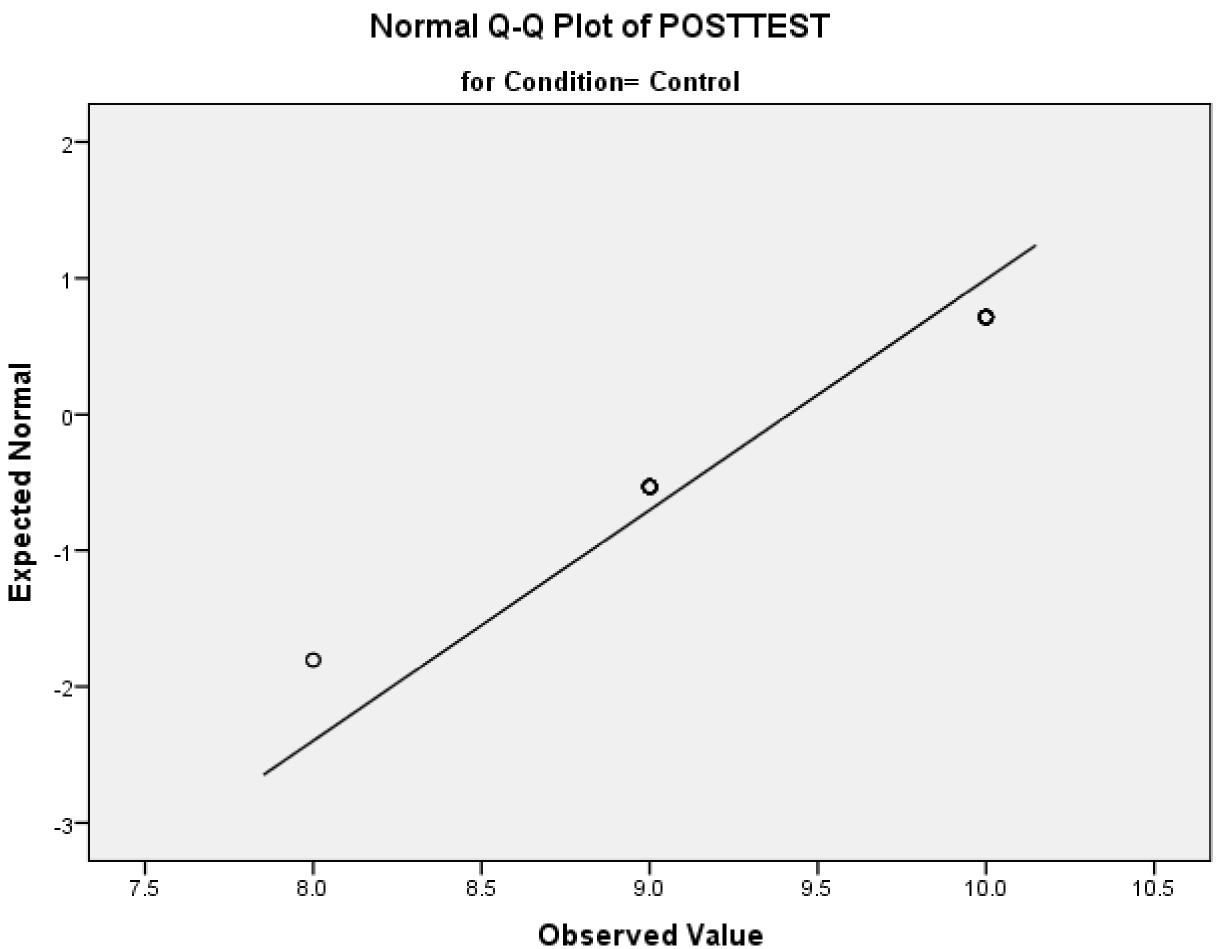
POSTTEST

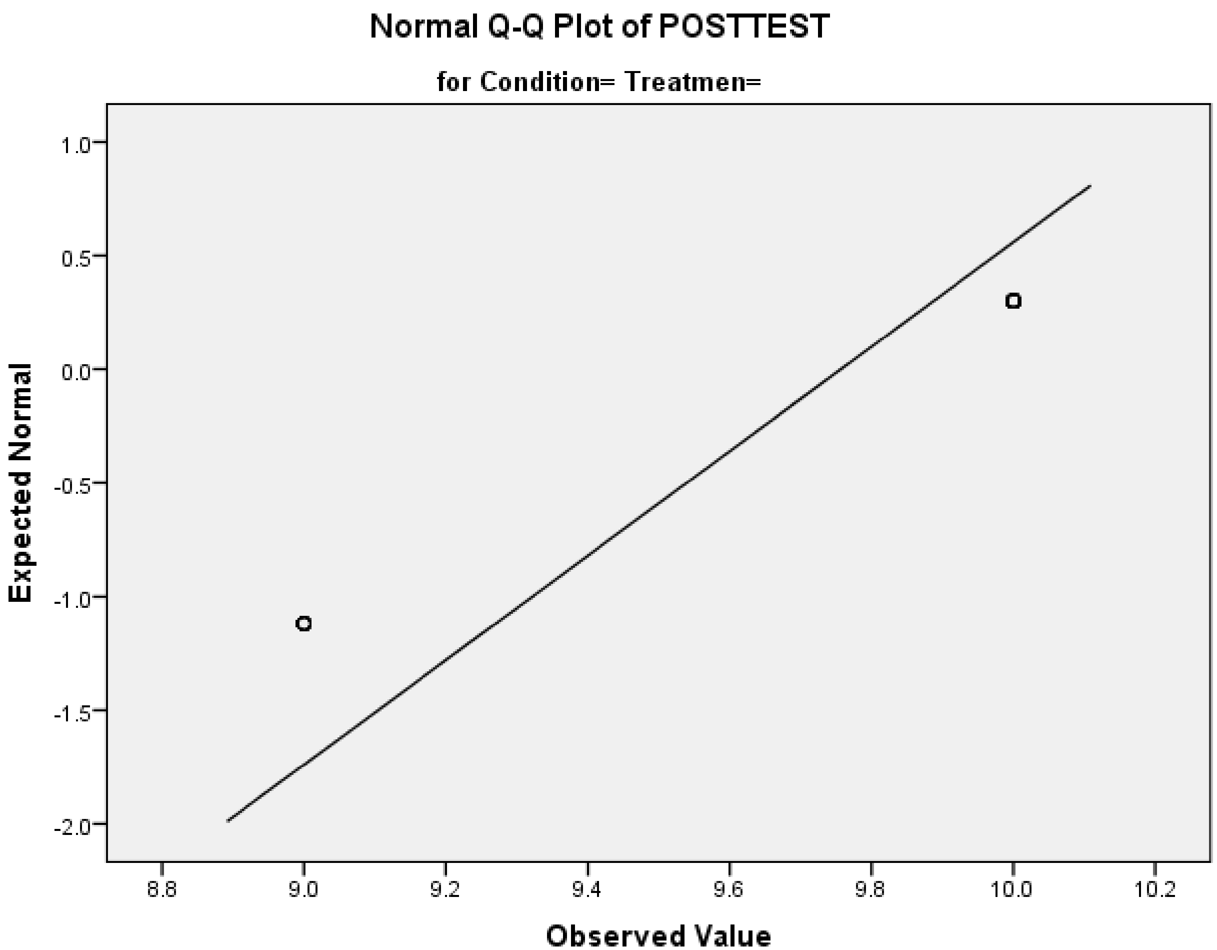
Stem-and-Leaf Plots

```
POSTTEST Stem-and-Leaf Plot for
Condition= Control

 Frequency    Stem &  Leaf

     2.00        8 .  00
      .00        8 .
    20.00        9 .  00000000000000000000
      .00        9 .
    19.00       10 .  0000000000000000000

 Stem width:         1
 Each leaf:       1 case(s)
```

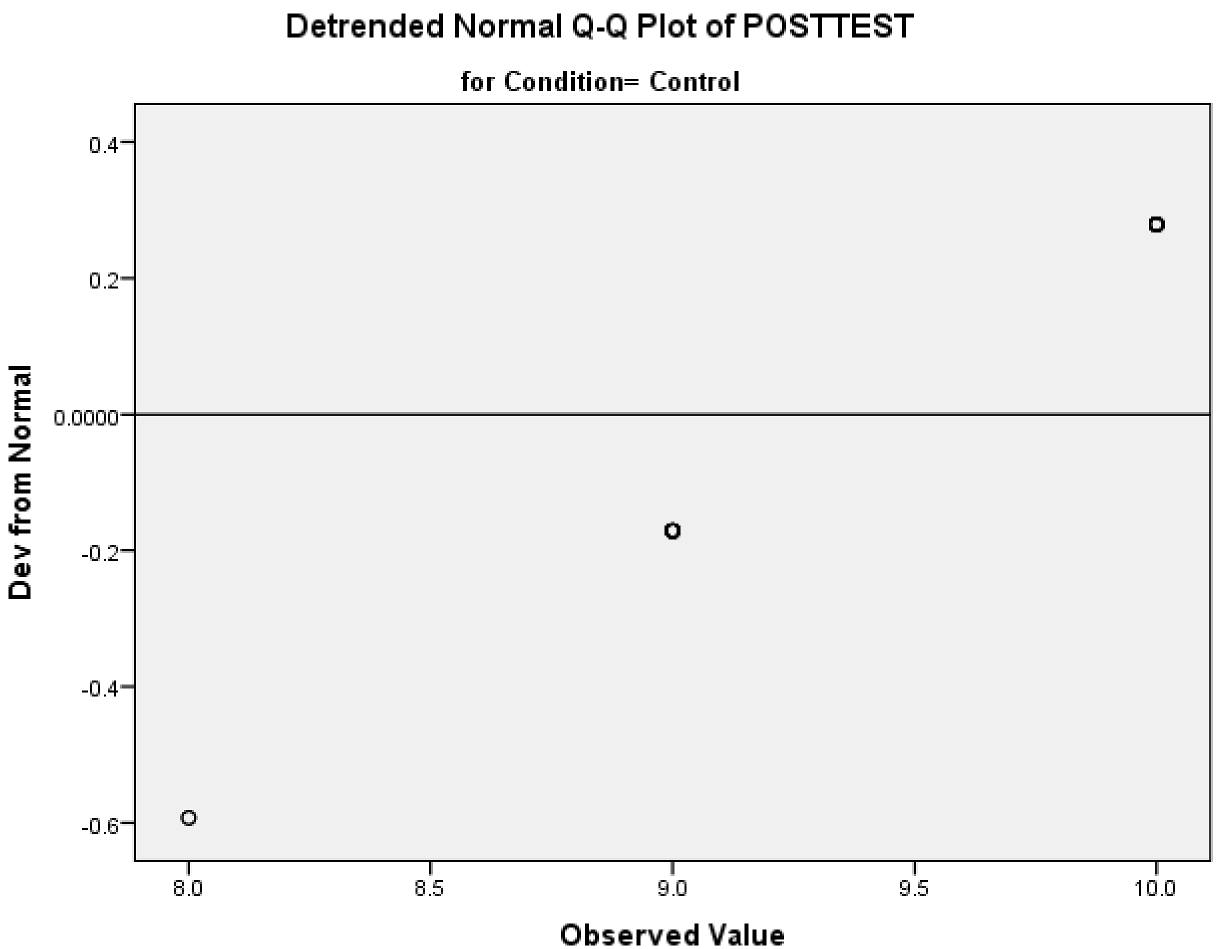
```
POSTTEST Stem-and-Leaf Plot for
Condition= Treatmen

 Frequency    Stem &  Leaf

     9.00 Extremes    (=<9)
    28.00        1 .  0000000000000000000000000000

 Stem width:        10
 Each leaf:       1 case(s)
```

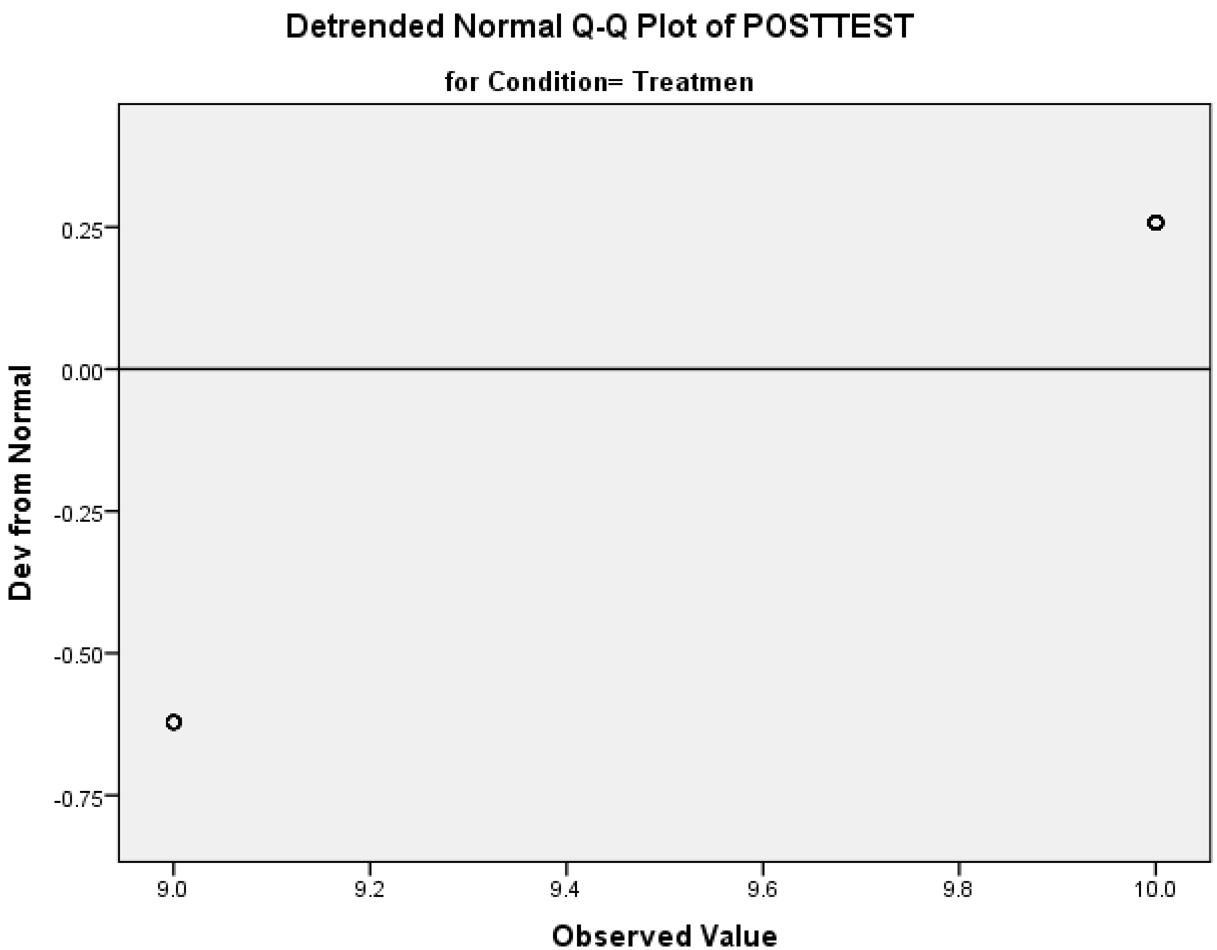
Normal Q-Q Plots

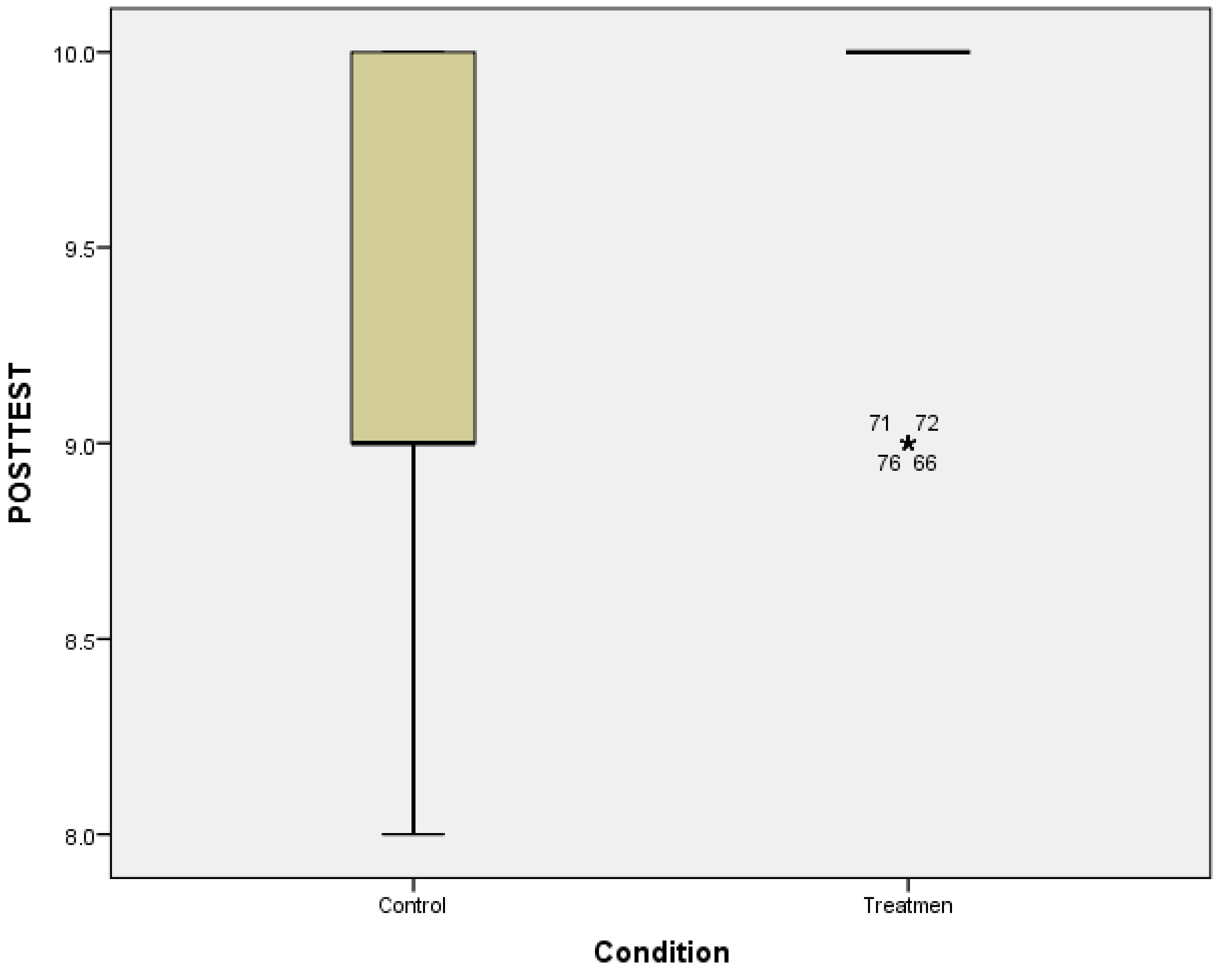

Normal Q-Q Plot of POSTTEST
for Condition= Control
Expected Normal
2
1
0
-1
-2
-3
7.5
8.0
8.5
9.0
9.5
10.0
10.5
Observed Value


Normal Q-Q Plot of POSTTEST
for Condition= Treatmen=
Expected Normal
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
8.8
9.0
9.2
9.4
9.6
9.8
10.0
10.2
Observed Value

Detrended Normal Q-Q Plots


Detrended Normal Q-Q Plot of POSTTEST
for Condition= Control
Dev from Normal
0.4
0.2
0.0000
-0.2
-0.4
-0.6
8.0
8.5
9.0
9.5
10.0
Observed Value


Detrended Normal Q-Q Plot of POSTTEST
for Condition= Treatmen
Dev from Normal
0.25
0.00
-0.25
-0.50
-0.75
9.0
9.2
9.4
9.6
9.8
10.0
Observed Value


10.0
9.5
9.0
8.5
8.0
POSTTEST
71
72
76
66
Control
Treatmen
Condition

```
UNIANOVA POSTTEST BY Condition WITH PRETEST
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /CRITERIA=ALPHA(0.05)
  /DESIGN=Condition PRETEST Condition*PRETEST.
```

Univariate Analysis of Variance

Notes

Output Created		11-SEP-2013 14:34:58
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.

	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
Syntax		UNIANOVA POSTTEST BY Condition WITH PRETEST /METHOD=SSTYPE(3) /INTERCEPT=INCLUDE /CRITERIA=ALPHA(0.05) /DESIGN=Condition PRETEST Condition*PRETEST.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

[DataSet1]

Between-Subjects Factors

		N
Condition	Control	41
	Treatment	37

Tests of Between-Subjects Effects

Dependent Variable: POSTTEST

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2.434[a]	3	.811	2.913	.040
Intercept	1390.038	1	1390.038	4992.148	.000
Condition	.860	1	.860	3.087	.083
PRETEST	.132	1	.132	.474	.493
Condition * PRETEST	.113	1	.113	.405	.527
Error	20.605	74	.278		
Total	7177.000	78			
Corrected Total	23.038	77			

a. R Squared = .106 (Adjusted R Squared = .069)

```
UNIANOVA POSTTEST BY Condition WITH PRETEST
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /EMMEANS=TABLES(Condition) WITH(PRETEST=MEAN)
  /PRINT=OPOWER ETASQ HOMOGENEITY DESCRIPTIVE
  /CRITERIA=ALPHA(.05)
  /DESIGN=PRETEST Condition.
```

Univariate Analysis of Variance

Notes

Output Created		11-SEP-2013 14:36:19
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
Syntax		UNIANOVA POSTTEST BY Condition WITH PRETEST /METHOD=SSTYPE(3) /INTERCEPT=INCLUDE /EMMEANS=TABLES(Condition) WITH(PRETEST=MEAN) /PRINT=OPOWER ETASQ HOMOGENEITY DESCRIPTIVE /CRITERIA=ALPHA(.05) /DESIGN=PRETEST Condition.

Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

[DataSet1]

Between-Subjects Factors

		N
Condition	Control	41
	Treatment	37

Descriptive Statistics

Dependent Variable: POSTTEST

Condition	Mean	Std. Deviation	N
Control	9.41	.591	41
Treatment	9.76	.435	37
Total	9.58	.547	78

Levene's Test of Equality of Error Variances[a]

Dependent Variable: POSTTEST

F	df1	df2	Sig.
12.748	1	76	.001

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + PRETEST + Condition

Tests of Between-Subjects Effects

Dependent Variable: POSTTEST

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	2.321[a]	2	1.160	4.201	.019	.101	8.402	.722
Intercept	1614.059	1	1614.059	5843.065	.000	.987	5843.065	1.000
PRETEST	.044	1	.044	.161	.690	.002	.161	.068
Condition	1.862	1	1.862	6.739	.011	.082	6.739	.727
Error	20.718	75	.276					
Total	7177.000	78						
Corrected Total	23.038	77						

a. R Squared = .101 (Adjusted R Squared = .077)

b. Computed using alpha = .05

Estimated Marginal Means

Condition

Dependent Variable: POSTTEST

Condition	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control	9.422[a]	.084	9.254	9.590
Treatment	9.748[a]	.089	9.571	9.925

a. Covariates appearing in the model are evaluated at the following values:

PRETEST = 4.15.

```
CORRELATIONS
  /VARIABLES=PRETEST POSTTEST
  /PRINT=TWOTAIL NOSIG
  /MISSING=PAIRWISE.
```

Correlations

Notes

Output Created		11-SEP-2013 14:37:19
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each pair of variables are based on all the cases with valid data for that pair.
Syntax		CORRELATIONS /VARIABLES=PRETEST POSTTEST /PRINT=TWOTAIL NOSIG /MISSING=PAIRWISE.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

[DataSet1]

Correlations

		PRETEST	POSTTEST
PRETEST	Pearson Correlation	1	-.141
	Sig. (2-tailed)		.218
	N	78	78
POSTTEST	Pearson Correlation	-.141	1
	Sig. (2-tailed)	.218	
	N	78	78

NPV Content Knowledge Posttest T-Test

```
GET DATA /TYPE=XLSX
  /FILE='F:\Chris_Andrews_PhD_Dissertation_2010_2011\Defense\DATA\Raw Data Dissertation Sep 11 2013.xlsx'
  /SHEET=name 'NPV Content Knowledge Test'
  /CELLRANGE=full
  /READNAMES=on
  /ASSUMEDSTRWIDTH=32767.
EXECUTE.
DATASET NAME DataSet1 WINDOW=FRONT.
EXAMINE VARIABLES=POSTTEST BY Condition
  /PLOT BOXPLOT NPPLOT
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.
```

Explore

Notes

Output Created	11-SEP-2013 14:43:50
Comments	

Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.
Syntax		EXAMINE VARIABLES=POSTTEST BY Condition /PLOT BOXPLOT NPPLOT /COMPARE GROUPS /STATISTICS DESCRIPTIVES /CINTERVAL 95 /MISSING LISTWISE /NOTOTAL.
Resources	Processor Time	00:00:01.26
	Elapsed Time	00:00:01.26

[DataSet1]

Condition

Case Processing Summary

	Condition	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
POSTTEST	0	41	100.0%	0	0.0%	41	100.0%
	1	37	100.0%	0	0.0%	37	100.0%

Descriptives

	Condition			Statistic	Std. Error
POSTTEST	0	Mean		9.41	.092
		95% Confidence Interval for Mean	Lower Bound	9.23	
			Upper Bound	9.60	
		5% Trimmed Mean		9.46	
		Median		9.00	
		Variance		.349	

	Std. Deviation		.591	
	Minimum		8	
	Maximum		10	
	Range		2	
	Interquartile Range		1	
	Skewness		-.418	.369
	Kurtosis		-.652	.724
	Mean		9.76	.072
	95% Confidence Interval for Mean	Lower Bound	9.61	
		Upper Bound	9.90	
	5% Trimmed Mean		9.79	
	Median		10.00	
	Variance		.189	
1	Std. Deviation		.435	
	Minimum		9	
	Maximum		10	
	Range		1	
	Interquartile Range		1	
	Skewness		-1.248	.388
	Kurtosis		-.471	.759

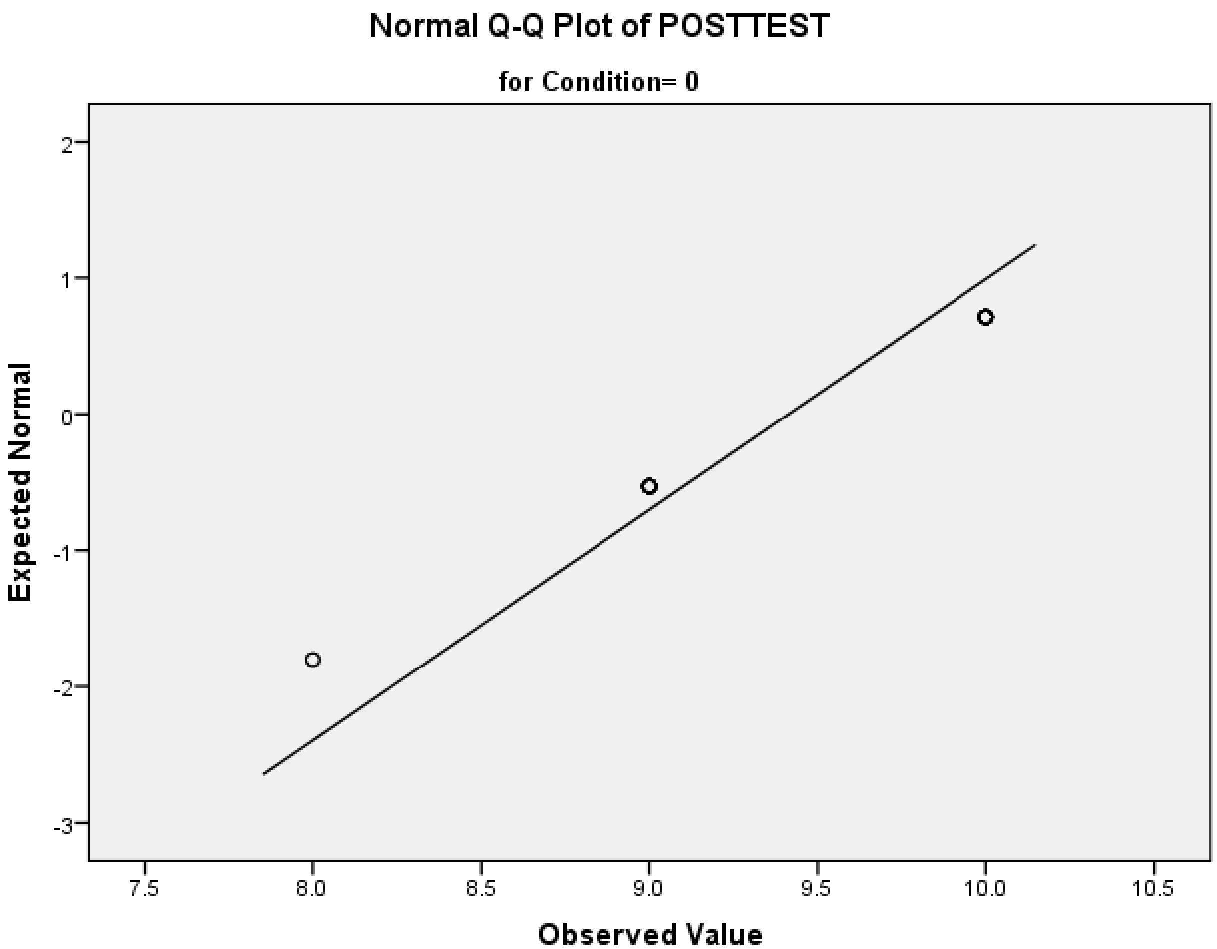
Tests of Normality

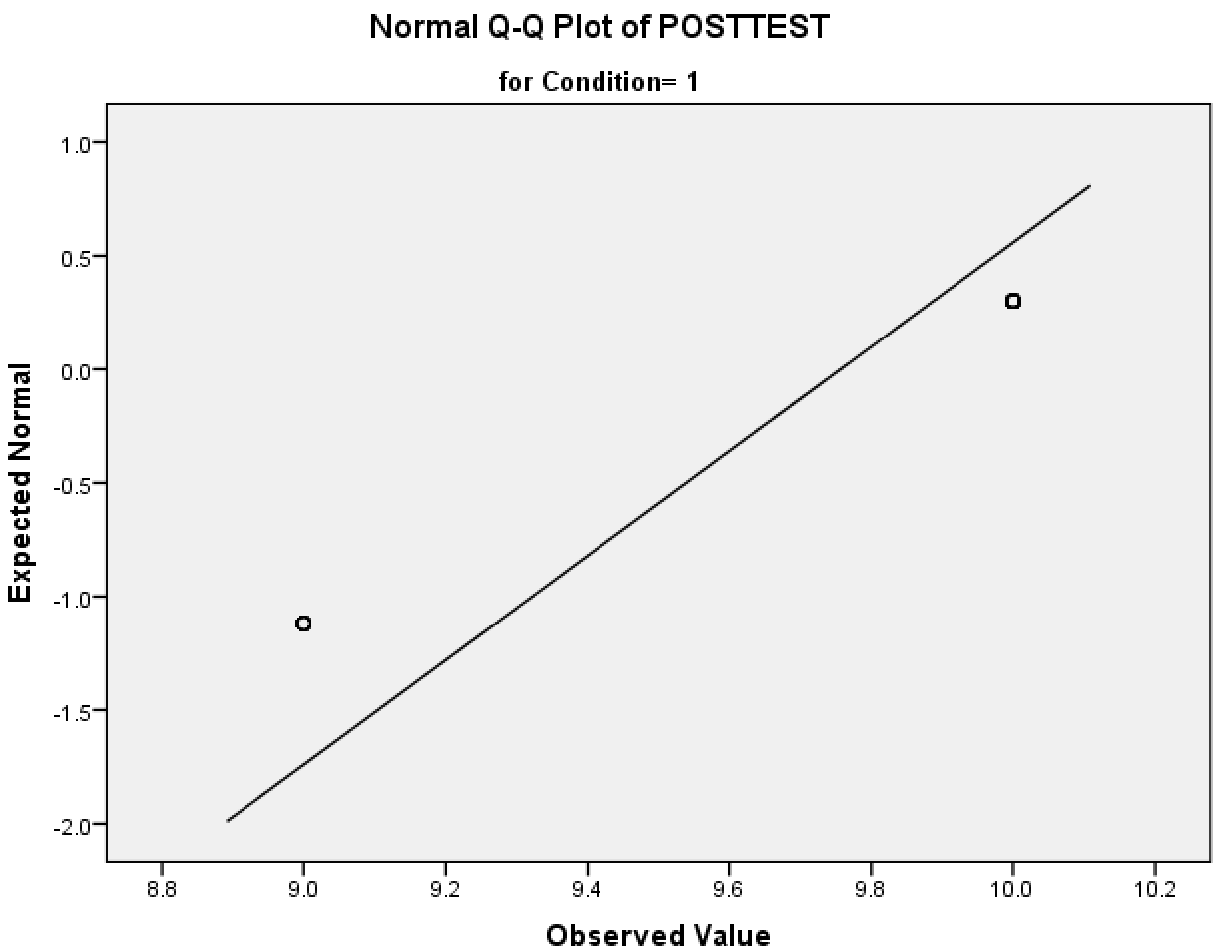
	Condition	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
POSTTEST	0	.303	41	.000	.734	41	.000
	1	.469	37	.000	.534	37	.000

a. Lilliefors Significance Correction

POSTTEST

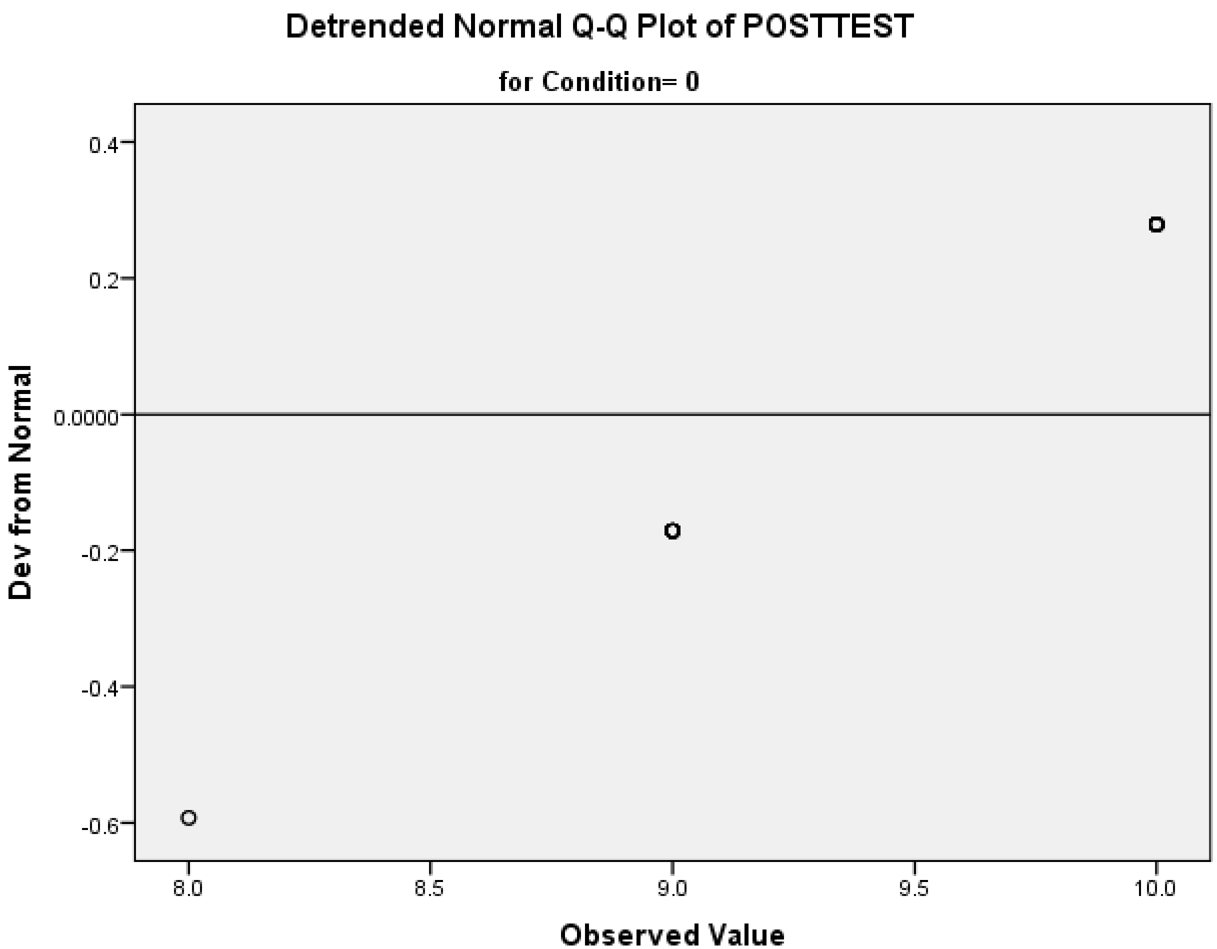
Normal Q-Q Plots

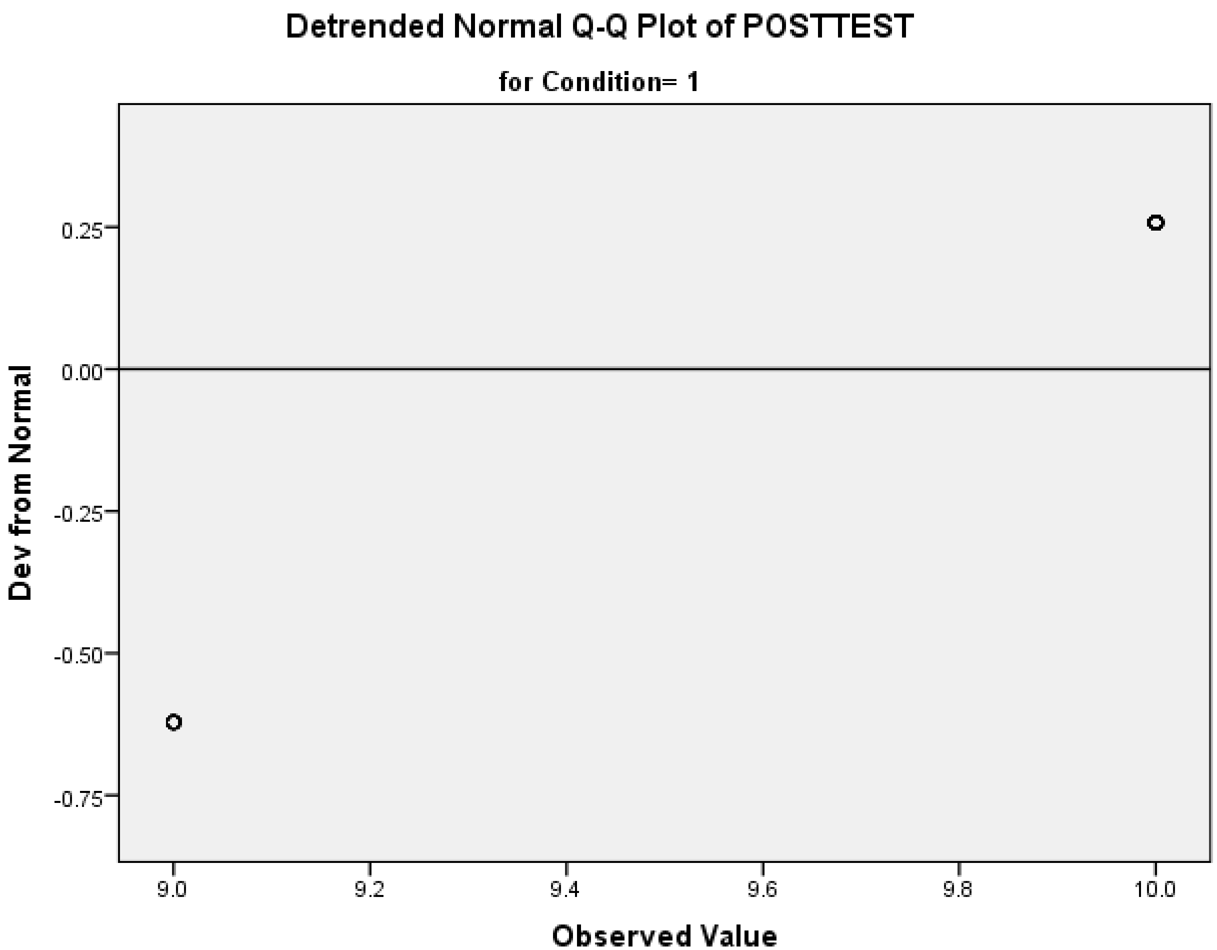

Normal Q-Q Plot of POSTTEST
for Condition= 0
Expected Normal
2
1
0
-1
-2
-3
7.5
8.0
8.5
9.0
9.5
10.0
10.5
Observed Value



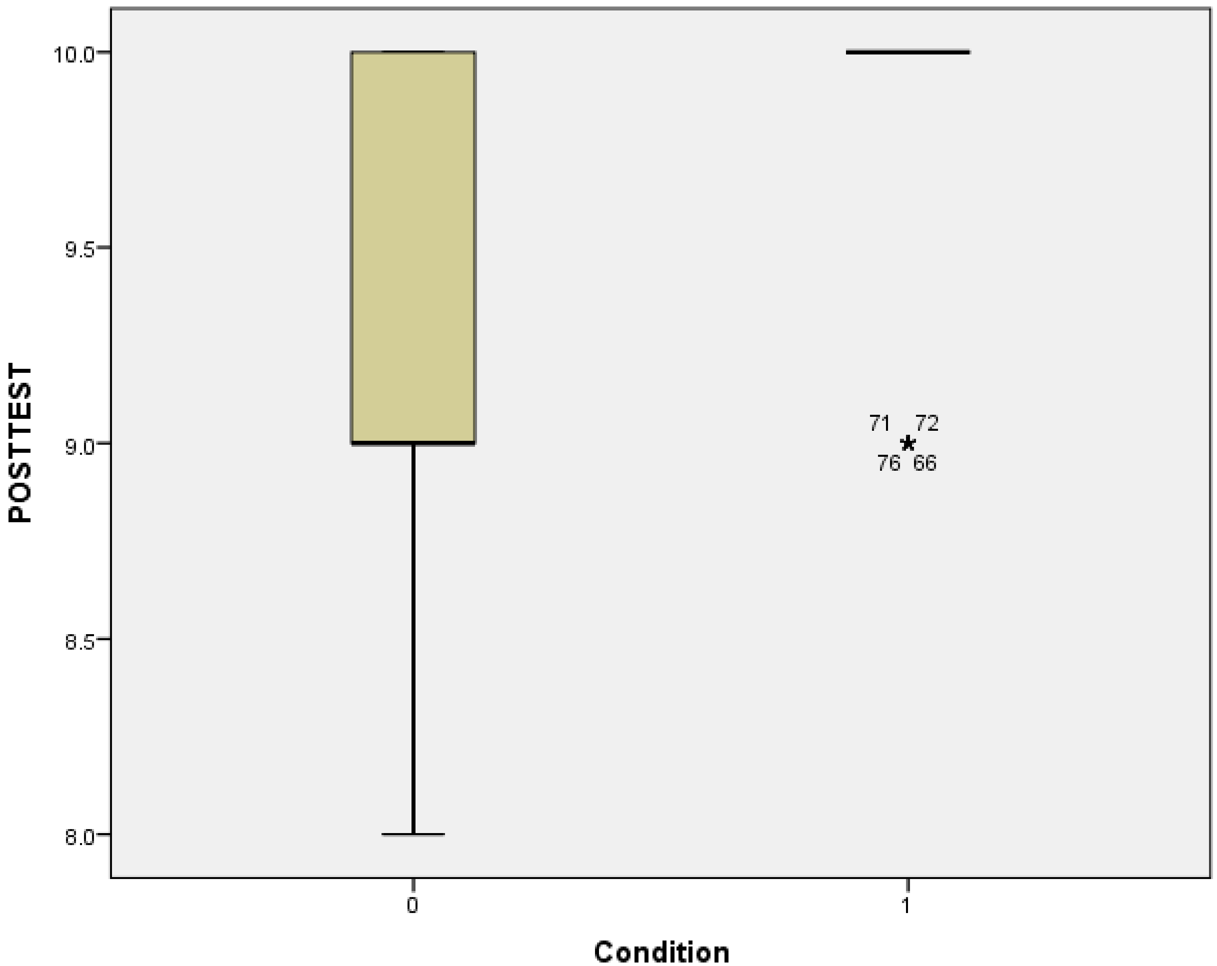
Normal Q-Q Plot of POSTTEST
for Condition= 1
Expected Normal
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
8.8
9.0
9.2
9.4
9.6
9.8
10.0
10.2
Observed Value

Detrended Normal Q-Q Plots


Detrended Normal Q-Q Plot of POSTTEST
for Condition= 0
Dev from Normal
0.4
0.2
0.0000
-0.2
-0.4
-0.6
8.0
8.5
9.0
9.5
10.0
Observed Value



Detrended Normal Q-Q Plot of POSTTEST
for Condition= 1
Dev from Normal
0.25
0.00
-0.25
-0.50
-0.75
9.0
9.2
9.4
9.6
9.8
10.0
Observed Value



10.0
9.5
9.0
8.5
8.0
POSTTEST
71
72
76
66
0
1
Condition

```
T-TEST GROUPS=Condition(0 1)
  /MISSING=ANALYSIS
  /VARIABLES=POSTTEST
  /CRITERIA=CI(.95).
```

T-Test

Notes

Output Created		11-SEP-2013 14:44:36
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.

	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST GROUPS=Condition(0 1) /MISSING=ANALYSIS /VARIABLES=POSTTEST /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

[DataSet1]

Group Statistics

	Condition	N	Mean	Std. Deviation	Std. Error Mean
POSTTEST	0	41	9.41	.591	.092
	1	37	9.76	.435	.072

	Levene's Test for Equality of Variances					
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference

POSTTEST	Equal variances assumed	12.217	.001	-2.887	76	.005	-.342
	Equal variances not assumed			-2.932	73.166	.004	-.342

```
NPAR TESTS
  /M-W= POSTTEST BY Condition(0 1)
  /STATISTICS=DESCRIPTIVES
  /MISSING ANALYSIS.
```

NPar Tests

Notes

Output Created		11-SEP-2013 14:45:48
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.

	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.
Syntax		NPAR TESTS /M-W= POSTTEST BY Condition(0 1) /STATISTICS=DESCRIPTIVES /MISSING ANALYSIS.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00
	Number of Cases Allowed[a]	112347

a. Based on availability of workspace memory.

[DataSet1]

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
POSTTEST	78	9.58	.547	8	10
Condition	78	.47	.503	0	1

Mann-Whitney Test

Ranks

	Condition	N	Mean Rank	Sum of Ranks
POSTTEST	0	41	33.85	1388.00
	1	37	45.76	1693.00
	Total	78		

Test Statistics[a]

	POSTTEST
Mann-Whitney U	527.000
Wilcoxon W	1388.000
Z	-2.711
Asymp. Sig. (2-tailed)	.007

a. Grouping Variable: Condition

NPV Content Knowledge Posttest T-Test

```
GET DATA /TYPE=XLSX
  /FILE='F:\Chris_Andrews_PhD_Dissertation_2010_2011\Defense\DATA\Raw Data Dissertation Sep 11 2013.xlsx'
  /SHEET=name 'NPV Content Knowledge Test'
  /CELLRANGE=full
  /READNAMES=on
  /ASSUMEDSTRWIDTH=32767.
EXECUTE.
DATASET NAME DataSet1 WINDOW=FRONT.
EXAMINE VARIABLES=POSTTEST BY Condition
  /PLOT BOXPLOT NPPLOT
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.
```

Explore

Notes

Output Created		11-SEP-2013 14:43:50
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>

Missing Value Handling	N of Rows in Working Data File	78
	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.
Syntax		EXAMINE VARIABLES=POSTTEST BY Condition /PLOT BOXPLOT NPPLOT /COMPARE GROUPS /STATISTICS DESCRIPTIVES /CINTERVAL 95 /MISSING LISTWISE /NOTOTAL.
Resources	Processor Time	00:00:01.26
	Elapsed Time	00:00:01.26

[DataSet1]

Condition

Case Processing Summary

	Condition	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
POSTTEST	0	41	100.0%	0	0.0%	41	100.0%
	1	37	100.0%	0	0.0%	37	100.0%

Descriptives

	Condition			Statistic	Std. Error
POSTTEST	0	Mean		9.41	.092
		95% Confidence Interval for Mean	Lower Bound	9.23	
			Upper Bound	9.60	
		5% Trimmed Mean		9.46	
		Median		9.00	
		Variance		.349	
		Std. Deviation		.591	
		Minimum		8	
		Maximum		10	
		Range		2	

	Interquartile Range		1	
	Skewness		-.418	.369
	Kurtosis		-.652	.724
	Mean		9.76	.072
	95% Confidence Interval for Mean	Lower Bound	9.61	
		Upper Bound	9.90	
	5% Trimmed Mean		9.79	
	Median		10.00	
	Variance		.189	
1	Std. Deviation		.435	
	Minimum		9	
	Maximum		10	
	Range		1	
	Interquartile Range		1	
	Skewness		-1.248	.388
	Kurtosis		-.471	.759

Tests of Normality

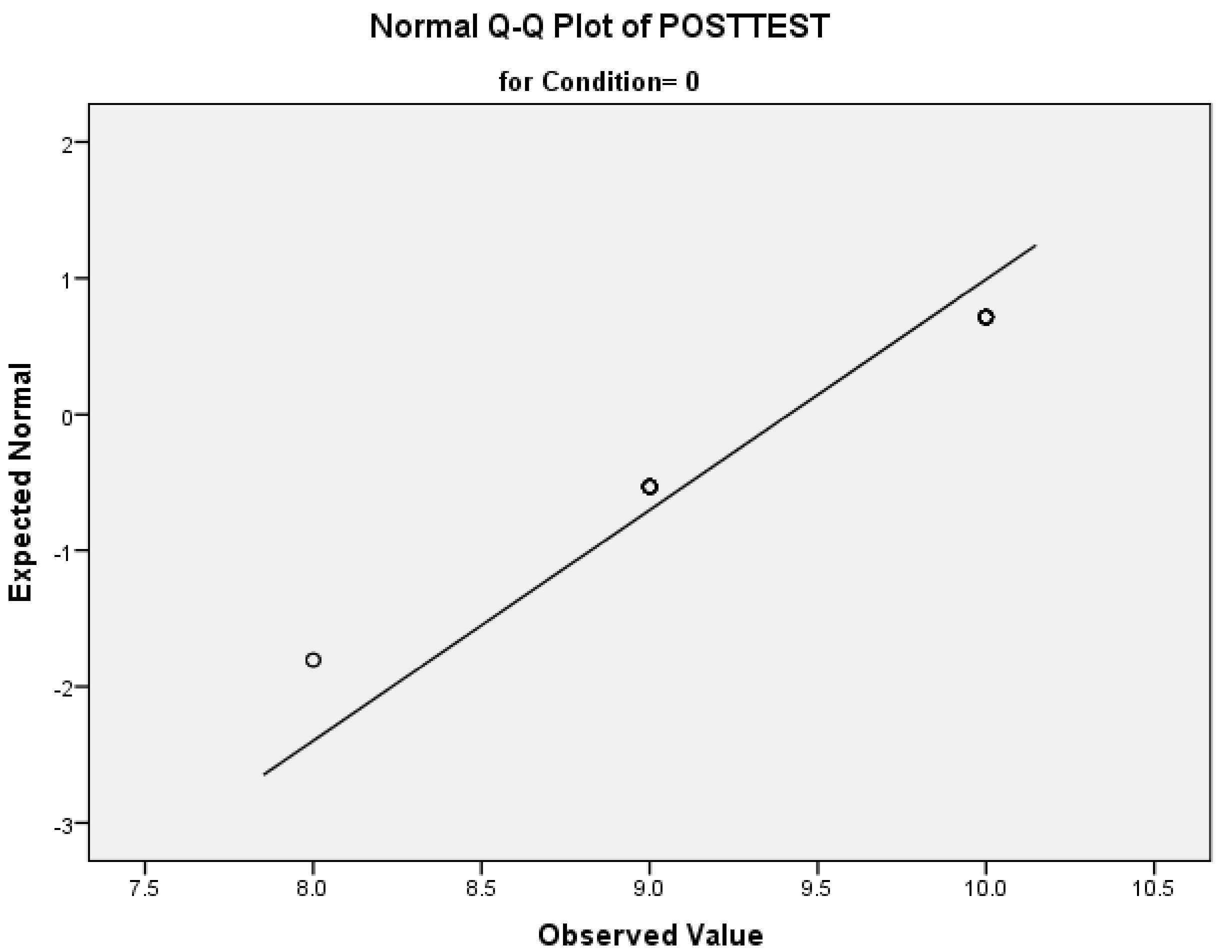
	Condition	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.

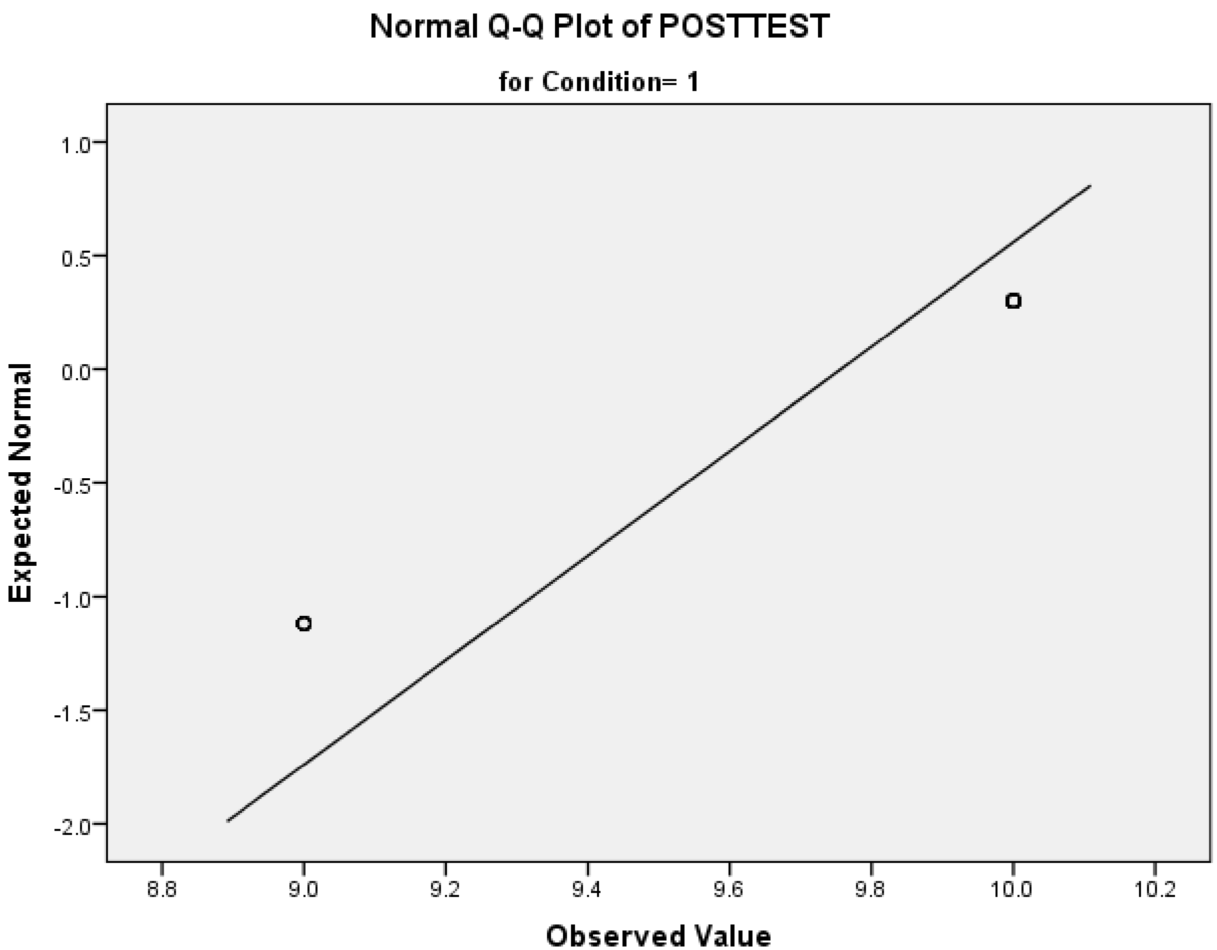
POSTTEST	0	.303	41	.000	.734	41	.000
	1	.469	37	.000	.534	37	.000

a. Lilliefors Significance Correction

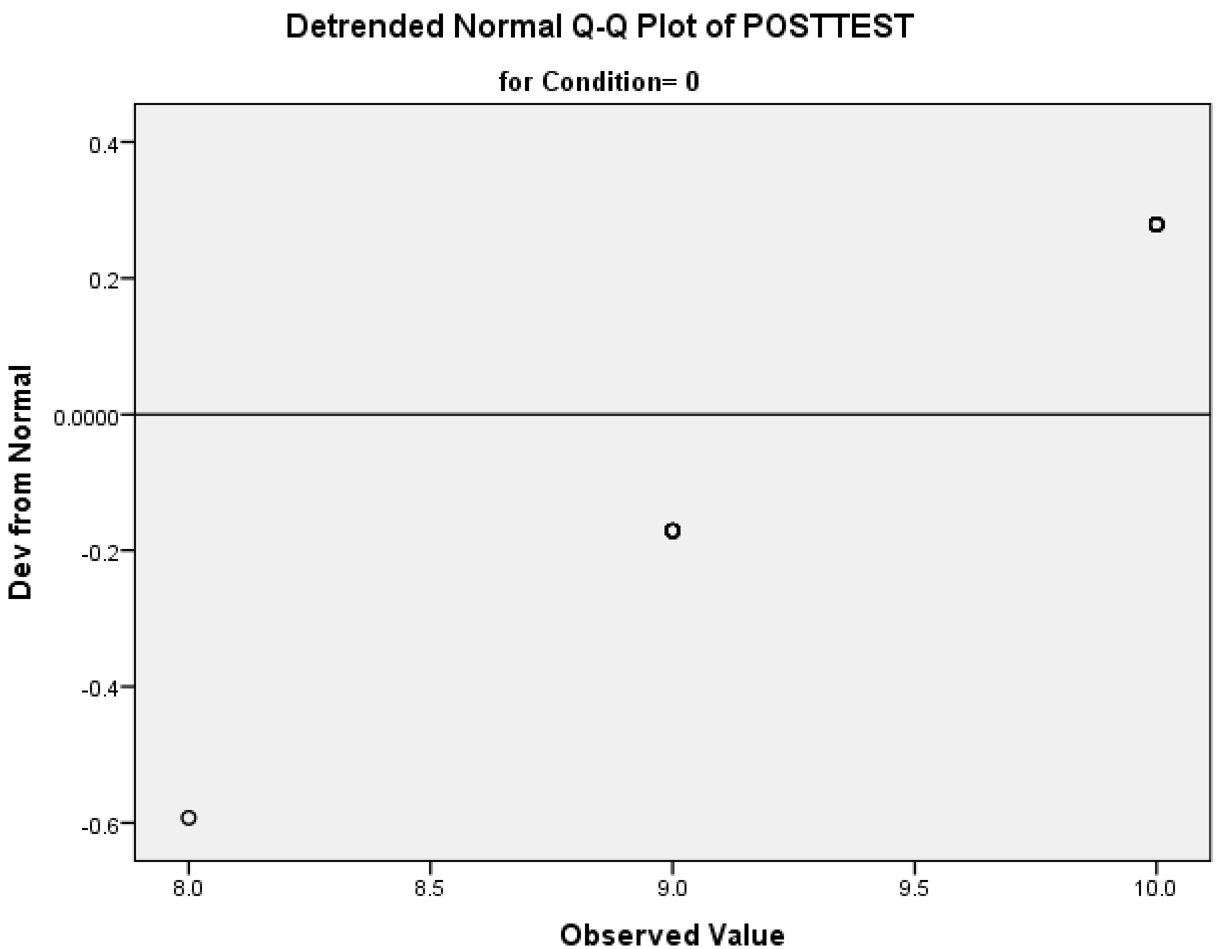
POSTTEST

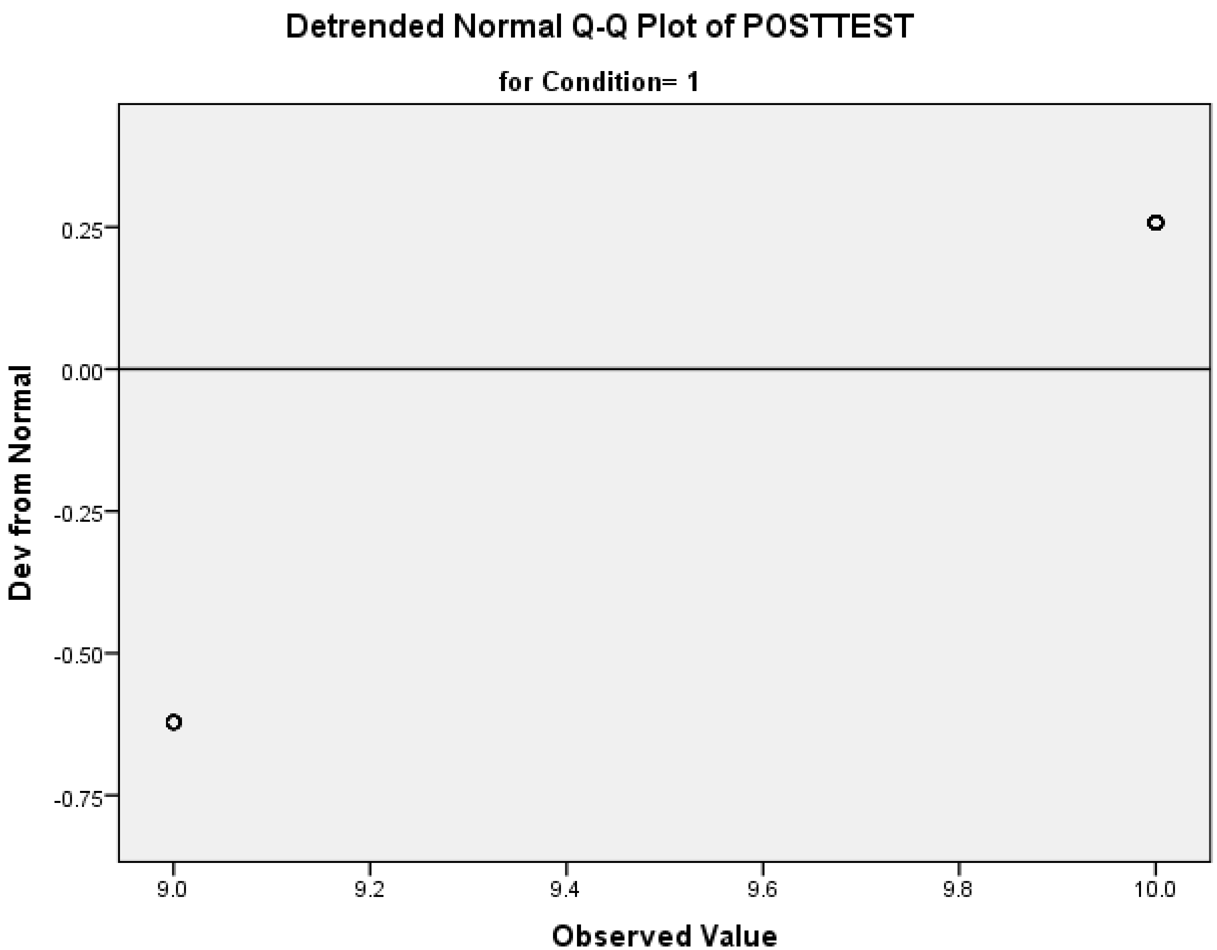
Normal Q-Q Plots


Normal Q-Q Plot of POSTTEST
for Condition= 0
Expected Normal
2
1
0
-1
-2
-3
7.5
8.0
8.5
9.0
9.5
10.0
10.5
Observed Value

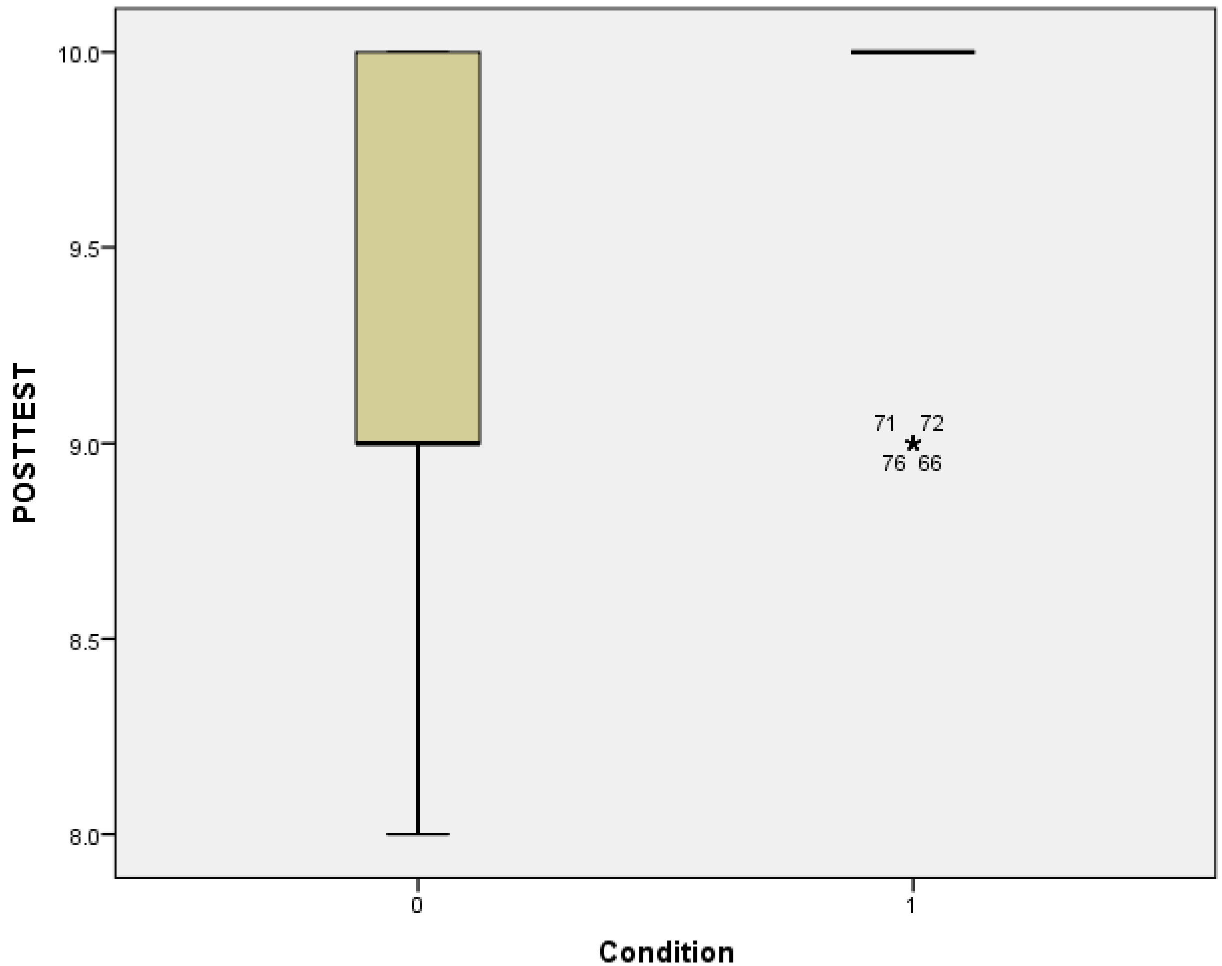

Normal Q-Q Plot of POSTTEST
for Condition= 1
Expected Normal
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
8.8
9.0
9.2
9.4
9.6
9.8
10.0
10.2
Observed Value

Detrended Normal Q-Q Plots


Detrended Normal Q-Q Plot of POSTTEST
for Condition= 0
Dev from Normal
0.4
0.2
0.0000
-0.2
-0.4
-0.6
8.0
8.5
9.0
9.5
10.0
Observed Value



Detrended Normal Q-Q Plot of POSTTEST
for Condition= 1
Dev from Normal
0.25
0.00
-0.25
-0.50
-0.75
9.0
9.2
9.4
9.6
9.8
10.0
Observed Value



10.0
9.5
9.0
8.5
8.0
POSTTEST
71
72
76
66
0
1
Condition

```
T-TEST GROUPS=Condition(0 1)
  /MISSING=ANALYSIS
  /VARIABLES=POSTTEST
  /CRITERIA=CI(.95).
```

T-Test

Notes

Output Created		11-SEP-2013 14:44:36
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.

	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST GROUPS=Condition(0 1) /MISSING=ANALYSIS /VARIABLES=POSTTEST /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

[DataSet1]

Group Statistics

	Condition	N	Mean	Std. Deviation	Std. Error Mean
POSTTEST	0	41	9.41	.591	.092
	1	37	9.76	.435	.072

	Levene's Test for Equality of Variances					
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference

POSTTEST	Equal variances assumed	12.217	.001	-2.887	76	.005	-.342
	Equal variances not assumed			-2.932	73.166	.004	-.342

```
NPAR TESTS
  /M-W= POSTTEST BY Condition(0 1)
  /STATISTICS=DESCRIPTIVES
  /MISSING ANALYSIS.
```

NPar Tests

Notes

Output Created		11-SEP-2013 14:45:48
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.

	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.
Syntax		NPAR TESTS /M-W= POSTTEST BY Condition(0 1) /STATISTICS=DESCRIPTIVES /MISSING ANALYSIS.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00
	Number of Cases Allowed[a]	112347

a. Based on availability of workspace memory.

[DataSet1]

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
POSTTEST	78	9.58	.547	8	10
Condition	78	.47	.503	0	1

Mann-Whitney Test

Ranks

	Condition	N	Mean Rank	Sum of Ranks
POSTTEST	0	41	33.85	1388.00
	1	37	45.76	1693.00
	Total	78		

Test Statistics[a]

	POSTTEST
Mann-Whitney U	527.000
Wilcoxon W	1388.000
Z	-2.711
Asymp. Sig. (2-tailed)	.007

a. Grouping Variable: Condition

TTEST for NPV Excel Models

```
GET DATA /TYPE=XLSX
  /FILE='F:\Chris_Andrews_PhD_Dissertation_2010_2011\Defense\DATA\Raw Data Dissertation Sep 11 2013.xlsx'
  /SHEET=name 'NPV Excel Model SPSS Inputs'
  /CELLRANGE=full
  /READNAMES=on
  /ASSUMEDSTRWIDTH=32767.
EXECUTE.
DATASET NAME DataSet1 WINDOW=FRONT.
EXAMINE VARIABLES=NPVExcelScore BY Condition
  /PLOT BOXPLOT NPPLOT
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.
```

Explore

Notes

Output Created		11-SEP-2013 14:56:32
Comments		
Input	Active Dataset	DataSet1

	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.
Syntax		EXAMINE VARIABLES=NPVExcelScore BY Condition /PLOT BOXPLOT NPPLOT /COMPARE GROUPS /STATISTICS DESCRIPTIVES /CINTERVAL 95 /MISSING LISTWISE /NOTOTAL.
Resources	Processor Time	00:00:01.26
	Elapsed Time	00:00:01.29

[DataSet1]

Condition

Case Processing Summary

	Condition	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
NPVExcelScore	0	41	100.0%	0	0.0%	41	100.0%
	1	37	100.0%	0	0.0%	37	100.0%

Descriptives

	Condition			Statistic	Std. Error
NPVExcelScore	0	Mean		30.56	.480
		95% Confidence Interval for Mean	Lower Bound	29.59	
			Upper Bound	31.53	
		5% Trimmed Mean		30.71	
		Median		33.00	
		Variance		9.452	
		Std. Deviation		3.074	

	Minimum		24	
	Maximum		34	
	Range		10	
	Interquartile Range		4	
	Skewness		-.577	.369
	Kurtosis		-.995	.724
	Mean		30.76	.420
	95% Confidence Interval for Mean	Lower Bound	29.91	
		Upper Bound	31.61	
	5% Trimmed Mean		30.90	
	Median		30.00	
	Variance		6.523	
1	Std. Deviation		2.554	
	Minimum		25	
	Maximum		34	
	Range		9	
	Interquartile Range		5	
	Skewness		-.221	.388
	Kurtosis		-.558	.759

Tests of Normality

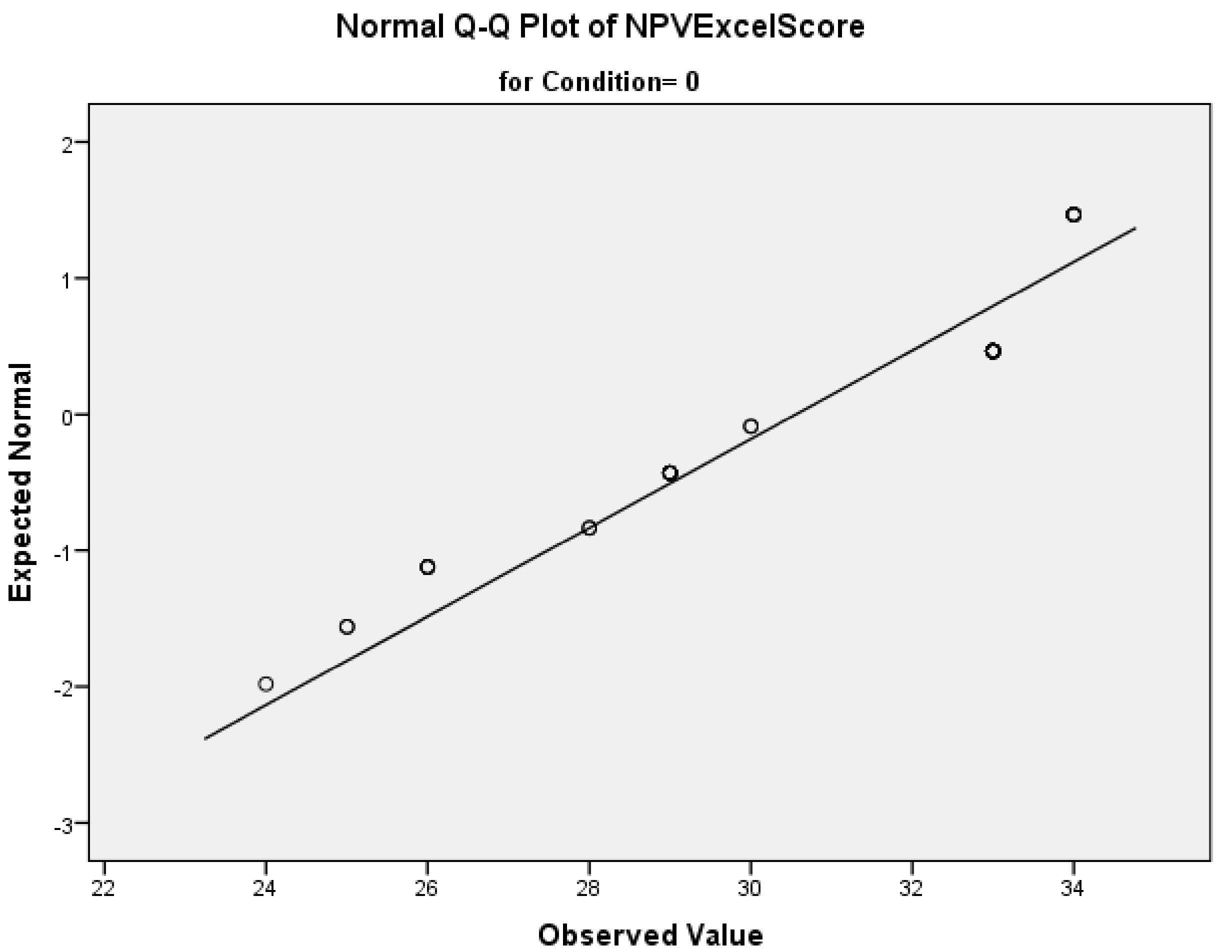
	Condition	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
NPVExcelScore	0	.298	41	.000	.848	41	.000
	1	.211	37	.000	.878	37	.001

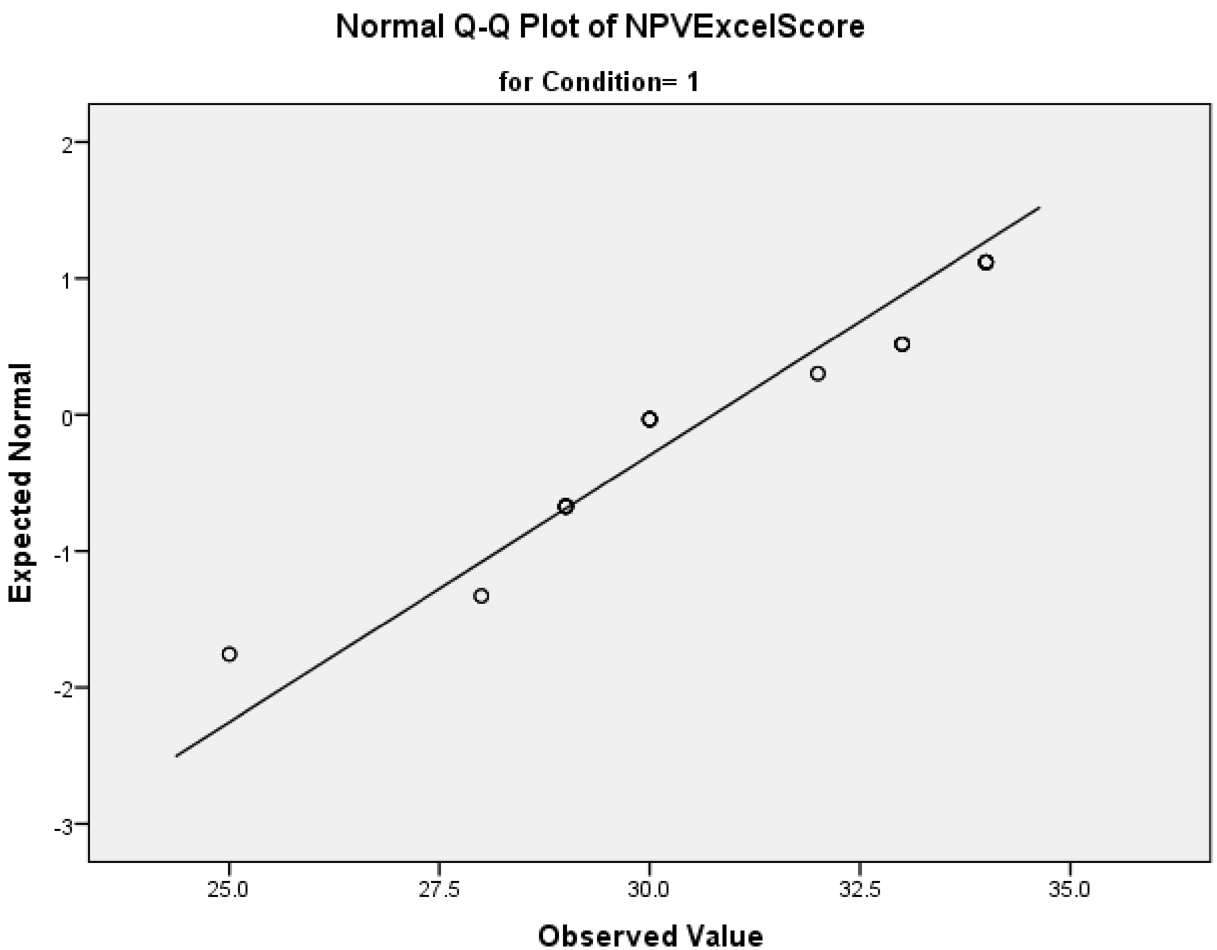
a. Lilliefors Significance Correction

FAILS test of Normality (< .05) therefore Nonparametric (Mannu Whit U)

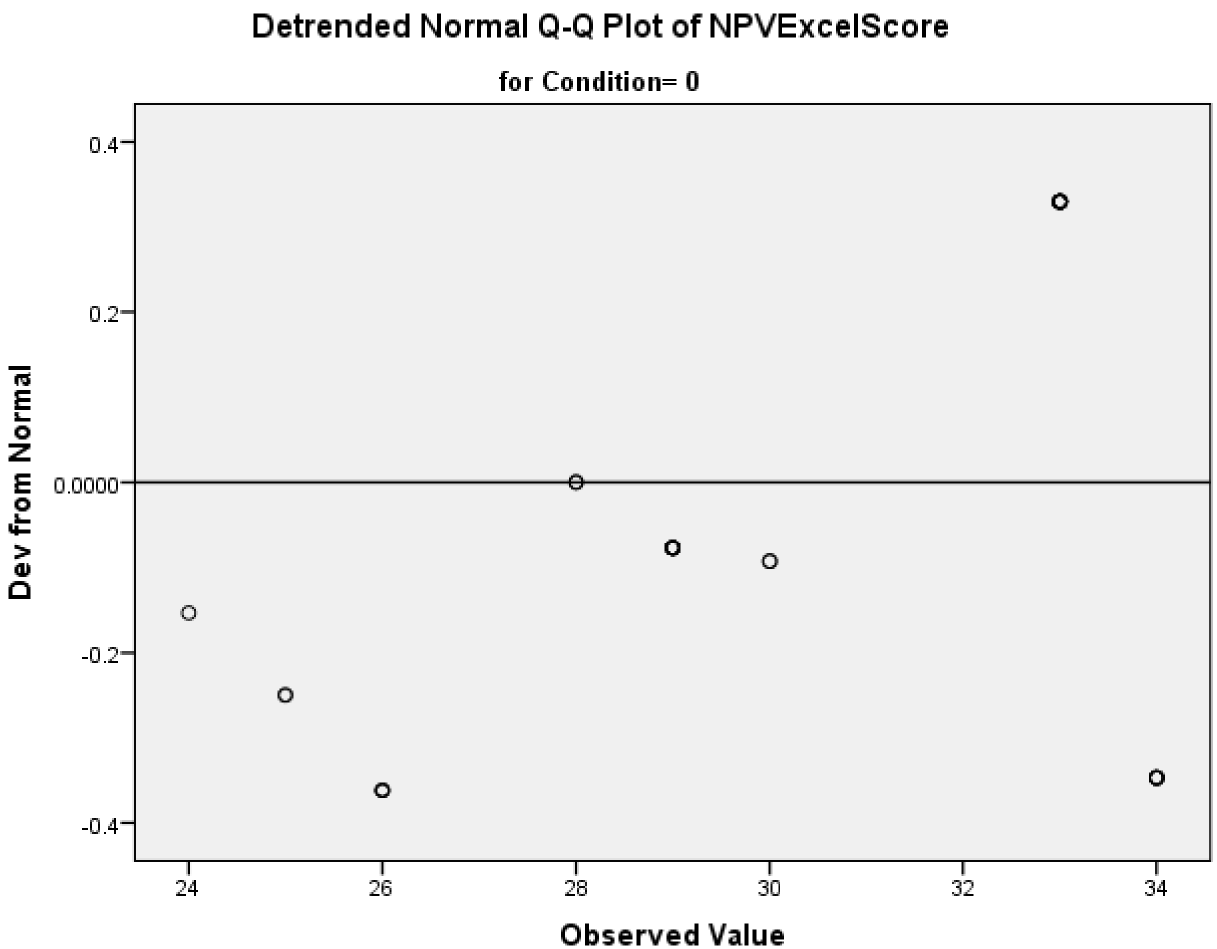
NPVExcelScore

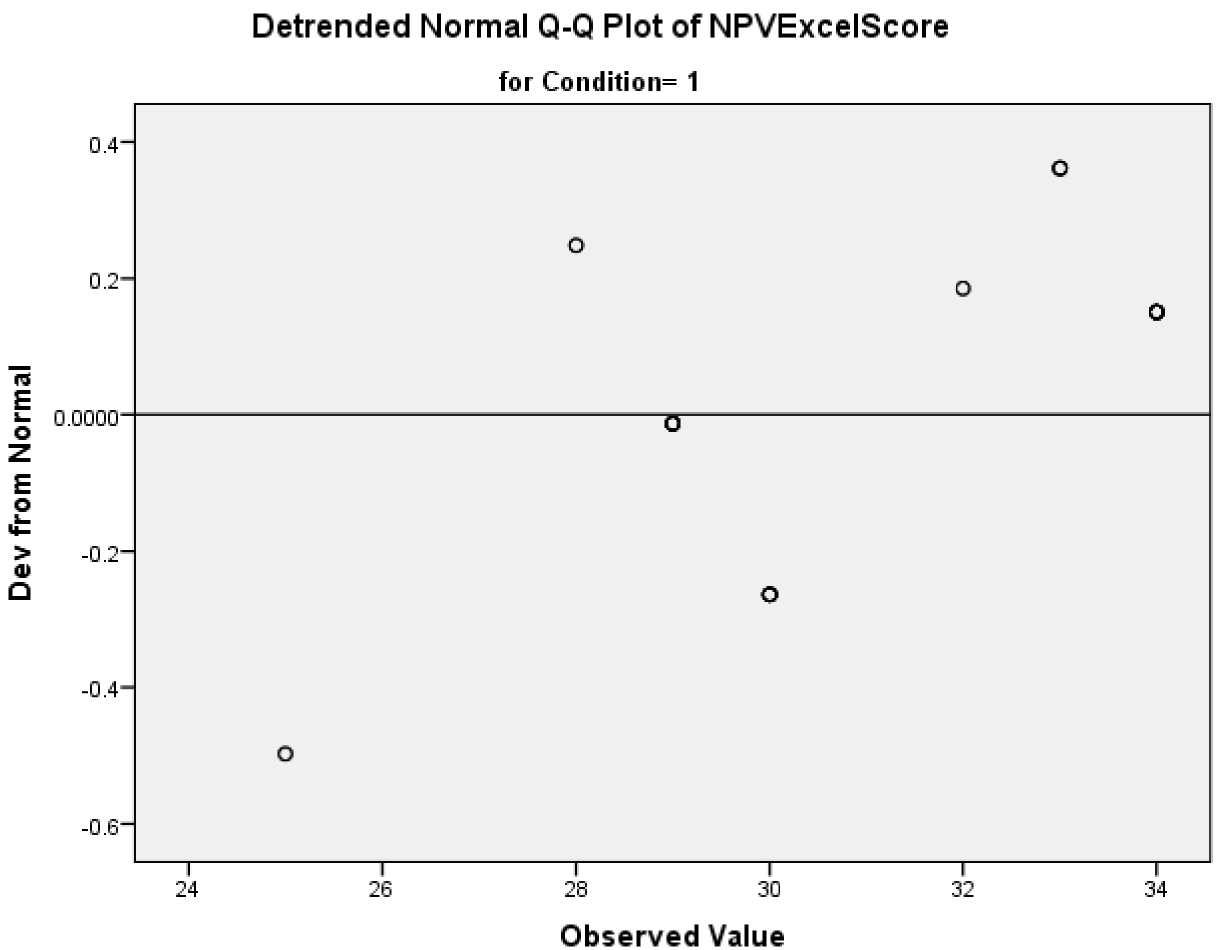
Normal Q-Q Plots

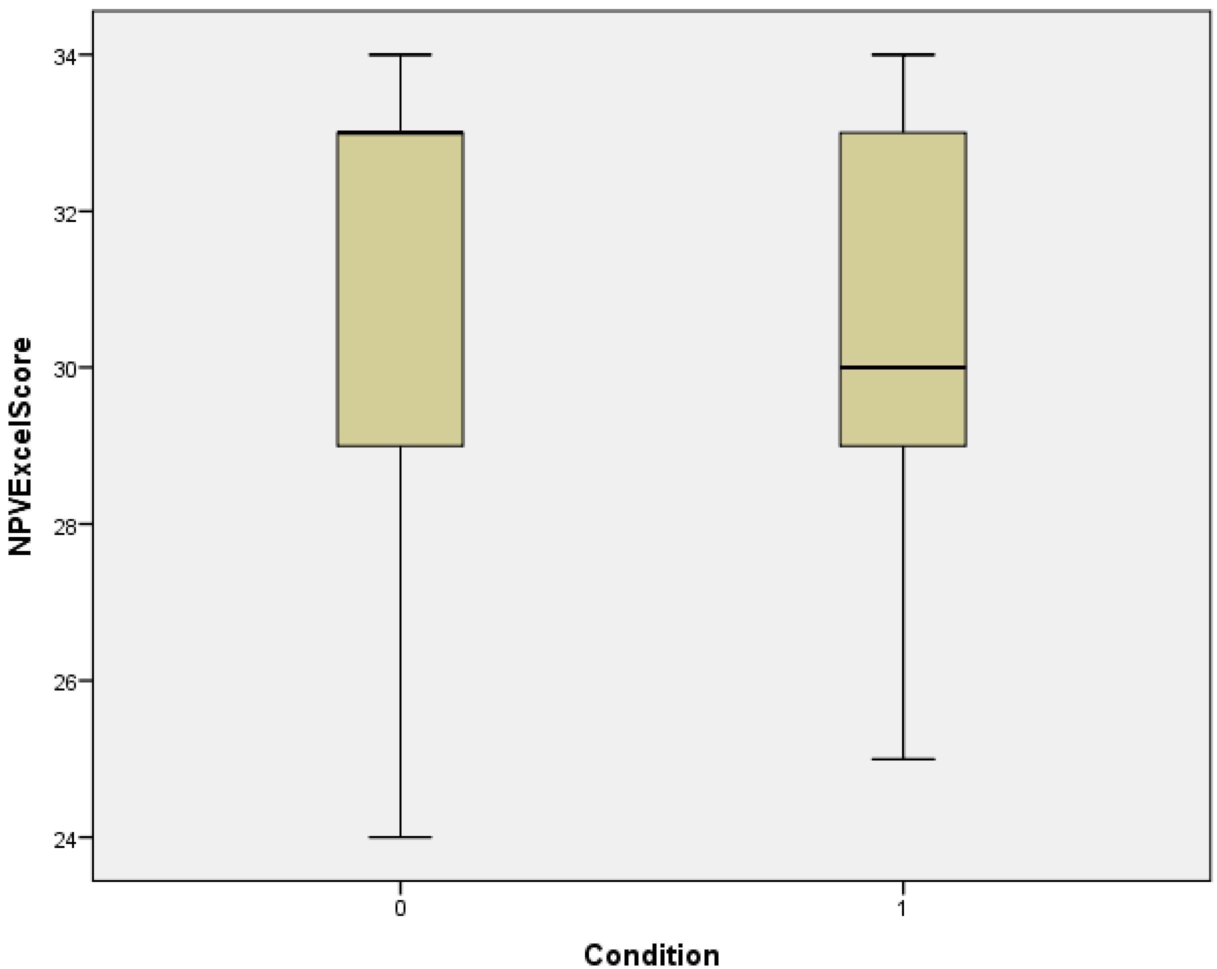

Normal Q-Q Plot of NPVExcelScore
for Condition= 0
Expected Normal
2
1
0
-1
-2
-3
22
24
26
28
30
32
34
Observed Value


Normal Q-Q Plot of NPVExcelScore
for Condition= 1
Expected Normal
Observed Value
2
1
0
-1
-2
-3
25.0
27.5
30.0
32.5
35.0

Detrended Normal Q-Q Plots


Detrended Normal Q-Q Plot of NPVExcelScore
for Condition= 0
0.4
0.2
0.0000
-0.2
-0.4
Dev from Normal
24
26
28
30
32
34
Observed Value


Detrended Normal Q-Q Plot of NPVExcelScore
for Condition= 1
Dev from Normal
0.4
0.2
0.0000
-0.2
-0.4
-0.6
24
26
28
30
32
34
Observed Value


34
32
30
28
26
24
NPVExcelScore
0
1
Condition

```
T-TEST GROUPS=Condition(0 1)
  /MISSING=ANALYSIS
  /VARIABLES=NPVExcelScore
  /CRITERIA=CI(.95).
```

T-Test

Notes

Output Created		11-SEP-2013 14:57:06
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.

	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST GROUPS=Condition(0 1) /MISSING=ANALYSIS /VARIABLES=NPVExcelScore /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.02
	Elapsed Time	00:00:00.02

[DataSet1]

Group Statistics

	Condition	N	Mean	Std. Deviation	Std. Error Mean
NPVExcelScore	0	41	30.56	3.074	.480
	1	37	30.76	2.554	.420

	Levene's Test for Equality of Variances					
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference

NPVExcelScore	Equal variances assumed	3.489	.066	-.304	76	.762	-.196
	Equal variances not assumed			-.307	75.506	.760	-.196

```
NPAR TESTS
  /M-W= NPVExcelScore BY Condition(0 1)
  /MISSING ANALYSIS.
```

NPar Tests

Notes

Output Created		11-SEP-2013 14:57:52
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.

	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.
Syntax		NPAR TESTS /M-W= NPVExcelScore BY Condition(0 1) /MISSING ANALYSIS.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00
	Number of Cases Allowed[a]	112347

a. Based on availability of workspace memory.

[DataSet1]

Mann-Whitney Test

Ranks

	Condition	N	Mean Rank	Sum of Ranks
NPVExcelScore	0	41	38.35	1572.50
	1	37	40.77	1508.50

	Total	78		

Test Statistics[a]

	NPVExcelScore
Mann-Whitney U	711.500
Wilcoxon W	1572.500
Z	-.480
Asymp. Sig. (2-tailed)	.631

a. Grouping Variable: Condition

NOT Significant difference (.631 > .05)

IRR Excel Model T-Test Results

```
GET DATA /TYPE=XLSX
  /FILE='F:\Chris_Andrews_PhD_Dissertation_2010_2011\Defense\DATA\Raw Data Dissertation Sep 11 2013.xlsx'
  /SHEET=name 'IRR Excel Model SPSS Inputs'
  /CELLRANGE=full
  /READNAMES=on
  /ASSUMEDSTRWIDTH=32767.
EXECUTE.
DATASET NAME DataSet1 WINDOW=FRONT.
EXAMINE VARIABLES=IRRExcelModelScore BY Condition
  /PLOT BOXPLOT NPPLOT
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.
```

Explore

Notes

Output Created	11-SEP-2013 15:04:46
Comments	

Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.
Syntax		EXAMINE VARIABLES=IRRExcelModelScore BY Condition /PLOT BOXPLOT NPPLOT /COMPARE GROUPS /STATISTICS DESCRIPTIVES /CINTERVAL 95 /MISSING LISTWISE /NOTOTAL.
Resources	Processor Time	00:00:01.28
	Elapsed Time	00:00:01.28

[DataSet1]

Condition

Case Processing Summary

	Condition	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
IRRExcelModelScore	0	41	100.0%	0	0.0%	41	100.0%
	1	37	100.0%	0	0.0%	37	100.0%

Descriptives

	Condition			Statistic	Std. Error
IRRExcelModelScore	0	Mean		22.59	.468
		95% Confidence Interval for Mean	Lower Bound	21.64	
			Upper Bound	23.53	
		5% Trimmed Mean		22.73	
		Median		22.00	

	Variance		8.999	
	Std. Deviation		3.000	
	Minimum		16	
	Maximum		26	
	Range		10	
	Interquartile Range		4	
	Skewness		-.547	.369
	Kurtosis		-.872	.724
	Mean		22.49	.427
	95% Confidence Interval for Mean	Lower Bound	21.62	
		Upper Bound	23.35	
	5% Trimmed Mean		22.60	
	Median		22.00	
	Variance		6.757	
1	Std. Deviation		2.599	
	Minimum		17	
	Maximum		26	
	Range		9	
	Interquartile Range		5	
	Skewness		-.059	.388
	Kurtosis		-.535	.759

Tests of Normality

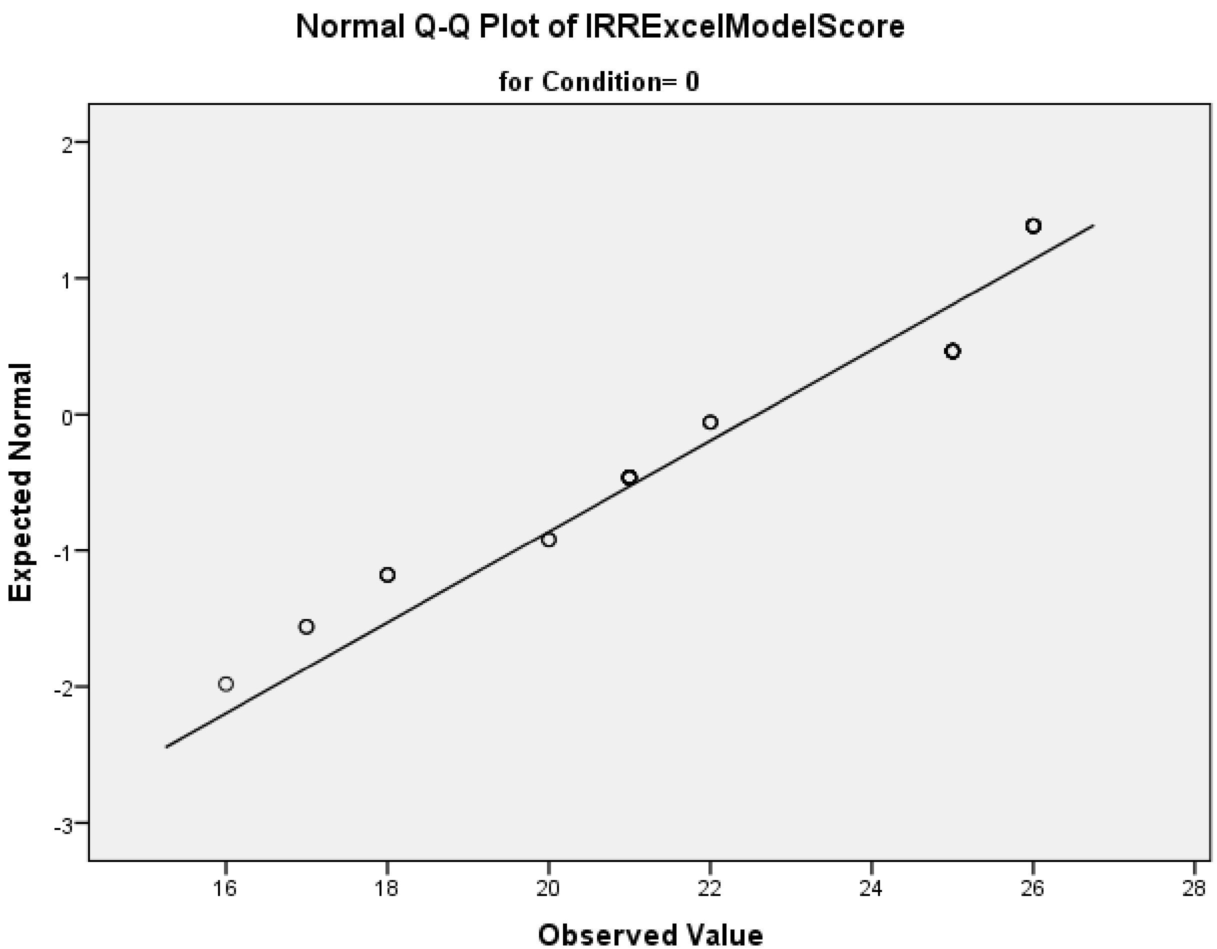
	Condition	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
IRRExcelModelScore	0	.277	41	.000	.865	41	.000
	1	.250	37	.000	.862	37	.000

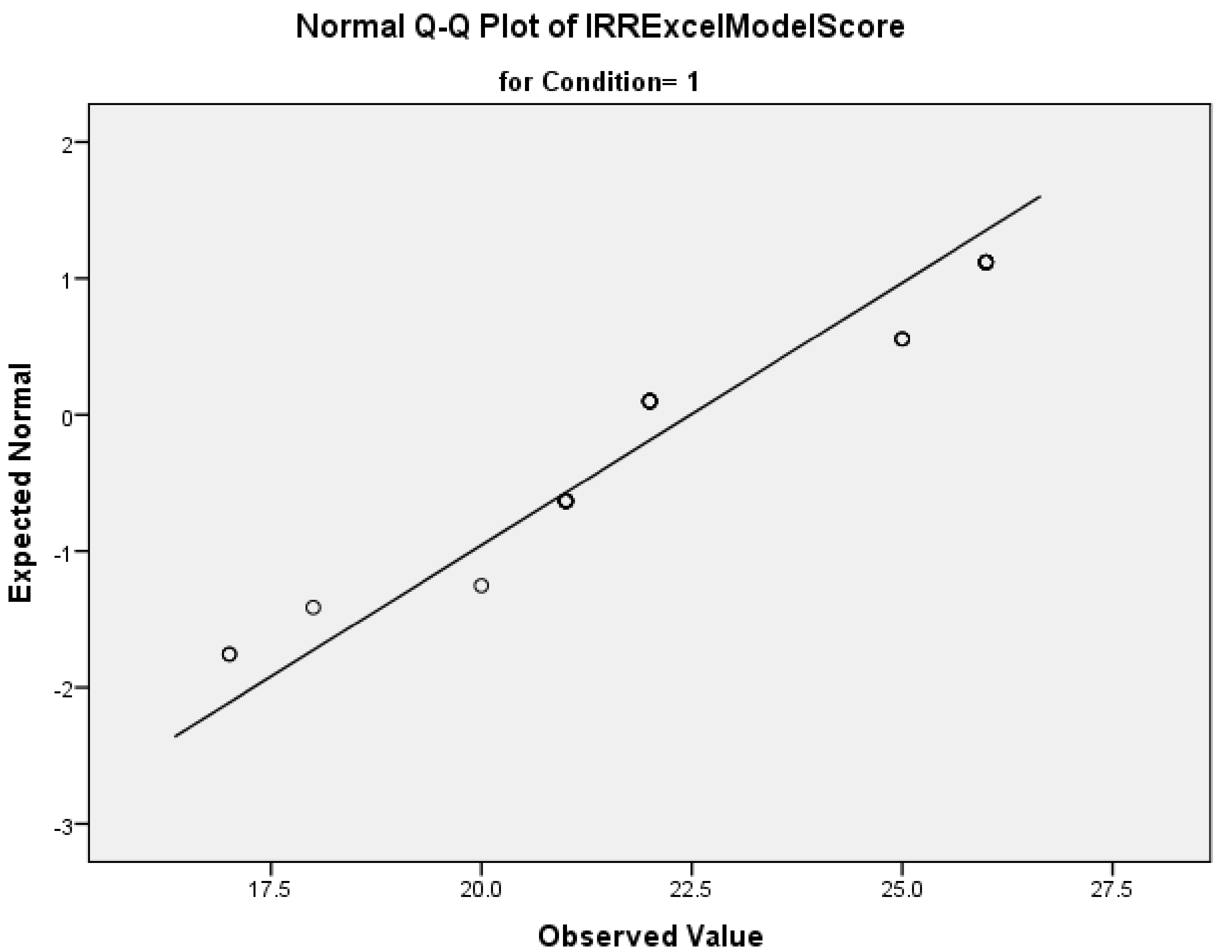
a. Lilliefors Significance Correction

FAILED (.000 < .05)

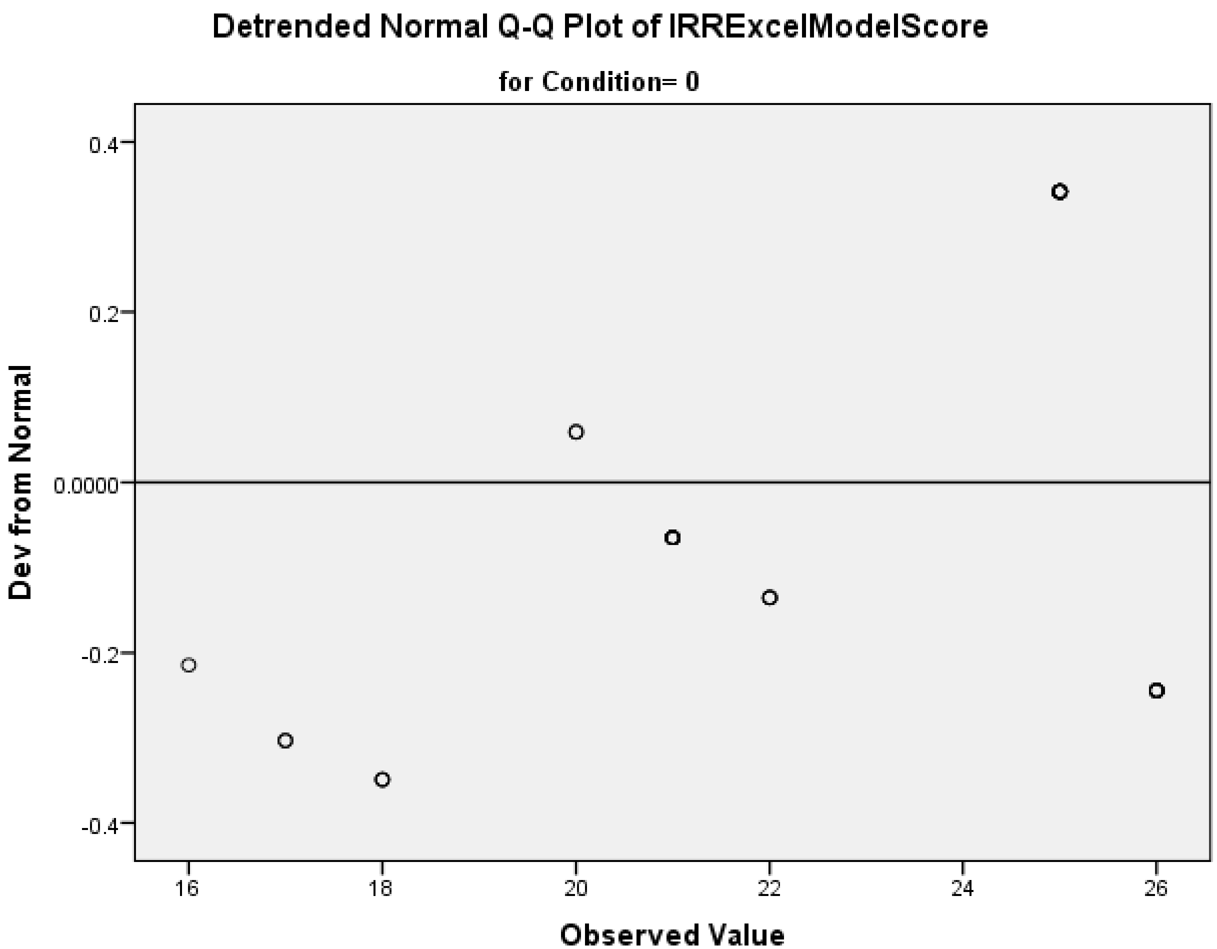
IRRExcelModelScore

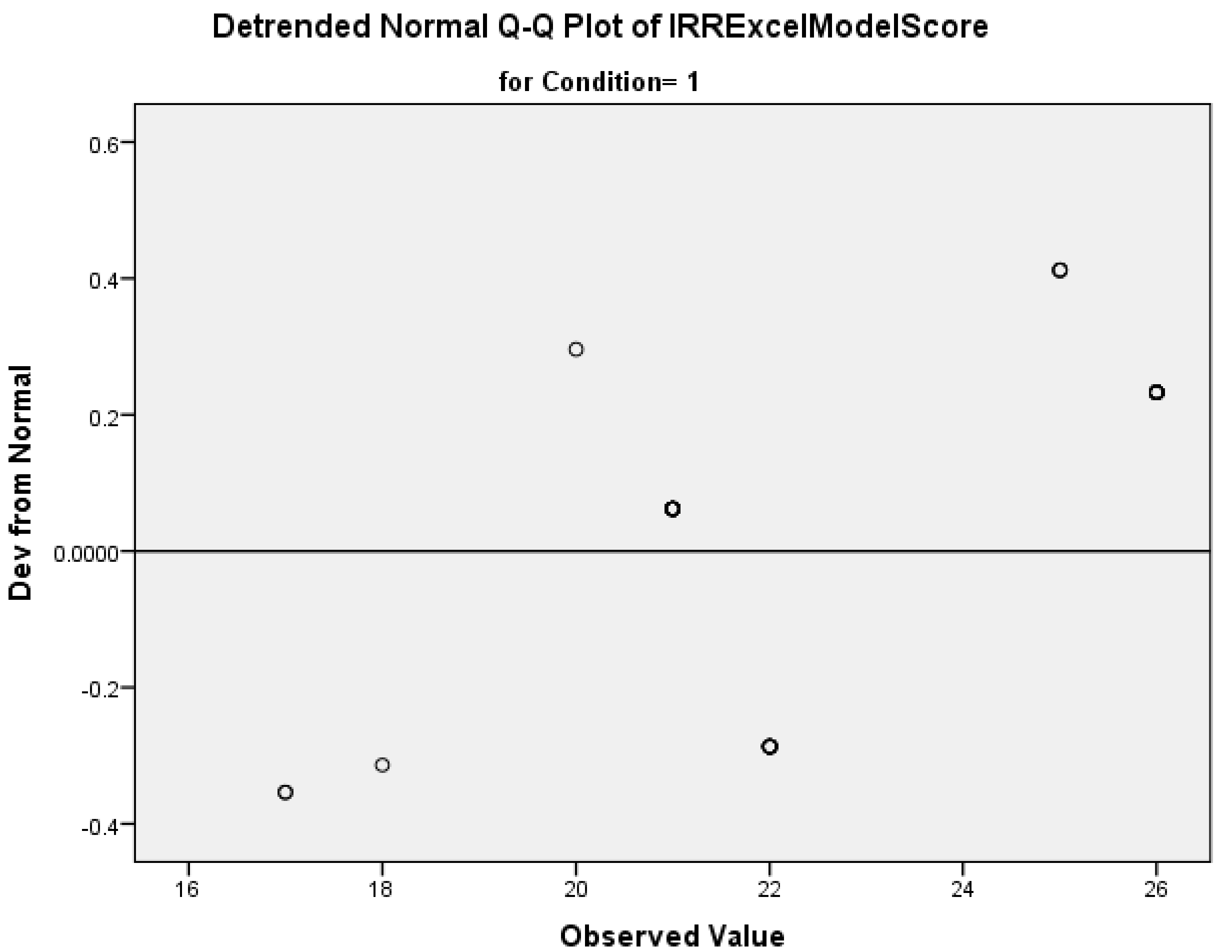
Normal Q-Q Plots

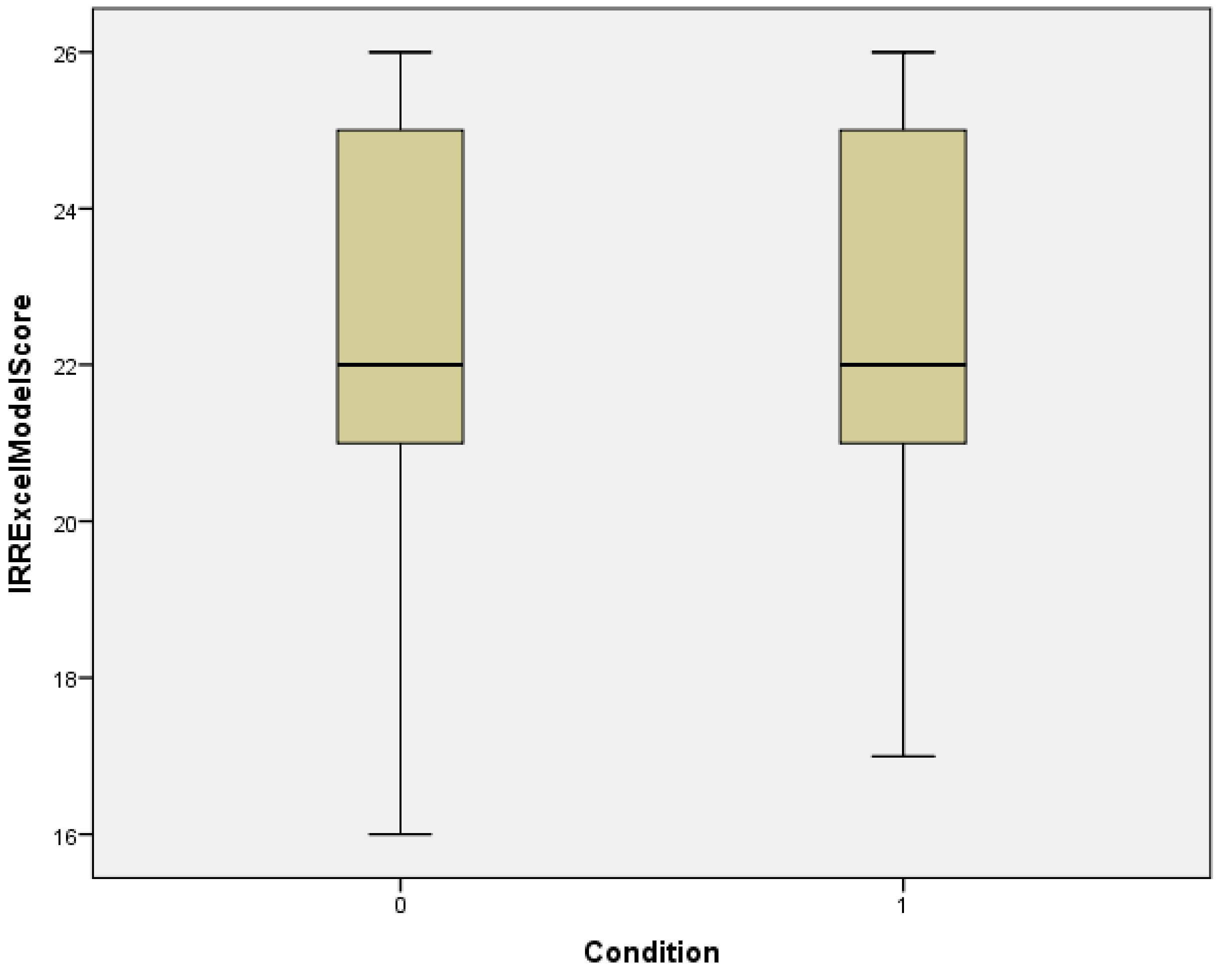

Normal Q-Q Plot of IRRExcelModelScore
for Condition= 0
Expected Normal
Observed Value
2
1
0
-1
-2
-3
16
18
20
22
24
26
28


Normal Q-Q Plot of IRRExcelModelScore
for Condition= 1
Expected Normal
2
1
0
-1
-2
-3
17.5
20.0
22.5
25.0
27.5
Observed Value

Detrended Normal Q-Q Plots


Detrended Normal Q-Q Plot of IRRExcelModelScore
for Condition= 0
Dev from Normal
0.4
0.2
0.0000
-0.2
-0.4
16
18
20
22
24
26
Observed Value


Detrended Normal Q-Q Plot of IRRExcelModelScore
for Condition= 1
Dev from Normal
0.6
0.4
0.2
0.0000
-0.2
-0.4
16
18
20
22
24
26
Observed Value


IRRExcelModelScore
26
24
22
20
18
16
0
1
Condition

```
T-TEST GROUPS=Condition(0 1)
  /MISSING=ANALYSIS
  /VARIABLES=IRRExcelModelScore
  /CRITERIA=CI(.95).
```

T-Test

Notes

Output Created		11-SEP-2013 15:05:24
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.

	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST GROUPS=Condition(0 1) /MISSING=ANALYSIS /VARIABLES=IRRExcelModelScore /CRITERIA=CI(.95).
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00

[DataSet1]

Group Statistics

	Condition	N	Mean	Std. Deviation	Std. Error Mean
IRRExcelModelScore	0	41	22.59	3.000	.468
	1	37	22.49	2.599	.427

	Levene's Test for Equality of Variances					
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference

IRRExcelModelScore	Equal variances assumed	2.788	.099	.155	76	.877	.099
	Equal variances not assumed			.156	75.884	.876	.099

DID NOT FAIL!... (.099 > .05)

```
NPAR TESTS
  /M-W= IRRExcelModelScore BY Condition(0 1)
  /MISSING ANALYSIS.
```

NPar Tests

Notes

Output Created		11-SEP-2013 15:05:51
Comments		
Input	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	78
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.

	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.
Syntax		NPAR TESTS /M-W= IRRExcelModelScore BY Condition(0 1) /MISSING ANALYSIS.
Resources	Processor Time	00:00:00.00
	Elapsed Time	00:00:00.00
	Number of Cases Allowed[a]	112347

a. Based on availability of workspace memory.

[DataSet1]

Mann-Whitney Test

Ranks

	Condition	N	Mean Rank	Sum of Ranks
IRRExcelModelScore	0	41	38.99	1598.50

	1	37	40.07	1482.50
	Total	78		

Test Statistics[a]

	IRRExcelModelScore
Mann-Whitney U	737.500
Wilcoxon W	1598.500
Z	-.215
Asymp. Sig. (2-tailed)	.830

a. Grouping Variable: Condition

NOT SIGNIFICANT….(.830 > .05)