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Analysis of the Relationship Between the Level of Educational Computer Game Use and Milken Exemplar Teacher Instructional Strategies

Yaela Dahan Marks
University of Central Florida

ANALYSIS OF THE RELATIONSHIP BETWEEN THE LEVEL OF EDUCATIONAL COMPUTER GAME USE AND MILKEN EXEMPLAR TEACHER INSTRUCTIONAL STRATEGIES

by

YAELA DAHAN MARKS
M.A. University of Central Florida, 2003
B.A. Warner Southern College, 1999
A.A. Valencia Community College, 1998

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Major Professor: Michael D. Proctor, Ph.D., LTC (Retired)

ABSTRACT

This research examines the nature and level of educational computer-based game techniques adoption by Milken Educator Award winning teachers in achieving success in their classrooms. The focus of the research is on their level of acceptance of educational computer-based games and the nature of game usage to increase student performance in the classroom. With Davis' (1985) Technology Acceptance Model (Davis, 1985) as the conceptual framework, the research also examines how teachers' perceptions of educational computer-based games influence their willingness to incorporate these teaching methods in their classroom. The approach utilizes a descriptive survey to develop and evaluate responses from exemplar teachers about the level and nature of their use (or lack thereof) of educational computer-based games and implementation in the classroom. Further, this research seeks to identify successful and unsuccessful techniques in the use of educational computer-based games in the classroom. In addition, data collection and analysis will seek to identify the strength of relationships between content-specific educational computer-based games and subject; educational computer-based games and gender; educational computer-based games and age; etc. A teacher who is exemplary as defined by Milken Educator Awards possesses, "exceptional educational talent as evidenced by effective instructional practices and student learning results in the classroom and school." Survey findings are placed within the Technology Acceptance Model framework developed by Davis.

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CHAPTER ONE: TOPIC INTRODUCTION AND MOTIVATION FOR RESEARCH

One of the most crucial methods of preparing students to become contributing members of society is through proper education. Providing students with the intrinsic motivation to learn starting in K-12 and extending through postsecondary education could save millions of dollars annually by decreasing social expenditure (e.g., welfare and crime) and increasing civic contributions (e.g., philanthropy and volunteerism) (Couturier and Cunningham, 2006). Education, as a cornerstone to life success, begins in the primary educational domain (Couturier and Cunningham, 2006). Continuing on to higher education results in many more benefits than the subject content itself such as reduced unemployment, higher salary, an overall better quality of life for themselves and their offspring, and more leisure time (Couturier and Cunningham, 2006).

As important as education is, the United States' lead in scholastic achievement is questionable when compared to other countries. Located in Amsterdam, The Netherlands, the International Association for the Evaluation of Educational Achievement is an independent, international cooperative of national research institutions and governmental research agencies whose goal is to provide participating countries internationally comparative data. Two specific reports from this cooperative includes data illustrating the position of educational achievement within the United States compared to several other countries. The first report, the Progress in International Reading Literacy Study (PIRLS) provides data regarding reading achievement of primary school students (fourth grade in most participating countries with students' ages ranging from 9-11 years) (Mullis, Martin, Gonzalez, and Kennedy, 2003; Mullis, Martin, Kennedy, and Foy, 2007), while the second report, Trends in International Mathematics and Science Study (TIMSS), provides data regarding mathematics and science achievement at the fourth and eighth grade levels (Martin et al., 2008; Martin, Mullis, Gonzalez, and Chrostowski, 2004; Mullis, Martin, Gonzalez, and Chrostowski, 2004; Mullis et al., 2008; Mullis et al., 2000). Combined, these reports address the United States' position in three major areas of K12 education.

United States Achievement Scores – Reading

The PIRLS report started in 2001 with data collected every five years. Data from two subscales – *average literary subscale score* (which assessed performance in reading for literary experience) and *average informational subscale score* (which assessed performance in reading for acquiring and using information) provided fourth grade student trends in reading achievement from the 28 countries who participated in both the 2001 and 2006 reports. Trends in reading achievement show that in 2001, the United States ranked #9 (behind Sweden, The Netherlands, England, Bulgaria, Canada Ontario, Latvia, Hungary and Lithuania) (Mullis et al., 2003) while in 2006, the US fell to #12 (behind Russian Federation, Hong Kong, Singapore, Canada Ontario, Hungary, Italy, Sweden, Germany, The Netherlands, Bulgaria and Latvia) (Mullis et al., 2007).

United States Achievement Scores – Mathematics

The TIMSS report has published data in 1995, 1999, 2003, and 2007. For fourth grade mathematics achievement, scores were collected from 16 countries for the reports from 1995 and 2007. In 1995, the United States ranked #8 (behind Singapore, Japan, Hong Kong, The Netherlands, Czech Republic, Austria, and Hungary) and rose to #7 in 2007 (behind Hong Kong, Singapore, Japan, England, Latvia, and The Netherlands). For eighth grade mathematics achievement, scores were collected from 20 countries for the reports from 1995 and 2007. The United States ranked #15 in 1995 (behind Singapore, Korea, Japan, Hong Kong, Czech Republic, Sweden, Hungary, Bulgaria, Russian Federation, Australia, England, Norway, Slovenia, and Scotland) and rose to #8 in 2007 (behind Korea, Singapore, Hong Kong, Japan, Hungary, England, and Russian Federation) (Mullis et al., 2008).

United States Achievement Scores – Science

For fourth grade science achievement, the TIMSS report collected scores from 16 countries for the reports from 1995 and 2007. The United States ranked #2 in 1995 (only behind Japan) and fell to #6 in 2007 (behind Singapore, Hong Kong, Japan, England, and Latvia). For eighth grade science achievement, the TIMSS report collected scores from 19 countries for the reports from 1995 and 2007. The United States ranked #12 in 1995 (behind Singapore, Czech Republic, Japan, Sweden, Korea, Hungary, England, Russian Federation, Slovenia, Australia, and Norway) and rose to #10 in 2007 (behind Singapore, Japan, Korea, England, Czech Republic, Hungary, Slovenia, Russian Federation, and Hong Kong) (Martin et al., 2008).

Cross-currently and during this same time period (1995-2006), computer game usage has increased. Students and adults alike are appreciating the enjoyment and benefits computer games bring and there is much research available to show how these computer games are beneficial in the educational domain (Akkermana, Admiraalb, and Huizengab, 2009; Din, 2001; Henderson, Klemes, and Eshet, 2000; Ke, 2006; Tompson and Dass, 2000; Papastergiou, 2009). Although Prensky did not conduct research to validate this, he cites 12 elements for why games are engaging. Among these 12 elements fun, structure, and the conflict/competition/challenge/opposition status they provide are included (2001). Computer usage is also a data point supplied by the PIRLS and TIMSS reports and the following discussion compares the United States to other countries.

Computer Usage for Literacy Skill Improvement

For fourth grade reading literacy achievement, 25 countries participated in both PIRLS reports for years 2001 and 2006. All but one country reported an increase in the percentage of students in schools with computers available. In PIRLS 2006, Israel reported a decrease of 15% of students in schools with computers available. For the remaining 24 countries, the percent increase of students in schools with computers available ranged from as low as 3% in England and Iceland to as high as 71% in the Slovak Republic. For the percentage of students in schools with computers available, the United States was #2 in 2001 (behind England) and remained in the same place in 2006 (behind England). For the percentage of students in schools with computers having Internet access for reading achievement improvement, the United States was #2 in 2001 (behind Sweden) and remained in the same place in 2006 (this time behind

England). For the percentage of students using instructional software to develop reading skills and strategies, the United States was #1 in 2001 and fell to #4 in 2006 (behind Hong Kong, Norway, and Singapore). Finally, for the percentage of students who read stories or other text on the computer, the United States was #2 in 2001 (behind Singapore) and fell to #4 in 2006 (behind Singapore, Hong Kong, and England) (Mullis et al., 2007).

Computer Usage for Mathematics Skill Improvement

Similarly, for both mathematics and science achievement in fourth and eighth grades, the percentage of students who have access to computers for each of these subjects increased in all countries surveyed except one (Italy) in both the 2003 and 2007 reports (Martin et al., 2008; Mullis et al., 2008). For the percentage of fourth grade students who use computers at home but not at school for mathematics achievement improvement, the United States ranked #10 in 2003 (behind Slovenia, Hungary, Italy, Lithuania, Armenia, Norway, Morocco, Russian Federation, and Singapore) and rose to #7 in 2007 (behind Slovenia, Lithuania, Hungary, Russian Federation, Armenia, and Norway). For the percentage of eighth grade students who use computers at home but not at school for mathematics achievement improvement, the United States ranked #12 in 2003 (behind Italy, Slovenia, Norway, Lithuania, Russian Federation, Morocco, Iran, Japan, Singapore, Armenia, and Scotland) and rose to #11 in 2007 (behind Lithuania, Slovenia, Italy, Norway, Iran, Armenia, Singapore, Scotland, Morocco, and Japan) (Mullis et al., 2008).

Computer Usage for Science Skill Improvement

For the percentage of fourth grade students who use computers at home but not at school for science achievement improvement, the United States ranked #11 in 2003 (behind Slovenia, Hungary, Italy, Lithuania, Armenia, Norway, Morocco, Tunisia, Russian Federation, and Singapore) and rose to #8 in 2007 (behind Slovenia, Lithuania, Hungary, Russian Federation, Armenia, and Norway and Tunisia). For the percentage of eighth grade students who use computers at home but not at school for science achievement improvement, the United States ranked #13 in 2003 (behind Italy, Slovenia, Lithuania, Norway, Tunisia, Russian Federation, Iran, Morocco, Japan, Armenia, Singapore, and Scotland) and rose to #12 in 2007 (behind Lithuania Slovenia, Tunisia, Italy, Norway, Iran, Armenia, Singapore, Scotland, Morocco, and Japan) (Martin et al., 2008).

Overall, the PIRLS and TIMSS reports demonstrate a clear fluctuation of United States rankings compared to other countries among all subjects studied. While we are fortunate to have achieved minor improvement in worldwide status for fourth and eighth grade mathematics achievement and eighth grade science achievement, the United States also suffered a decline in worldwide status in fourth grade reading achievement in fourth grade science achievement. What is consistent is the increase of computer usage used for improving these skills in the United States and around the world. Games, specifically are one of many methods used to maintain student engagement. Given the growing population of computer users for scholastic achievement, the question arises – do US K-12 teachers capitalize on what is already in use by their students to increase their engagement thereby increasing performance in worldwide rankings? Does their comfort with (or resistance towards) technology, specifically educational computer-based games, influence if and how they incorporate these games in the classroom?

Literature Review of Topics Related to Technology

An analysis of articles that have incorporated technology and game usage in the K-12 classroom is presented. The section begins with a brief overview of teaching approaches followed by a discussion of technology implementation. A discussion on the pros and cons to game implementation follows leading us to the formal literature review in chapter 2.

Improving student interest, motivation, and performance through engagement in the K-12 classroom is a challenge K-12 teachers constantly face (Slater, 2008; Stigler and Hiebert, 1999). How can K-12 teachers keep their students' attention to meet the challenges of an ever increasing knowledge base and imminent competition locally and globally? In his article, Slater (2008) explains that the key to increasing student engagement is to have the student become an active, rather than a passive, participant. As Slater explains, in a learner-centered teaching environment, the student – not the teacher – is responsible for his/her knowledge gain (2008).

Many approaches have been exercised in an attempt to engage the learner. One such approach, the Socratic Method, engages the student by asking questions, eliciting information, and guiding them to a new level of understanding. Other engaging methods such as apprenticeships, role-play, and various types of exercises are also used, each with their own share of advantages and disadvantages. For example, an advantage of role playing includes the dramatic introduction of problem situations while providing the opportunity for students to assume roles of others, thus appreciating another's point of view. A disadvantage may be the self-consciousness some students may feel when put in a role-playing situation (Adprima, 2008).

Traditional classroom teaching (lecture) has its share of advantages and disadvantages as well. For example, lectures provide the platform for students to question, clarify, discuss, and challenge (Adprima, 2008). Immediate feedback to a student's specific question is another advantage. A disadvantage is the passivity involved in a traditional environment (Adprima, 2008) often on the parts of both the instructor and the student (Slater, 2008) resulting in a process "by which the teacher's notes get transferred into the students' notebooks without passing through brains of either" (Slater, 2008, p.317).

Technology Acceptance Among Teachers

The following section discusses the influences that impact whether and how technology is integrated in classroom curriculum. Garcia and Romero (2009) conducted a study to explore how technology influenced students' ability to learn mathematical concepts. Specifically, how Information and Communication Technology (ICT) influenced students' ability to learn mathematics and their overall attitudes towards mathematics. Their study compared ninth, tenth, and eleventh grade students to each other across three levels of complexity. Level one (Reproduction) is defined as a student's ability to solve questions in a simple context, make limited interpretation, and directly apply mathematical knowledge. Level two (Connection) is defined as a student's ability to work with relatively unknown situations and interpret abstract representations and link them to real life situations. Level three (Reflection) is defined as a student's ability to apply reflection and creativity to unknown situations. The student can link different classes of information and representations and transfer between them flexibly. The authors divided all students into two groups – those completing activities using the ICT and those completing activities using pencil and paper. Data was collected and analyzed using SPSS analyses – student *t*-tests were used for comparing related means and two non-parametric tests were used for two related samples, the Wilcoxon signed-rank test and rank-sum test. No significant differences appeared in Level 1 due to the lack of complexity at this level (Garcia and Romero, 2009). While there was also no significant difference in Level two, 50% of the students' grades did improve. Significant differences were apparent in Level 3 where nearly 65% of students improved when using the ICT. Qualitative data showed that students' attitudes were very positive of the use of ICT to learn the mathematical concepts.

In her dissertation, Hirose (2009) researched whether high school family consumer sciences teachers felt supported by their schools to use technology, received the proper training to instruct students through using technology, and if they use technology to teach higher order thinking skills. Higher order thinking skills were defined as the top three levels of Bloom's taxonomy – analysis, synthesis, and evaluation. SurveyMonkey® was used for data gathering of both qualitative and quantitative data. Student *t*-tests compared responses to each other. Results indicated that, overall, these teachers felt supported by their school to use this technology, they felt that they received enough technology training, and that higher order thinking skills were taught using technology. Similarly, in their book, Shelly, Cashman, Gunter, and Gunter (2008) report that when technology is readily available to a teacher, s/he will be more likely to use it.

Lowther, Inan, Strahl, and Ross (2008) reported the findings from a study designed to meet the No Child Left Behind mandate. This study sought to measure effects on student achievement and teachers' skills and attitudes toward technology integration if the most common barriers teachers experienced when attempting to incorporate technology in their classrooms were eliminated. Barriers identified included availability and access to computers, teachers' beliefs, teachers' technological and content knowledge and technical, administrative, and peer support. Twenty six schools participating over a three year period were divided into control and experimental groups. On-site, full-time technology coaches helped teachers create lessons with the purpose of fostering critical thinking and the use of computers in their students. Project effectiveness was measured through observations and surveys. The dependent measures – impact on classroom instruction; impact on students; teacher readiness; overall support; and technical support were analyzed via multivariate analysis of variance (MANOVA). Results were highly significant, ($F(5, 716) = 43.89$, $p < .001$). Teachers in the experimental group had more confidence (Effect Size = +0.78) than control teachers, they were ready to integrate technology, and felt that use of technology positively impacted students (Effect Size = +0.76).

Shelly, Cashman, Gunter, and Gunter (2008) share an example of technology integration where an instructor uses technology to enhance a lesson about owls. First he reads the story (ending with a mouse barely escaped being eaten whole by the owl) which results in multiple questions by the students regarding owls. This is the point of instruction where the instructor engages technology to introduce the classroom to not only answer their specific questions, but to teach about the entire owl specie.

Integration of technology can help groups larger than just those in the classroom. Poscente, Rourke and Anderson (2006) surveyed K-12 teachers and administrators in Canada on their perceptions of how the use of a broad-band network might impact their work and the education of their students as compared to the current standard network in place. One advantage of using the broad-band network includes the incorporation of videoconferencing capabilities. This allows a lecturer from one school to help another school that may not be able to hire a teacher with the same level of expertise in a given area. The result is the school without the on-site teacher can still offer this subject to the students. One concern included the issue of compatibility. In order to use the videoconferencing software synchronously, users must have compatible hardware, software and schedules, operating systems, cameras, microphones, and speakers proving cost prohibitive for some users (Poscente, Rourke, and Anderson, 2006).

Dede and Nelson (2005) discuss an effort to advance technology incorporation for all Milwaukee Public Schools. The purpose of this program is to provide learning opportunities through the use of technology for students in large urban schools, many of whom don't even have working phone lines in their houses. The school system, through an executive committee consisting of school principals, district leaders, technology leaders from major area companies, and the superintendent, began instituting technology to empower student learning, teachers in their curriculum development, and overall staff development. While each of these areas responded positively to the interventions, there are those who did not feel it was necessary to change what they were doing in order to accommodate new ways of working.

In another article, Dede (2009) discusses how immersive interfaces provide learning opportunities thus far unattainable in typical classroom settings. His article discusses using immersive environments as a way to provide students the opportunity to both see the problem they are trying to solve from a global perspective (the exocentric view) and up close (the egocentric view). These views, plus the ease afforded by immersive environments (as compared to a classroom environment) in creating associated complex real-world settings, allow students the opportunity to more quickly achieve 'legitimate peripheral participation' – a phrase Dede uses to describe the learning that occurs when one learns in an environment by participating at one's current level of ability while paying attention to those around that are more advanced.

Bahr, Shaha, Farnsworth, Lewis, and Benson (2004) found that preservice teachers who used technology experienced significantly better attitudes towards technology than those who did not use technology. The purpose of Reynolds' research (2001) was to determine if teachers used technology, if so what kinds, and what barriers teachers experienced. The K-12 teachers interviewed in Wyoming reported the use of Microsoft Office, the Internet, and email. Several barriers included: lack of money, knowledge, resources in labs, the need for time to learn, use, and implement technologies into their curriculum.

In 2001, Reynolds conducted a series of interviews with K-12 teachers about their perceptions of technology in the classroom after having gone through some inservice activities such as implementing a grade book on the computer or attendance software (overall these were district driven inservices as opposed to curriculum driven). Most teachers felt they would like to integrate technology more into their classroom but felt the current approach of sending certain teachers to the conferences where these inservices were taught was ineffective and unfair. They felt that upon return to school, if the conference attendee teachers could be mentors to the non-attendee teachers, implementation of the inservice objectives would be more effective. Reynolds followed this research with an investigation in 2008 using a video game to supplement teaching in one classroom. One teacher incorporated “CAPITALISM II” into her agriculture class as a supplemental approach to meeting the course’s objectives to teach the differences between capitalism and communism, as they existed in the 1940’s and 1950’s. The teacher reported that high school student motivation for learning this subject increased and the choice of using gaming to increase student motivation was brought to the agricultural education curriculum.

In 2000, Keiper surveyed preservice elementary and secondary teachers to see what obstacles they experienced when considering the use of technology in their elementary and secondary level social studies methods classes. His findings pointed to accessibility, differing ability levels, dependability, and student supervision as the main reasons preservice teachers may not be inclined to utilize technology. In his same study, Keiper (2000) also found benefits to utilizing technology in the classroom. These benefits included: data collection, improved student computer skills, dynamic sound and images, instructional variety, and technology as a communication tool.

Game Usage in the Classroom

Computer games are used in various domains such as entertainment (e.g., Halo, the World of Warcraft series, and Mario Brothers) and bringing people’s attention to specific causes (e.g., 3rd World Farmer which aims at simulating the real-world systems that cause and sustain poverty in 3rd World countries or Trauma Center New Blood for surgery room demands). Educational computer games are also becoming incorporated into some academic curriculum (e.g., CAPITALISM II to understand the differences between capitalism and communism, ASTRA EAGLE to reinforce mathematics skill, and Message in a Fossil to understand and apply basic archaeology concepts) (Ke and Grabowski, 2007; Reynolds, 2001; Henderson, Klemes, And Eshet, 2000).

The concepts that underlie game development relate not only with entertainment, causal awareness (e.g., World Farmer), or education, but also with the philosophy upon which Modeling and Simulation stands. Modeling and Simulation is often used in training, management, and concept exploration. "A model is a simplified representation of a system at some particular point in time or space intended to promote understanding of the real system" (Bellinger, 2004, ¶3). The purpose of a simulation is to test that system in an environment that provides the safety and cost effectiveness a real environment cannot, while also providing the user with as much realism as possible in order to make the training as life-like as possible. Similarly, games, too, are simplifications of reality – just like books, pictures, or film (Squire, 2008). They bring our focus to a certain element or point of reality, while shutting out other unrelated elements (Squire 2008).

There are many researchers in the education community who embrace the benefits educational computer games can provide as an alternative approach to attract and sustain student engagement. Squire (2008) discusses two examples of how games are used to increase engagement among students. In his first example, the game *CIVILIZATION* series is used to teach geography. The series has four eras: 4000 BC highlighting Egypt, Phoenicia, the Hittites, and Babylonia; 2000 BC highlighting the

Aztecs, Mayans, and Mississippi tribes; 100 AD highlighting ancient Rome, Greece, Germanic tribes, Persians, and Celts; and 1800 AD highlighting the Ottoman empire, English, French, Germans, Scandinavians, Dutch, and Spanish. Squire reports this game was originally intended as a voluntary, after-school activity. Students attended 1-2 hours per session; there were two sessions during the summer and one session during the school year. Eventually, most students bought the game for home use and played a few nights a week at home as well. Results indicated that students exhibited a striking improvement in basic geography and history skills; such as being able to locate major ancient civilizations on a map. In his second example, the scientific role playing game Mad City Mystery was used to change students' attitudes towards science and mathematics. The story is centered on the death of a man whose family was also ill (but didn't die) from a potentially lake-related cause. The students' job is to uncover the real reason for the death. They are provided with a global positioning system (GPS) to find hints in the real world that tie into the story. As Squire points out, there are five features related to role playing games that are also present in Mad City Mystery: "1) embedded and cascading challenges, 2) differentiated roles, 3) embedded narrative resources, 4) connections to space and place, and 5) emergent collaboration and competition" (p.21). Students began by gathering clues, developing their own hypotheses of the cause for death drawing on their own life experiences while also having clues and alternate hypotheses provided to them from within the game. The game took about two hours to play. Qualitative results showed that the students viewed the lake differently and contributed a considerable amount of emotional investment in solving this issue.

Papastergiou (2009) conducted a study with high school computer science students in Greece using an educational computer game as the independent variable between two groups of high school students (game users and non-game users). Her study sought to identify not only if educational computer game usage was an effective teaching tool but if gender made a difference in learning effectiveness and motivational appeal. Results showed that compared to the control (non game-use) group, the game user group's knowledge and motivation was higher and that gender did not make a difference in learning effectiveness and motivational appeal.

Tompson and Dass (2000) studied over 250 undergraduate students in a strategic management class. Results of their experiment showed that educational computer games enhanced students' self efficacy more than the control group (traditional, lecture-based) approach did due to increased learning. In his study of elementary students, Din and Calao (2001) also concluded that game usage was significantly more effective in teaching kindergarten reading and spelling than the control group (no game usage) because inclusion of the game approach seemed to have played a facilitative role in students' learning of age appropriate verbal skills. Henderson, Klemes, and Eshet (2000) studied second graders using embedded content and concepts in a science microworld game. Results indicated that second grade students in the game condition showed significant improvement in thinking skills and strategies as well as improved use of scientific language compared to those in the non-game condition.

Shaffer and Gee (2005) clearly show in their working paper, how games can be used not only in the classroom to teach academic classes, but can also be used (in the same classroom environment) to help the United States from losing its quickly dissolving global competitive edge through encouraging innovative thinking among its users. They discuss the idea of epistemic games – games that provide users the opportunity to think and work as "innovative professionals" (pg. 11). In their paper, they discuss two games in particular – *Madison 2200* and *Digital Zoo.* The purpose of *Madison 2200* is to provide at risk high school students the opportunity to consider the responsibilities of an urban planner and, given the project of redesigning a downtown district, consider the consequences to many social, demographic, and physical decisions. While the paper didn't describe the specific statistical analyses conducted, statistically significant results are reported on the development of concept maps used to measure (before and after the game) student responses toward the science of urban planning and factors that influenced city planning. *Digital Zoo* is a game used on sixth and seventh graders to increase science understanding. In this game, students are tasked with making virtual structures and creatures (for example, a computer-simulated animal one might see in a movie). Once the necessary concepts such as physics and biology were mastered, students' ability to more comprehensively respond to textbook science problems increased by 600%.

Despite the strong support for increasing student engagement using educational computer games, there are many issues concerning their use in the classroom or for homework assignments. McFarlane, Sparrowhawk, and Heald (2002) opine that content of games used in schools are ill-matched to the curriculum content. They also state there is not enough opportunity for K-12 teachers to develop their skills in educational computer games. Other issues include lack of adequate hardware in schools to run newer game software and graphics quality (Rice, 2007b).

Rice (2007b) cautions while games are a useful supplement to learning, they should not replace teacher involvement. The teacher's involvement and feedback is crucial to the student's success in appreciating the game in the context of the curriculum. Betz (1995-6) used Sim City 2000 as the independent variable to bring awareness to undergraduate freshmen students about non-technical consequences – social, political, economic and environmental factors – in their Materials and Methods of Construction I class. The control group was provided the necessary content in a reading format only. While exam scores indicated students in the game use group did better than those in the control group, most students felt that the combined reading *and* gaming approach would have better taught the concepts and strategies than either one of the methods alone did. The reading provided the concepts and theory, while the game provided them the opportunity to see what happened when learned concepts were applied (Rice, 2007b).

Sandford, Ulicsak, Facer, and Rudd (2006) found that the idea of 'expertise' differed between K-12 teachers and students aged 11-16 years causing unexpected outcomes in their research. They also discovered that the linear novice/beginner/intermediate/expert model is not linear at all. Some students were experts in the game but could not navigate in the menu screen. Other students seemed to experience bursts of expertise. Surprisingly, they also learned that the incorporation of a game did not increase engagement in itself. Instead, the game needs to be tied to the learning objectives and *explicitly communicated with the students* so they know what the purpose is – outside of just playing the game for its own sake. Finally, Nworie and Haughton (2008) suggest that games can provide clear interruption from the lesson's specific intended purpose and a decrease in classroom engagement.

In their article, Gunter, Kenny, and Vick (2008) introduce the Relevance Embedding Translation Adaptation Immersion and Naturalization (RETAIN) model. Based on three overarching theories – Keller's ARCS Model, Gagné's Events of Instruction, and Piaget's ideas on schemas – the model provides a methodology to evaluate how well academic content is embedded within a game's storyline. In this model, engagement, along with interaction and immersion, are considered essential conditions to learning in a gaming environment. They discuss an immersion hierarchy where engagement is dependent upon interacting with the environment. From engagement, immersion in the environment occurs.

Several of the above studies (Tompson and Dass, 2000; Din and Calao, 2001; Henderson, Klemes, and Eshet, 2000; Squire, 2008; Papastergiou 2009) demonstrate increased self efficacy and motivation through game implementation. On a national scale, do teachers use games to increase engagement? If so, how? The next chapter will go into more detail on characteristics of games and techniques teachers use when implementing games in their classrooms as well as methodology to obtaining that data and techniques planned for extracting information to address the above and related research questions.

CHAPTER TWO: CONEPTUAL FRAMEWORK

As indicated previously, this research seeks to examine the nature and level of techniques used by exemplar teachers with respect to if and how educational computer-based games are used to increase student engagement in the classroom. The conceptual framework proposed for this dissertation is based on Davis' (1985) Technology Acceptance Model (TAM). The TAM stems from the Theory of Reasoned Action (TRA) from Fishbein and Azjen (1975; (Ajzen and Fishbein, 1980) which has its roots in social psychology. The Theory of Reasoned Action (TRA) adopts the view that attitudes towards a behavior are determined by beliefs the individual considers relevant; that humans are rational and intentional and act consciously (Ajzen and Fishbein, 1980). Davis's Technology Acceptance Model focuses the TRA on the individual's use and perceived usefulness of technology.

Theory of Reasoned Action

The primary goal of the Theory of Reasoned Action (TRA) developed by Fishbein and Ajzen (1975) and refined by Ajzen and Fishbein (1980) was to predict and understand human behavior. Ajzen and Fishbein (1980) explain that behavior is predicated upon a person's intent to perform or not perform a particular behavior. Further, they discuss there are two determinants of intention – personal and social – and that it is these determinants that can help one understand human behavior.

Ajzen and Fishbein (1980) continue that even though personal and social determinants are key factors in understanding human behavior, often it is the case where two people may hold the same personal attitudes and subjective norms but ultimately act differently. Their theory explains that attitude acts as a function of beliefs where personal attitudes are influenced by behavioral beliefs and subjective norms are influenced by normative beliefs. The TRA is presented in Figure 1 below.

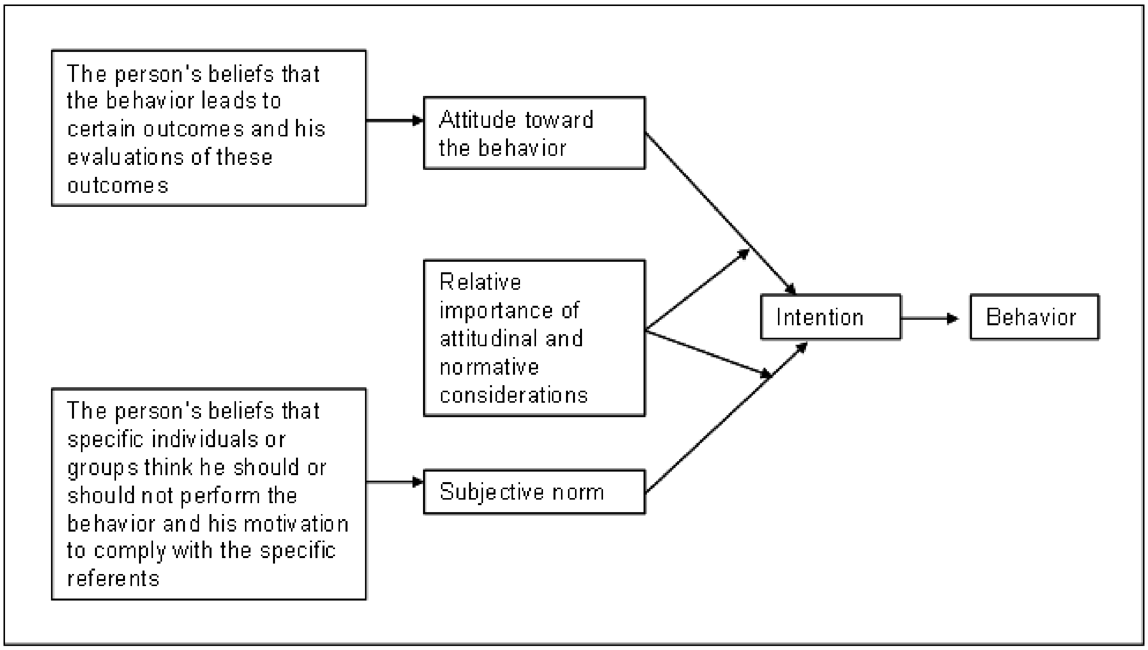

Figure 1. Theory of Reasoned Action

Factors determining a person's behavior (Ajzen and Fishbein, 1980, p.8)

Technology Acceptance Model

While the Theory of Reasoned Action sought to understand the determinants of all types of behaviors (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975), the Technology Acceptance Model (TAM) is much less general and was adapted from the TRA to specifically address the individual's acceptance of technology. As it pertains to computer acceptance, the Technology Acceptance Model expands the idea of attitude to include two other beliefs: perceived usefulness (PU) and perceived ease of use

(PEOU) stating that, “a potential user’s overall attitude toward using a given system is hypothesized to be a major determinant of whether or not he actually uses it” (Davis, 1985, p.24). Davis defines perceived usefulness as, “the degree to which an individual believes that using a particular system would enhance his or her job performance” and perceived ease of use as, “the degree to which an individual believes that using a particular system would be free of physical and mental effort” (Davis, 1985, p.26). The TAM suggests that design features (later generalized to external factors (Davis, 1993)) influence an individual’s PU and PEOU, both of which influence the individual’s attitude or intention to use the system. This attitude (or intention) then influences the individual’s actual use. The TAM is presented in Figure 2.

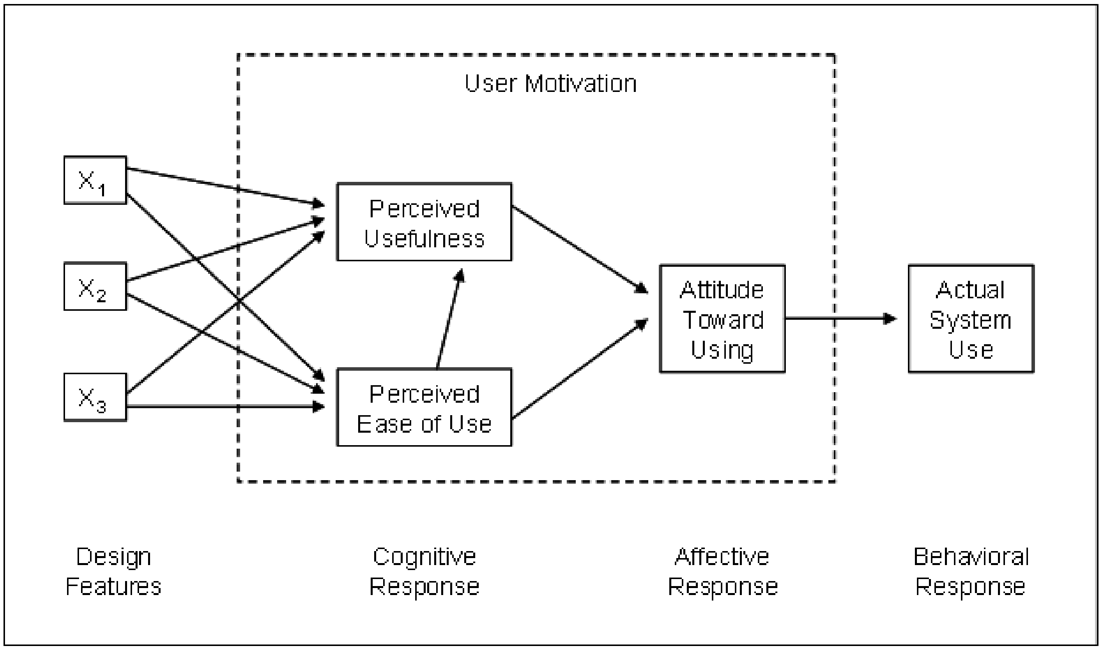

Figure 2. Technology Acceptance Model (Davis, 1985, p.24)

Validations of the model began shortly after being presented to the community. In 1989, Davis, Bagozzi, and Warshaw applied the TAM towards predicting individuals' computer acceptance through measuring their intentions in terms of attitudes, subjective norms, perceived usefulness, perceived ease of use, and other variables in a longitudinal study. With 107 graduate students and 14 weeks, this study was designed to assess the TRA and TAM in predicting and explaining user acceptance and rejection of computer-based technology – specifically predicting future usage. Results showed that computer use can be predicted from people's intentions, that perceived usefulness is a major determinant of people's intentions to use computers, and that perceived ease of use is a significant secondary determinant of people's intentions to use computers. In 1993, Davis used the TAM on 112 users regarding two end-user systems to further validate the model. Results indicated that perceived usefulness was 50% more influential than ease of use in determining usage. Venkatesh and Davis (2000) extended the TAM to include additional theoretical constructs such as subjective norms, voluntariness, image, job relevance, output quality, and result demonstrability – they called this TAM2. In this model, they illustrate how more external factors directly influence perceived usefulness, including perceived ease of use. The TAM2 is presented in Figure 3.

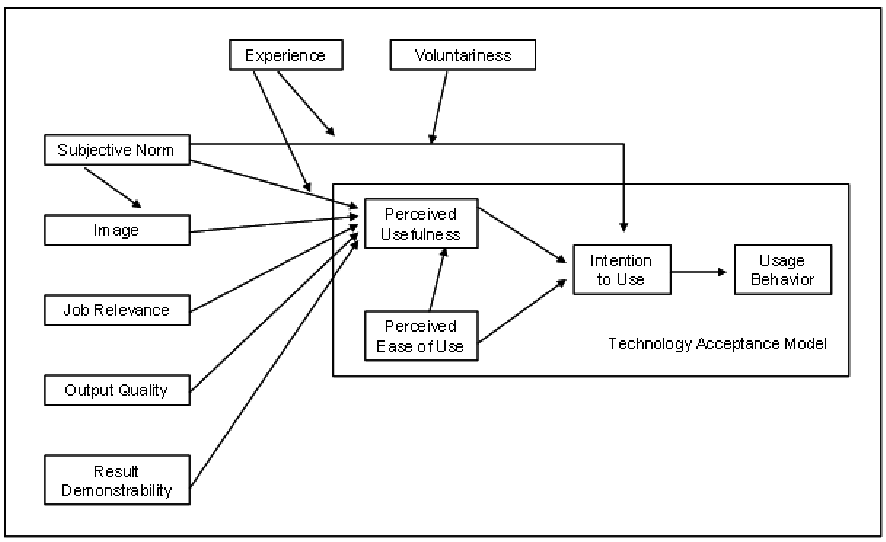

Figure 3. TAM2 (Venkatesh and Davis, 2000, p. 188)

In 2003 Venkatesh, Morris, Davis, and Davis reviewed the TAM in context with eight other models (including the TRA). Through the results of testing those eight models, the Unified Theory of Acceptance and Use of Technology (UTAUT) was developed that incorporated four core determinants and up to four moderators of key relationships. The UTAUT is presented in Figure 4 below.

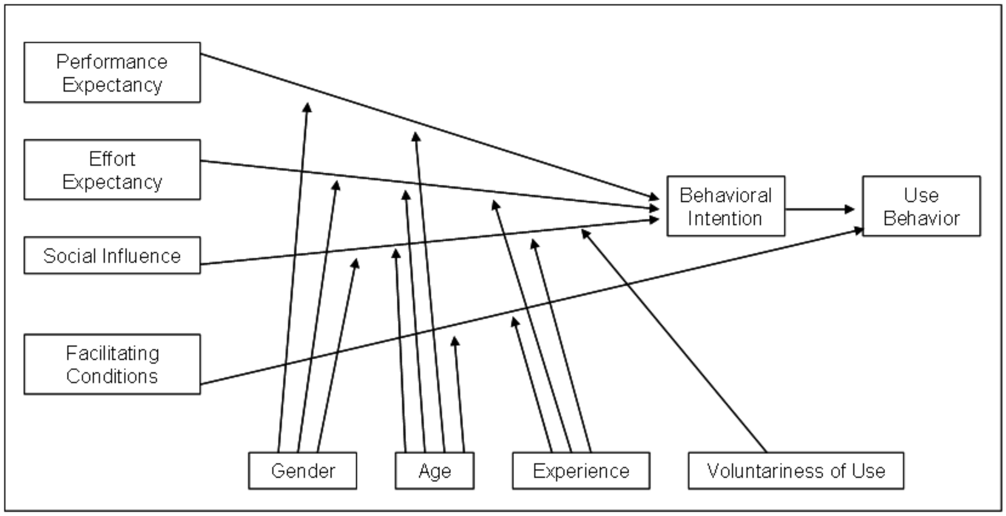

Figure 4. Unified Theory of Acceptance and Use of Technology (UTAUT)

(Venkatesh, Morris, Davis, and Davis, 2003, p.447)

Technology Acceptance Model in Education

A recent review of the use of TAM through a search in the Social Science Citation Index showed 441 citations in various domains of studies using TAM from 2005-2009; 86 of those were published in 2009 alone. Following is a brief discussion showcasing studies conducted using the TAM specific to the educational domain.

In 2008, Ball and Levy used a variation of the TAM on 56 instructors to investigate factors influencing their intention to use Tegrity®, an educational technology with capabilities of capturing lectures and in-class activities for university students to play at a later date. Specific factors investigated were computer self-efficacy, computer anxiety, and experience with use of technology. Results indicated that computer self-efficacy was the greatest determinant on an instructor's intent to use the software.

Yunus (2007) used the TAM as part of an investigation into Malaysian English as a Second Language (ESL) teachers' use (or lack thereof) of Information and Communication Technologies (ICT). Information and Communication Technologies (ICT) is defined as, "any computer based on communication technologies, networked and stand alone, including both hardware and software, which can be used as teaching, learning, and information resources" (p. 83). Four hundred forty four responses to a survey were collected from ESL teachers at 75 technical schools in Peninsular Malaysia followed up by select interviews. Results showed that while teacher attitudes towards computer usage were positive, one main obstacle was insufficient computer resources.

In his dissertation, Pan (2003) used the TAM to measure university students' attitudes towards the use of WebCT, a course management system. There were multiple purposes to the study including extend the TAM "by adding subjective norms and computer self-efficacy to the proposed model to better explain the perception-attitude-behavior relationship from the student's perspective" (p.73). Some questions he researched included how the TAM accounts for actual use and grades and how user attitude towards WebCT predict actual use and grade. Results indicated that the TAM explained actual use of WebCT by measuring variance in frequency and variance in grade. The easier students thought WebCT was (perceived ease of use), the less time they spent using it, and the higher their grades were. Students who had positive attitudes towards the course management system tended to use it more frequently and receive higher grades than their peers.

In 2005, Gao applied the TAM to determine if users would be inclined to use a type of educational hypermedia, an online companion, to the already provided course textbook. Undergraduate students served as the participants. Results showed that there was no significant correlation between participants' age, gender, or time spent on the Web and attitude and intention to return to the educational hypermedia website; however, perceived ease of use was positively related to perceived usefulness of the educational hypermedia website. Perceived usefulness was positively related to attitude toward using the website but perceived ease of use was not. Both perceived usefulness and attitude was positively related toward intention to use. Finally, intention to use was positively related to actual use.

Ma, Andersson, and Streith (2005) studied preservice teachers' perceptions of computer technology in relation to their intention to use computers. The purpose of their research was to discover more effective ways to motivate future teachers to incorporate technology in their classroom. Conducted in Sweden, 84 participants completed an expanded version of the TAM questionnaire. Significant results identified that preservice teachers' perceived usefulness of computer technology directly influenced their intent to use the technology and perceived ease of use indirectly influenced their intent to use the technology. Also identified was that preservice teachers' subjective norms (external expectations) did not either directly or indirectly significantly influence their intent to use technology.

In 2006, Kiraz and Devrim gathered responses from 320 preservice teachers to investigate whether differing educational philosophies have an effect on technology acceptance. The article discusses six types of philosophies that fall under two general categories – conservative and liberal educational philosophies. Participants responded to a five-part survey: demographics, educational philosophies, perceived ease of use, perceived usefulness, attitude toward computer use, and frequency of use. Results indicated that teachers' attitudes towards use and perceived usefulness of technology were influenced by their educational philosophy and that these philosophies also influenced the frequency of use of technology.

Smarkola (2007) used the TAM to study preservice and inservice teachers. One hundred sixty preservice and 158 inservice participants were surveyed to investigate computer usage and future intentions of using computer applications for school assignments. Results showed that both sets of participants perceived computer usage as useful for their classroom lessons and that inservice (experienced) teachers used subject-specific and educational software more often than preservice (undergraduate student) teachers did. That perceived usefulness and perceived ease of use predicted intentions are in line with other studies using TAM.

In 2008, Chin, Johnson, and Schwarz focused on improving the TAM's Likert scale approach into what they termed a "fast form." By adjusting some of the questions from the strongly disagree to strongly agree continuum to ranges of ineffective to effective, the authors felt that clearer feedback was provided by the response. All TAM items were converted to semantic differential scale format from the Likert scale format. Validity was assessed with the participation of 283 undergraduates – 129 using the original TAM, 154 using the new fast form. Results indicated that the constructs between both assessments were measured equally as well as saving 40% in survey completion time.

Smarkola (2008) used the TAM along with the Decomposed Theory of Planned Behavior to measure technology usage among teachers in varied grade levels. The purpose of this experiment was to determine if usage was in agreement with the International Society for Technology in Education's (ISTE) National Educational Technology Standards (NETS) for Students. These standards were established to ensure K-12 students receive enough computer literacy to remain competitive in the global environment. Results showed that significant differences were found for technology use across grade levels, but experience level of the teachers did not contribute to the difference.

Teo, Lee, and Chai (2008) extended the TAM to measure preservice teachers' attitudes towards computer use as well as subjective norms and facilitating conditions as external variables. Results indicated that perceived usefulness, perceived ease of use and subjective norm determined preservice computer attitudes. Through perceived ease of use, facilitating conditions indirectly influenced computer attitude. As explained in the article, computer attitude is defined as how teachers respond to technologies.

The teachers' attitude, be it positive or negative affects how students view a computer's importance in schools (Teo, Lee, and Chai, 2008).

In 2009, Teo (2009) used the TAM to build a model that would predict technology acceptance among teachers in Singapore. Four hundred seventy five preservice teachers participated in the study. Results showed that perceived usefulness, attitude toward computer use and computer self-efficacy directly influenced intention to use technology. Similar to previous studies, perceived ease of use indirectly affected technology acceptance.

The above studies show not only that there is much current research on the Technology Acceptance Model but that it is currently being adapted and applied in the education domain. These studies illustrate how the perceived ease of use determinant is significant to individuals' actual use of a new form of technology. The lack of current, in-depth research of the Technology Acceptance Model used for game usage in the classroom further justifies its use as part of this study.

Characteristics of Games Used in the Classroom

What characteristics do games possess that might encourage a teacher to employ one in his/her classroom?

Malone and Lepper (1987) present a taxonomy of intrinsic motivations factors that make games interesting for learners. They define intrinsic motivation as learning that occurs without any external reward or punishment (Malone and Lepper, 1987). They break these factors into four broad areas: challenge – characteristics of which include uncertain goal attainment and feedback that uplifts self-esteem; curiosity – in the form of sensory and cognitive; control – characteristics of which include choice, power – in which the choices learners make redeem powerful changes in the environment; and fantasy.

In his book, Digital Game-Based Learning, Prensky (2001) discusses eleven important characteristics of games:

1. Games possess a clear overall vision
2. The focus is constantly on the player's experience
3. The structure of the game is thought about and decided upon in advance. Meaning, some games have several branches while others start with limited options, expand and return to limited options again later, while others are exponentially unlimited. Whichever way the game is to go, it needs to be decided in the beginning.
4. The game must be "playable" by many levels of users.
5. Games should be easy to learn but hard to master.
6. Games need to keep the user engaged – not being too easy or too hard. An example of this is when games to get easier if the user falls behind.
7. The game is played with frequent rewards, not punishment.
8. The ability to discover and explore; although this may not be practical for puzzles or sports games.
9. Games should possess elements that solve more than one mystery or help more than one part of the game.

10. Games should have easy to use interfaces.

11. Games should provide the ability to save progress.

Garris, Ahlers, and Driskell (2002) argue that there are six key characteristics to games: fantasy, rules/goals, sensory stimuli, challenge, mystery and control. McFarlane, Sparrowhawk, and Heald (2002) evaluated teachers' opinions on game usage. While teachers overall had positive opinions, they did state a common concern that game goals did not match up with already established curriculum objectives. A summary of their assessment of favorable characteristics are listed in Table 1 below.

Table 1. Early-childhood developmental areas and characteristics in games that can help (McFarlane, Sparrowhawk, and Heald, 2002, p.13, 14)

Areas of early development	Characteristics of games that can help meet the developmental needs
Personal and Social Development	Provide interest and motivation to learn. Maintain attention and concentration levels. Can work as part of a group and can learn to share resources.
Language and literacy	Encourage children to explain what is happening. Sustain attentive listening, responding to what they have heard by relevant comments, questions or actions. Use talk to organize, sequence and clarify thinking, ideas, feelings and events.
Mathematical development	Use everyday words to describe position.
Creative development	Recognize and explore how sounds can be changed, sing simple songs from memory, recognize repeated sounds and sound patterns and match movements to music. Respond in a variety of ways to what they see, hear, smell, touch and feel. Use their imagination in art and design, music, dance, imaginative and role play and stories.
Knowledge and Understanding of the World	Use early control software to investigate direction and control.
Physical Development	Fine motor control can be developed with the increased refinement in using a mouse for navigation and selecting objects.

Wegerif, Littleton and Jones (2003), suggest that characteristics of games may provide anonymity. For example, through the use of avatars, potentially immoral questions can be addressed with both parties being somewhat removed from the situation. For example, the article describes one elementary aged student (acting through his an avatar) asking another similarly aged student (also acting through his avatar) if he'd like to throw bricks through an abandoned house on their way home from school later that day. The avatars provided 'protection' to both students so it was the avatar who asked the immoral question, not the real student; and it was the avatar who disagreed with the idea, not the actual student – nobody felt intimated to do the act, and no one's feelings got hurt.

In their well-written literature review, Kirriemuir and McFarlane (2004) discuss key characteristics that turn teachers *off* from employing games in the classroom. For example, the multiple steps necessary to first understand, then incorporate, then keep elementary students focused on how the game relates to the course objectives is a daunting task in itself and provides little motivation for the teacher to take these measures. Another concern was with the incompatibility with school hardware, licensing agreements, and other software serves as caution areas for incorporation of games.

In his article, Egenfeldt-Nielsen (2007) includes examples of both positive and negative characteristics in educational games. Positive characteristics of a game include:

- An environment where the student can scaffold information
- A non-problematic interface
- Easy to access, in-game, references or other help

- Does not bombard the student with overwhelming amounts of information

Potential negative characteristics according to Egenfeldt-Nielsen (2007) are those that employ rote learning, such as those used to teach spelling and reading for pre-school and early school grades. While this will lead to memorization of the aspects presented, it does little for deep understanding of the content or transfer and application. He opines that games serve as a small and condensed micro-universe that provides experiences that can be explored further with a variety of teaching techniques.

In Gros's (2007) article, she suggests that since children are learning digitally, combining the most powerful features of interactive multimedia with technology-mediated learning is a beneficial approach to increasing learning in the classroom. Some game characteristics that support this approach include user-centeredness; promoting challenges, cooperation, engagement and development of problem-solving strategies. As reported in her 2007 article, through design features, many computer applications shift the required balance of information processing from verbal to visual. This may or may not be applicable today in light of the advent of Voice Over Internet Protocol (VOIP) and agents with intelligence as these have now expanded design features to include verbal information processing capabilities. Action games are spatial, iconic and dynamic, having many things happening at once and in different locations. These characteristics can help children prepare for science and technology, where activity increasingly depends on their ability to manipulate images on the screen (Gros, 2007).

In his article, Rice (2007a) explains that games like those in the Math Blaster series, while fantastic for teaching mathematics concepts, are targeted for learners no more than 14 years of age. On Bloom's taxonomy, these games cover the lower order thinking levels: knowledge and comprehension. If a teacher wants to target the higher order thinking levels on Bloom's taxonomy: application, analysis, synthesis and evaluation, cognitive virtual interactive environments (VIE) are software products designed to do so.

Squire writes from his experiments using a history game called *Civilization* that "games can illuminate the intrinsically interesting aspects of an area so that kids think of doing research – learning more about an area as form of entertainment." (Squire, 2008, p.20). In his article, Video Games and Education: Designing Learning Systems for an Interactive Age, students (the grade level was not specified, but it appears as elementary level) developed interest in a particular strategy, which in turn led their interest to a specific area of history. They checked books out, wrote reports in these areas. and voluntarily engaged in extra learning activities. Squire continues his discussion with Mad City Mystery, a scientific role-playing game used to advance mathematics and science skills. A chief element of this game is its incorporation of global positioning systems to create fictional context which is superimposed on the real world. Squire notes that this game takes advantage of five specific elements that are shared in role playing games: 1) embedded challenges, 2) discriminating roles, 3) embedded narrative resources, 4) connections to space and place, and 5) developing alliance and controversy. Another game Squire discusses, *Blizzard*, takes the student (again grade level not specified, but it appears as elementary level) from novice to expert by creating experiences through internal and external play testing.

Gunter, Kenny, and Vick (2008) point out several characteristics that games should have to be successful. Successful games include sound instructional strategies, are fun and inherently motivating. They have clear and germane goals, encouraging and constructive feedback, and incorporate curiosity and fantasy into their design. Games successful in education also allow “intermediate control” (p.534) over game features, giving students choices not often present in the classroom.

Reasoner’s (2008) article discusses a game called *I Have, Who Has?* as an engaging approach to review mathematics vocabulary words and definitions. This game also has the capability to let students build their own version of the game. An important characteristic of this activity is that the game is self-correcting; if a student gives an incorrect response, the game will not end – students have to backtrack to discover where the incorrect answer was provided.

Ash (2009) discusses characteristics in two types of games that seem to be making a difference in many areas. The first is the Situated Multimedia Arts Learning Lab (or SMALLab) – a 15x15 mat on the floor with object-tracking cameras on scaffolding around it that collect data based on ninth grade students’ movements.

Experiences are provided to students via video projector and speakers, which also provide real-time visual and audio feedback. Students use colored plastic balls that light up (glowballs) to participate in scenarios. The second, which aligns with Maryland State Voluntary Curriculum as well as national standards and is available free online, is a prealgebra game targeted for middle school students called Lure of the Labyrinth. In this game, students must complete three puzzles created to emphasize three prealgebra topics – proportions, variables and equations, and numbers and operations, prior to moving on. For teachers, this game provides transparency to see when students last logged in, what each student may be struggling with, how long they played for and other information.

Instructional Techniques Applied When Employing Games

Egenfeldt-Nielsen (2007) states that games in the classroom require the teacher to adapt their original approach to teaching a given subject to act as a facilitator of the learning experience as well as the debriefing following game sessions. Gros (2007) discusses that teaching methods need to be adapted to enhance skills that today's learners will need to be able to apply. Also in her paper, Gros illustrates how some games have characteristics that can be used for different subjects. For example, *Age of Empires II* is a game that can be used for aspects of social studies and mathematics statistical graphics.

Becker's (2007) article discusses techniques teachers can use to employ games in the classroom. For example, games can be used to open a discussion or as a part of a larger lesson. She shares that the game *September 12* was developed as a commentary on and reaction to the events of September 11th and used as a class opener. Students (graduate level teachers) played the game for a few minutes then as a class discussed their first impressions. Another technique the author discusses is the use of Electronic Arts' *FIFA World Cup Soccer* game as the central point for an English as a Second Language unit. The in-game commentary provided the context that the students would be familiar with.

Ranalli (2008) replicated a previous study, conducted by Miller and Hegelheimer (2006), which tested *The SIMs*™ with additional supplementary material as a technique to teach vocabulary and grammar to ESL learners. Ranalli used the same modifications that Miller and Hegelheimer (2006) did:

1. Guidance for completing particular tasks
2. Vocabulary lists and accompanying practice material for uncommon words the participants were likely to experience
3. Illustrative notes on the game's cultural subject matter
4. Access to an online dictionary
5. Occasions to play the game collaboratively with other learners

Results indicated that not only did these participants enjoy the learning environment and game, they really did learn. Pre-tests were used to evaluate existing knowledge of target words, roughly group participants into levels of proficiency, and provide a baseline for post-test comparison. The same set of 30 vocabulary words were used in both pre- and post-tests but administered in different formats (matching, multiple choice, and short answer) and randomized. Descriptive statistics were calculated for pre- and post-test scores then a paired-samples t-test was conducted to compare means. These scores signaled an increase of 14% in the average score from pre- to post-test. The t-test showed this difference to be significant at the 0.05 level.

Other techniques include prebriefing and debriefing after the gaming sessions. Prebriefing allows for planning time, role and task familiarization while debriefing provides the opportunity for review and discussion (Balajthy, 1984; Garris, Ahlers, and Driskell, 2002; Higgins and Johns, 1984). Also, Balajthy (1984) and Carrier (1991) agree that working in small groups helps promote cooperative learning and reinforce opportunities for language use.

Simpson and Clem (2008) tested the game *Restaurant Empire*™ on a class of 13 to 14-year old students as an addition to the curriculum in helping students meet state vocational standards. The small class of 12 students was a mix – some of the students were identified as 'at risk' and one was not a native English speaker. The approach used was Camp's (1996) problem-based learning (PBL) model which associates with constructivist principles and necessitates complex tasks. Techniques borne from this experiment included: setting clear expectations for the students, anticipating on-demand learning moments, maintaining students focus on the task at hand, making it clear to the students which aspects of the game support the curriculum objectives, asking school for information/support for the teachers and colleagues.

In her article High-Tech Simulations Linked to Learning, Ash (2009) described some characteristics and techniques that emerged from her research. With SMALLab, ninth grade students are able to communicate with each other to solve problems collaboratively. To understand the concept of metaphor, students paired up words that were projected onto the platform using glowballs. Then, they had to justify the pairs. Finally, curriculum is developed with the game in mind, rather than trying to make the game match the pre-established curriculum. With Lure of the Labyrinth, students have to solve a puzzle three times before leaving that environment and entering another. Students can either play each puzzle individually or have the larger goal in mind, to leave the room and (enter another wing to) learn a new topic. One teacher expressed that since Lure of the Labyrinth provides so much data for teachers, he can see how many students have dealt with a particular concept before it's even been formally introduced in class; it provides him with a rough idea of where students' understanding is when he does discuss it.

Ke and Grabowski (2007) compared two types of game-play groups to each other and a control group (non-game play) for fifth grade math performance. The first type of game-play group, teams-games-tournament (TGT), involved fifth grade students in randomized teams of three individually representing their team while competing against members of other teams in skilled exercises during weekly tournaments. The second type of game-play group, interpersonal competitive, involved students sitting at their desks playing games against the computer. While the two game-play groups results were not significantly different from each other, they were both significantly better than the control group in math performance. A 3 x 2 x 2 multivariate analysis of covariance (MANCOVA) was conducted on both tests administered to participants - the Game Skills Arithmetic Test (GSAT) and Attitudes Towards Maths Inventory (ATMI). Pre-test scores and participant previous Pennsylvania System of School Assessment (PSSA) scores were used as covariates. Analyses of variance (ANOVA) between groups on the pretest and PSSA scores indicated that there were no significant group differences at the pretest comparison. Results from a post hoc pair-wise comparison showed no significant difference between cooperative gameplaying and competitive gameplaying (M_{coop}=61.2; M_{comp}=59.9; p=0.543), but both performed significantly higher than the control group (M_{cont} = 55.3; p_{coop} = 0.009; p_{comp} = 0.050). No significant differences were found between the competitive gameplaying and the control group (p=0.239).

Akkermana, Admiraalb and Huizengab (2009) studied 12-16 year old (most of whom were 13 years old) students' use of a history game. The researchers looked at three main factors – receiving (e.g., reading and watching), constructing (e.g., the student defines the story as if s/he were the author) and participating (e.g., where the student can pretend s/he is an actor in the story). Results showed that constructing the history story made the students aware of the whole story more than participating did. But both constructing and participating effected motivation and engagement of the student more than simply receiving.

Gunter, Kenny, and Vick (2008) affirm that embedding content in a story is critical to a student's ability to apply newly acquired knowledge in a different or more challenging environment. They point to the significant evidence supporting the belief that games that include story motivate players more and increase immersion in a game. The RETAIN model proposed in their article provides a tool with which teachers and instructional designers can assess any commercial off-the-shelf (COTS) game considered for use in their classrooms. Embedding the lesson in a carefully thought out manner reinforces the concept of relevance and suspension of disbelief. The act of playing the game should draw on the knowledge or skills that the game is designed to foster in its player learners.

Wegerif, Littleton and Jones (2003), provide techniques teachers can apply when implementing computer based education in the classroom environment. The first is through the Initiation, *Discussion*, Response and Feedback (I*D*RF) model where the computer acts as a conduit for learning to take place between two participants by presenting a situation or question. Using the I*D*RF model, the elementary aged students discuss the provided situation before submitting their response to the computer. The second approach is by having two students think together against the computer. This approach not only increases the skill (math, in this article) presented by the computer because the students think through and work *together* against the computer instead of in competition with each other, it also fosters social development.

In his book, Gee (2003) discusses 36 learning principles meant to be equally relevant both to a game and content in the classroom; hence, these principles lend themselves as a summary of the previous two sections, providing both good characteristics of educational computer games and techniques in applying these games to the classroom. Learning principles that seem to apply most closely to the present research include:

- All elements of the learning environment are designed to facilitate active and discriminating – not passive – learning.
- Students feel that the learning environment is safe enough to take risks.
- Students are committed to extending themselves to understand a concept.
- The game illuminates to the student their current and potential capabilities.
- The game provides many – and different – opportunities for the student to practice such that the student is interested and compelled to learn.

Student Perspectives on Educational Games

Simpson and Clem (2008) shared that when the 13 and 14-year old students were told they would be trying something new by using a game on which they could practice their computer skills, the entire class' demeanor changed. Where previously they were disengaged and defiant, immediately they became upbeat and optimistic. While using this game, the students engaged with each other more, collaborating on the finances of building a restaurant and determining what it took to make a restaurant successful.

In 2007, Saade and Kira theorized that since students, specifically undergraduate students, are so dependent on computers for their coursework there might be an anxiety component attached to computer usage. They conducted an investigation to determine whether anxiety played a role in influencing perceived ease of use in technology usage. Data came from 114 undergraduates responses to questionnaires. Results indicated that anxiety has no deciding effect on the impact of computer usage and perceived ease of use.

Ash (2009) shares that ninth grade students who have used SMALLab agree that harder concepts are better understood in this environment than by the teacher trying to explain them. Students are more engaged and pre/post test scores show significant improvement in overall comprehension of the subject matter; students are more articulate in justifying responses to questions.

In their study of comparing two types of game-play groups (cooperative TGT and interpersonal competitive) against a control group (non-game play) for fifth grade math improvement, Ke and Gabrowski (2006) found that fifth grade student attitudes increased with the cooperative group, regardless of their individual differences. Lopez-Morteo and López (2007) studied the effects of implementing an electronic collaborative learning environment on high school student motivation to learn math. Not only did this environment supply multi-player math games, it also featured chat rooms and instant messaging. Results show that this environment positively affected student attitudes towards mathematics. Sedig (2008) studied the effects of Super Tangrams, an educational game used to engage learners and teach nontrivial transformational geometry concepts on sixth graders. Results showed that not only did students increase in their knowledge of transformational geometry; they were motivated and found the exercises to be fun and enjoyable. Spires, Lee, Turner, and Johnson (2008) studied the perspective of 4,000 middle school students specifically as it pertained to using educational games through surveys and focus groups. Students shared that games and technology make learning fun. They are already listening to music, playing video games, and using cell phones. Incorporating technology into the classroom is not far from their norms at all. Tüzün, Yılmaz-Soylua, Karakuşb, İnalb, and Kızılkaya (2009) tested 13 students, in the fourth and fifth grades played on a Multi-User Virtual Environment (MUVE) called Quest Atlantis developed to teach geography. They measured both intrinsic and extrinsic motivation as well as learning achievement. Results showed that intrinsic motivation increased, extrinsic motivation decreased, students' focus on getting grades decreased, yet they learned more and were more independent when participating in these game-based activities.

Purpose of Research

This research examines the nature and level of educational computer-based game techniques implemented by modern exemplar teachers in achieving success in their classrooms. Academic subjects, grade levels for which games are or are not used, and perceived effectiveness of educational computer-based games will be the variables assessed. We assume that increased student performance was an outcome since the teachers we intend to survey have been identified as exemplary based in part on effective instructional practices and student learning results in the classroom. Exemplar teachers are those who won awards from the Milken Educator Awards. The Milken Educator Awards were chosen because the criteria for winning mandated proof of student improvement. The criteria used by the Milkin Educator Award to select exemplary teachers is (as taken from the website on July 8, 2009):

- Exceptional educational talent as evidenced by effective instructional practices and student learning results in the classroom and school;
- Exemplary educational accomplishments beyond the classroom that provide models of excellence for the profession;
- Individuals whose contributions to education are largely unheralded yet worthy of the spotlight;
- Early- to mid-career educators who offer strong long-range potential for professional and policy leadership; and

- Engaging and inspiring presence that motivates and impacts students, colleagues and the community.

The proposal suggests a descriptive, survey-based approach to developing and evaluating responses from exemplar teachers about their use (or lack) of educational computer game implementation in the classroom. Further, this research seeks to identify successful and less successful techniques of the use of educational computer-based games in the classroom. Since its first awarding ceremony in 1987, the Milken Educator Awards has become the nation's largest teacher recognition program honoring more than 2,400 educators from coast to coast with over $60 million in unrestricted cash awards. Other initiatives include Milken Scholars, Milken Archive, Mike's Math Club, and Epilepsy Research awards, Jewish Educator Awards, the Teacher Advancement Program (TAP™). While this research may evolve somewhat as development progress, the plan is to use survey responses to place findings within the framework of Davis' Technology Acceptance Model. Davis' Technology Acceptance Model will be adapted and incorporated to examine whether a teacher's acceptance of (or resistance towards) educational computer game usage is dependent upon their acceptance and usage of these games.

CHAPTER THREE : METHODOLOGY

This chapter presents a methodology for the research that will be accomplished. It first summarizes the research questions and hypotheses then outlines the sample population and research design. Data collection instruments to be used and data collection and analysis procedures follow.

The overall objective of this research is to examine, from a contemporary and longitudinal perspective, the nature and level of educational computer-based game techniques implemented by modern exemplar teachers (defined below) in achieving success in their classrooms. The research focuses specifically on these areas:

1. Exemplar teachers' level of acceptance of educational computer games using an adaptation of Davis's Technology Acceptance Model;
2. The level and nature of teachers' use of educational computer games in the classroom;
3. Access students have to educational computer games either in their classrooms or in computer labs;
4. Instructional techniques teachers use most when incorporating educational computer games in their classrooms.

The research design is non-experimental, exploratory, and descriptive. This approach is limited in terms of identification, control, time, and access of the teacher population, common issues with survey type research. First, we do not have the resources or ability to identify and evaluate "exemplar teachers" ourselves. Second, sampling exemplar teachers only may limit the generalizability of the findings. Third, we will be soliciting voluntary participation which may limit the sample size. Fourth, teachers will be asked to recall events from the past and their memory may not be accurate. Fifth, teachers' current level of acceptance and use of educational computer-based games may bias the assessment of past level of acceptance and use of educational computer-based games. Sixth, an independent organization will need to be used to identify and access the exemplar teacher population.

Despite these limitations, which are common and usually accepted as part of survey type research, the present study will be able to contribute to the research literature by exploring the stated variables related to acceptance and use of educational computer-based games in the classroom. Participation levels are expected to be in line with other survey-based studies. Teacher recollection of the past experience will be sufficient for this research as winning a Milken award was a significant event. Also, participant bias, such as attempts to be viewed as early adopters, will be reduced through anonymous response.

Study Population and Sample Selection

In order to find exemplar teachers, an evaluation of numerous national awarding agencies was conducted. The statement to "improve student performance" was required as one (though, not necessarily the first) criteria for selection of teachers for award. Of the agencies evaluated, Milken Educator Awards was the only one that listed this important component. Founded by brothers Michael and Lowell Milken, the Milken

Educator Award is one of the many initiatives sponsored by the Milken Family Foundation. The Milken Educator Awards were established to provide public recognition and individual financial rewards of $25,000 to elementary and secondary teachers, principals, and specialists who are furthering excellence in education. Awards for the Milken Educator Award alternate each year between elementary and secondary educators. Based on guidelines established by the Foundation, participating states' departments of education appoint blue-ribbon committees that recommend candidates for selection. Identification and selection procedures are confidential, and the program does not include a formal nomination or application procedure. The criteria for the selection of outstanding elementary and secondary school teachers, principals and other education professionals as Milken Educators include all of the following:

- Exceptional educational talent as evidenced by effective instructional practices and student learning results in the classroom and school;
- Exemplary educational accomplishments beyond the classroom that provide models of excellence for the profession;
- Individuals whose contributions to education are largely unheralded yet worthy of the spotlight;
- Early- to mid-career educators who offer strong long-range potential for professional and policy leadership; and
- Engaging and inspiring presence that motivates and impacts students, colleagues and the community.

The survey research strategy focuses on Milken Educator Award winners' use of educational computer-based games as a teaching tool in the classroom. Participation will be totally voluntary with no compensation provided. No endorsement is provided by the Milken Family Foundation. Participants of this survey will be teachers who have won a Milken Educator Award between the years 1996-2009 (n=1561).

Research questions, Hypotheses, and Analysis Design

This research will address seven research questions. Analysis of the research questions will be based on frequency, inferential, statistics and effect size (Cohen, 1988). Frequency statistics for overall results and for each of the following variables will be computed: grade level, subject, teacher gender, and teacher age. G*Power 3.1.0 (Faul, Erdfelder, Lang, & Buchner, 2007) will be used to calculate sample sizes needed for inferential statistics. Effect size will be determined based on Cohen's (1988) recommendations.

Research Question 1. In any given year or group of years depending on inferential statistic requirements, is the teacher's level of acceptance of educational computer-based games different from ambivalence based on each dimension of acceptance?

H_0 = There is no difference between level of acceptance of educational computer-based games and ambivalence for any given dimensions.

H_a = There is a difference between level of acceptance of educational computer-based games and ambivalence for any given dimensions.

Survey questions 8-18 will be used to address this research question. Analyses on each dimension of level of acceptance will be evaluated against a hypothesized mean of ambivalence where ambivalence is measured on a seven level ordinal scale used to measure subject subjective responses. The Wilcoxon-signed rank test will be used to determine the statistical significance of inferences for groups and dimension combinations. N, or cells per group, will be determined using G*Power 3.1.0 (Faul, et al., 2007) with A = .05, β = .20, ES = (medium) .50 (Cohen, 1988). Sample size for year group groupings must equal or exceed 68.

Sub-hypothesis one: H_0 = There is no difference between ambivalence and other responses for PEOU.

Survey questions 8-13 will be used to address this sub-hypothesis.

Sub-hypothesis two: H_0 = There is no difference between ambivalence and other responses for PU.

Survey questions 14-18 will be used to address this research sub-hypothesis.

Research Question 2. In any given year or group of years depending on inferential statistic requirements, are the dimensions of teacher's level of acceptance of educational computer-based games different from each other?

H_0 = There is no difference between the level of acceptance dimensions for use of educational computer-based games for classroom instruction.

H_a = There is a difference between the level of acceptance dimensions for use of educational computer-based games for classroom instruction.

Survey questions 8-18 address this research question. Analyses on each dimension of level of acceptance will be evaluated against each group. The Kruskal-Wallis test will be used to determine the statistical significance of inferences for groups and dimension combinations. N, or cells per group, will be determined using G*Power 3.1.0 (Faul, et al., 2007) with A = .05, β = .20, ES = (medium) .50 (Cohen, 1988). Sample size for year group groupings must equal or exceed 68.

Research Question 3. In any given year or group of years depending on inferential statistic requirements, is there a difference within each dimension of level of acceptance for use or non-use of educational computer-based games?

H_0 = There is no difference between use and non-use of educational computer-based games within each dimension of level of acceptance over time.

H_a = There is a difference between use and non-use of educational computer-based games within each dimension of level of acceptance over time.

Survey questions 8-18 and 19 address this research question. Each level of acceptance will be compared to actual use using the Mann-Whitney inferential test of location for two independent samples. N, or cells per group, will be determined using G*Power 3.1.0 (Faul, et al., 2007) with A = .05, β = .20, ES = (medium) .50 (Cohen, 1988). Sample size for year group groupings must equal or exceed 68.

Research question 4. How has the trend in each dimension of level of acceptance toward educational computer-based games in classroom instruction changed over time?

H_0 = There is no trend in acceptance of educational computer-based games in classroom instruction over time.

H_a = There is a trend in acceptance of educational computer-based games in classroom instruction over time.

Survey questions 8-18 address this research question. Analysis used will be Cox-Stuart test for trend. N, or cells per group, will be determined using G*Power 3.1.0 (Faul, et al., 2007) with A = .05.

Research question 5. How has the level of the use of educational computer-based games changed over time?

H_0 = There is no increase of use of educational computer-based games over time.

H_a = There is an increase of use of educational computer-based games over time.

Survey questions 19 and 20 address this research question. Analysis used will be Chi square test of homogeneity using r x n matrices.

Research question 6. How has the level of access students have to computers with educational computer-based games to meet subject objectives changed over time?

H_0 = There is no change of access students have to computers with educational computer-based games to meet subject objectives over time.

H_a = There is a change of access students have to computers with educational computer-based games to meet subject objectives over time.

Survey questions 5, 6, and 7 address this research question. Analysis used will be Chi square test of homogeneity using r x n matrices.

Research question 7. Which of the following instructional techniques are used most when incorporating educational computer-based games in the classroom over time?

- As a class topic opener (Becker, 2007)
- One of many techniques for teaching objectives (Becker, 2007)
- Main technique for teaching objective (Becker, 2007)
- Summarization tool (Balajthy, 1984; Garris, Ahlers, and Driskell, 2002; Higgins and Johns, 1984)
- Were students able to interact with the game individually (Ke and Grabowski, 2007)
- Were students able to interact with the game as a group (Ke and Grabowski, 2007; Carrier, 1991; Balajthy, 1984).

H_0 = There is no difference among use of instructional techniques over time.

H_a = There is a difference among use of instructional techniques over time.

Survey question 21 addresses this research question. Analysis used will be Chi square test of homogeneity using r x n matrices

Assumptions

Assumptions of the study are:

1. Participant Milken Educator Award email addresses are still valid and they check their email regularly.
2. Windows 95 operating system provides the beginning of today's computer-based game interface (compared to previous Windows releases). Due to its release on August 24, 1995 (Windows '95, 1995), participant range is from 1996 forward.

Research Design

An online questionnaire (Appendix B) will be administered to award winning teachers. The questionnaire focuses on several areas: participants' acceptance and use of educational computer games as an instructional strategy in the classroom and access to educational computer games for students. While this research may evolve somewhat as development progress, the plan is to use survey responses to place findings within the framework of Davis' Technology Acceptance Model. Davis' Technology Acceptance Model will be incorporated to examine whether a teacher's acceptance of (or resistance towards) educational computer game usage is dependent upon their acceptance and usage of these games. The Davis' Technology Acceptance Model is validated for current acceptance of technology, not past acceptance of technology. Thus a possible source of bias may be that the use of the acceptance model for past use may not be valid. We do not believe that such a bias exists as stated earlier. A pilot study will be conducted and the estimated time to complete is 15 minutes or less.

To avoid boredom of participants, demographic questions are presented in two parts – at the beginning and again after the main questions of the survey. The first set of demographic questions gather participant gender, age at time of winning the Milken Educator Award, and what subject(s) and grade(s) was (were) taught at the time of award (see questions 1 through 4). The second set of demographic questions asks about their years of experience, level of education and teaching experience, and so on (see questions 22 through 25).

The main survey measures participants' acceptance of educational computer-based games using Davis's Technology Acceptance Model. Educational computer-based games acceptance questions are derived from two constructs of Davis's (1989) Technology Acceptance Model – perceived usefulness of technology and perceived ease of use of technology (see questions 8 through 18). Davis (1993) argued that a user's overall attitude toward using a given system is a major determinant of whether or not s/he will actually use it. He further advanced that attitude toward using a system is a function of two beliefs: perceived usefulness and perceived ease of use; and that perceived ease of use has a causal effect on perceived usefulness. The perceived usefulness and perceived ease of use subscales adapted from Davis' (1985) research are combined into one "acceptance scale" for the present study. Participants will be asked to respond based on their perception about the use of educational computer-based games at the time they won the Milken Educator Award. Participant responses will be recorded using a seven-point Likert scale ranging from 'strongly agree' to 'strongly disagree'. As reported in Davis' (1985) research, the Cronbach coefficient alpha measured the reliability of both measures with both scales exceeding .90. The TAM has and continues to prove readily adaptable as an assessment instrument in a variety of technology contexts. Other questions in the survey include what educational computer-based games were used for classroom instruction and access to educational computer-based games for students.

A pilot test was conducted on February 20, 2009 using students from a graduate class in grant writing. The purpose of the pilot was to time the survey, find any glaring errors, and consider any recommendations. Thirteen students took the survey. Some of the participants were current teachers, while others were pre-service teachers. The time it took participants to complete the survey ranged from 5-15 minutes. Minor typos were found and corrected. Additionally, six other individuals (not in the class) took the survey with response time also falling within the 5-15 minute timeframe. A recommendation included clarifying the term 'educational computer-based games' to 'content-specific educational computer-based games'. This recommendation was incorporated.

Data Collection Procedure

Through the Milken Educator Award website, an invitation will be sent to all Milken Educator Award winners from 1996 – 2009. They will be requested to complete the 10-15 minute survey within two weeks. This invitation includes information about the purpose of the study and that in no way is this survey connected with the Milken

Family Foundation. Participation will be totally voluntary with no compensation provided. Also included in this invitation will be the researcher's contact information if they have additional questions. The email invitation will contain a link to the online survey, administered through LimeSurvey. Participants who do not respond will receive a follow up email and will be given additional time to complete the survey. Upon clicking the online survey link, participants will be presented with an online consent form, and upon agreeing, the survey. They will be given sets of directions for each section of the survey. The survey will begin with gathering demographic information, followed by questions adapted from the Technology Acceptance Model, questions regarding technology use and educational computer-based games use. These questions will ask them to recall the year when they won the Milken Educator Award and respond to the aforementioned questions. This will help us uncover the increase in educational computer-game game acceptance and use if there is one.

CHAPTER FOUR: DATA COLLECTION AND ANALYSIS

This chapter presents data on and analysis of seven hypotheses. Following the introduction, the Chapter has the following major sections: (1) Data Collection; (2) Demographics of the Sample Population: Year Groups; (3) Demographics of the Sample Population: Instructional Profile; (4) Reliability of Sample Population Responses; (5) Use of Alpha and Beta Values for Type 1 and Type 2 Error Assessment; and (6) Sequential Analysis of Research Questions. The majority of chapter is devoted to the analysis of the research questions (Question 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10) from the perspective of hypotheses tests. These hypotheses may be placed into two groups all of which address the overall purpose of this dissertation – to understand the relationship between the level of educational computer game use and Milken exemplar teacher instructional strategies. In this research, Milken exemplar teachers represent teachers whose implementation of teaching strategies resulted in measureable performance improvements. The basis of the research was to determine the level and nature of the contribution of educational computer games to student performance improvements. The analysis of the specific hypotheses will be addressed in this chapter in turn. The first group of hypotheses deal with identifying differences between the two dimensions of the TAM (Perceived Ease of Use (PEOU) and Perceived Usefulness (PU)) as published by Davis (1989) and is addressed within research questions 1-3. The second group of hypotheses deals with finding trends over time among the TAM, educational computer game usage, access to computers, and instructional strategies. These are addressed within research questions 4-7.

Data Collection

The target sample population for this research was the entire population of Milken Educator Award (MEA) winners from 1996-2009 (N=1,561). The overall approach to the data collection plan was to solicit MEA winners' participation in a survey posted on a web site. The survey was created in LimeSurvey, posted at www.yaelasresearch.com, and is located in Appendix B.

To establish the data collection protocol, communication took place between the Milken Communications Content Editor and the author throughout the data collection period. All data solicitation sessions were held in a computer lab at UCF. The initial data solicitation session took place on Monday, March 15, 2010. I was assisted by three students who were paid $10/hr. Technical difficulties arising from a crash of the Milken server handling the e-mail solicitations caused the first solicitation session to be incomplete. Two additional evenings by one person were necessary to complete the first solicitation. The first solicitation identified that 13 participants were deceased and 67 could not be reached as they did not have a current email address. No further attempts to solicit survey completion were sent to those 80 winners resulting in 1,481 possible participants. Of the 1,481 winners solicited, 59 completed surveys were received, resulting in a 4% response rate.

Future solicitation sessions were conducted at a different lab at UCF, where more computer resources were located. Twelve friends assisted in the solicitations, allowing all 1,481 emails to be sent in one session Tuesday, March 30, 2010. The Milken server crashed again and only two completed surveys were received (1% response rate). This was cause for concern.

The third and final e-mail solicitation occurred on Tuesday, May 4, 2010. Again, twelve additional individuals assisted in sending emails, allowing all 1,481 emails to be sent in one session. Again, the Milken server crashed. Fortunately, this data collection session resulted in 178 receiving completed surveys (12.5% response rate) resulting in a 17.5% total response rate.

Demographics of the Sample Population: Year Groups

Of the final target MEA population (N=1,481), 269 surveys were completed; 239 were completed fully and 30 were incomplete. During the data cleaning process, 20 of the incomplete surveys were accepted into the data analysis pool because they answered the minimal questions needed to conduct data analysis for any research question in this study. What this means is that all 259 participant responses were not used in every research question analyzed, but that these responses were used to analyze at least one research question. As a result, 259 participant responses were used for data analysis, becoming our sample population. This equals an overall 17.5% response rate from the target population. Table 2 below presents the distribution of responses by the year in which the participants won the MEA award. The year with the largest percent of responses from the sample population came from 2009 with a 31.5% response rate.

Table 2. Response Distribution

Year	Population	No email sent		Sent to	# Responses received	Response rate
		No Email Provided (NEP)	Deceased (D)			
1996	137	19		118	18	0.153
1997	150	12	2	136	16	0.118
1998	160	13	6	141	25	0.177
1999	171	10	1	160	24	0.15
2000	155	5		150	28	0.187
2001	119	3	3	113	13	0.115
2002	100	1	1	98	7	0.071
2003	100	2		98	20	0.204
2004	98	2		96	18	0.188
2005	90			90	20	0.222
2006	82			82	21	0.256
2007	75			75	14	0.187
2008	70			70	18	0.257
2009	54			54	17	0.315
Total	1561	67	13	1481	259	0.175

Table 3 presents the distribution of the sample population by year group and the percent of each year compared to the entire sample population.

Table 3. Frequency of Responses by Year Group and as a Percentage of the Total Sample Population

Year	Frequency	Percent	Valid Percent	Cumulative percent
1996	18	6.9	6.9	6.9
1997	16	6.2	6.2	13.1
1998	25	9.7	9.7	22.8
1999	24	9.3	9.3	32.0
2000	28	10.8	10.8	42.9
2001	13	5.0	5.0	47.9
2002	7	2.7	2.7	50.6
2003	20	7.7	7.7	58.3
2004	18	6.9	6.9	65.3
2005	20	7.7	7.7	73.0
2006	21	8.1	8.1	81.1
2007	14	5.4	5.4	86.5
2008	18	6.9	6.9	93.4
2009	17	6.6	6.6	100.0
Total	259	100.0	100.0	

Demographics of the Sample Population: Instructional Profile

Of the sample population, 169 participants were female, 88 were male, and two did not report gender. The average age was 39.35 years (SD=7.03). Participants were given the following subject options from which to choose: Language Arts (which encompassed Communication, Composition, Creative Writing, English, Literature, Reading, and Writing), Mathematics (which encompassed Algebra, Calculus, Geometry, Liberal Arts Math, Probability and Statistics), Science (which encompassed Anatomy and Physiology, Biology, Chemistry, Earth Science, Environmental Science, General Science, Natural Science, Physics), and Social Studies (which encompassed American Government, Civics, Current Events, Economics, Geography, History, Legal Studies, Psychology, World Religions). The grade level and instructional subject mode of the sample population was eighth grade Language Arts. Table 4 provides the distribution of the sample population by the grade level taught most by the participants at the time of winning the MEA award.

Table 4. Distribution of Sample Population by Grade Level taught by Participants

Grade Level	Frequency	Percent
Valid	7	2.7
K	6	2.3
1	14	5.4
2	11	4.2
3	19	7.3
4	27	10.4
5	28	10.8
6	15	5.8
7	10	3.9
8	32	12.4
9	20	7.7
10	25	9.7
11	27	10.4
12	18	6.9
Total	259	100.0

Table 5 provides the distribution of the sample population by the subject taught most by the participants at the time of winning the MEA award.

Table 5. Distribution of sample population by Subject taught by Participants

Subject	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	17	6.6	6.6	6.6
Language Arts (e.g., Communication, Composition, Creative Writing, English, Literature, Reading, Writing)	110	42.5	42.5	49.0
Mathematics (e.g., Algebra, Calculus, Geometry, Liberal Arts Math, Probability and Statistics)	58	22.4	22.4	71.4
Science (e.g., Anatomy and Physiology, Biology, Chemistry, Earth Science, Environmental Science, General Science, Natural Science, Physics)	51	19.7	19.7	91.1
Social Studies (e.g., American Government, Civics, Current Events, Economics, Geography, History, Legal Studies, Psychology, World Religions)	23	8.9	8.9	100.0
Total	259	100	100	

Homogeneity Test Analysis

Overall and individual year homogeneity tests were conducted to validate the quantity of 'email response rate' to 'email sent rate'. Homogeneity tests are frequently used to determine whether frequency counts are distributed identically across different populations (Conover, 1971). When comparing 'sent emails' to 'received emails' by year group, counts were significant, meaning, not homogeneous, Pearson $\chi 2$ (2, N = 1481) = 15.781, p=.000, Cramérs *V* = .103. The proportions of level of game usage per level was .825 and .175, respectively. Because count of received emails are significantly different from, and not homogeneous to, the count of sent emails, this means is that, by year group, received emails are not representative of the actual year group. One reason for this may be because, as illustrated in Table 2 above, the Milken Foundation handed out more awards in the more distant past (see 'Population' column) than they have more recently. Overall homogeneity counts by year group are illustrated in Table 6.

Table 6. Overall Homogeneity Test by Group

		Overall by Group		Total
		Emails sent (Expected)	Emails received (Observed)	
Year Group 1 (1996-1999)	Count	472	83	555
	Expected Count	457.9	97.1	555.0
	% within Group	85.0%	15.0%	100.0%
Year Group 2 (2000-2004)	Count	469	86	555
	Expected Count	457.9	97.1	555.0
	% within Group	84.5%	15.5%	100.0%
Year Group 3 (2005-2009)	Count	281	90	371
	Expected Count	306.1	64.9	371.0
	% within Group	75.7%	24.3%	100.0%
Total	Count	1222	259	1481
	Expected Count	1222.0	259.0	1481.0
	% within Group	82.5%	17.5%	100.0%

Follow up homogeneity tests were conducted to validate the email response rate to email sent rate by individual year. When comparing sent email to received email counts by individual year, counts were significant here as well, not homogeneous, Pearson $\chi2$ (13, N = 1481) = 30.918, p=.003, Cramérs *V* = .144. The proportions of level of game usage per level was .825 and .175, respectively. Similar to the year group analysis, because count of received emails are significantly different from, and not homogeneous to, the count of sent emails, this means is that, by individual year, received emails are not representative of the actual individual year. Counts are illustrated in Table 7.

Table 7. Overall Homogeneity Test by Individual Year

		Overall by Individual Year		
		Emails sent (Expected)	Emails received (Observed)	Total
Year 1996	Count	100	18	118
	Expected Count	97.4	20.6	118.0
	% within Group	84.7%	15.3%	100.0%
Year 1997	Count	120	16	136
	Expected Count	112.2	23.8	136.0
	% within Group	88.2%	11.8%	100.0%
Year 1998	Count	116	25	141
	Expected Count	116.3	24.7	141.0
	% within Group	82.3%	17.7%	100.0%
Year 1999	Count	136	24	160
	Expected Count	132.0	28.0	160.0
	% within Group	85.0%	15.0%	100.0%
Year 2000	Count	122	28	150
	Expected Count	123.8	26.2	150.0
	% within Group	81.3%	18.7%	100.0%
Year 2001	Count	100	13	113
	Expected Count	93.2	19.8	113.0
	% within Group	88.5%	11.5%	100.0%
Year 2002	Count	91	7	98
	Expected Count	80.9	17.1	98.0
	% within Group	92.9%	7.1%	100.0%
Year 2003	Count	78	20	98
	Expected Count	80.9	17.1	98.0
	% within Group	79.6%	20.4%	100.0%

		Overall by Individual Year		
		Emails sent (Expected)	Emails received (Observed)	Total
Year 2004	Count	78	18	96
	Expected Count	79.2	16.8	96.0
	% within Group	81.2%	18.8%	100.0%
Year 2005	Count	70	20	90
	Expected Count	74.3	15.7	90.0
	% within Group	77.8%	22.2%	100.0%
Year 2006	Count	61	21	82
	Expected Count	67.7	14.3	82.0
	% within Group	74.4%	25.6%	100.0%
Year 2007	Count	61	14	75
	Expected Count	61.9	13.1	75.0
	% within Group	81.3%	18.7%	100.0%
Year 2008	Count	52	18	70
	Expected Count	57.8	12.2	70.0
	% within Group	74.3%	25.7%	100.0%
Year 2009	Count	37	17	54
	Expected Count	44.6	9.4	54.0
	% within Group	68.5%	31.5%	100.0%
Total	Count	1222	259	1481
	Expected Count	1222.0	259.0	1481.0
	% within Group	82.5%	17.5%	100.0%

As a result of both types of homogeneity tests, analysis of research questions was based on received responses, which did provide homogeneous counts. When analyses called for year groups, we divided received responses into three year groups (year group 1 (1996-1999; year group 2 (2000-2004); and year group 3 (2005-2009). Otherwise, analyses were performed on individual year (1996, 1997, 1998,…2009). Each analysis discusses how data was divided.

Reliability of Sample Population Responses

The only change made to Davis's TAM was to replace all instances of the word 'technology' with the phrase 'educational computer-based games'. A reliability test of the adapted TAM was conducted using the Cronbach alpha test for reliability.

Coefficients of .00 indicate complete absence of relationship among test items, while coefficients of 1.00 is the highest coefficient that can be achieved (Fraenkel and Wallen, 2000). According to Fraenkel and Wallen (2000), the general expected reliability for research is .70.

Table 8 presents the Cronbach alpha test result for reliability of the PEOU dimension of the TAM. The result shows that each question in the PEOU dimension reliably tested participants' views on PEOU on educational computer-based games. The alpha coefficients obtained confirm Davis's strong reliability of PEOU measures (questions 8-13).

Table 8. PEOU Reliability

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.909	.923	6

Table 9 presents the Cronbach alpha test result for reliability of the PU dimension of the TAM. The result shows that each question in the PU dimension reliably tested participants' views on perceived usefulness on educational computer-based games. The alpha coefficients obtained confirm Davis's strong reliability of PU measures (questions 14-18).

Table 9. PU Reliability

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.947	.947	5

Use of Alpha and Beta Values for Type 1 and Type 2 Error Assessment

Type 1 error (also known as making a false alarm), or alpha error (α), is rejecting the H_0 when it should have been accepted. To minimize the occurrence of this error, researchers set low probability cutoffs for rejecting H_0, .01 or .05, for example. Type 2 error (also known as missing a detection), or beta error (β), is accepting H_0 when it should have been rejected (Rumsey, 2003; Cohen, 1977). To minimize the occurrence of this error, large sample sizes are preferred to smaller sample sizes. Since beta is the complement to power, if beta equals .20, power equals .80 (1-β). For each research question analyzed, minimum desired alpha and beta values prior to collecting the survey data were .05 and .2, respectively, as recommended from Table 2 by Cohen (1992). SPSS 13.0 for Windows GradPack, Excel, and online tools to perform the Fisher's Exact Test (Joosse, 2010) and regression analysis (Regression Calculator, n.d.) were used to analyze all research questions.

Sequential Analysis of Research Questions

Research Question 1 (Level of acceptance of educational computer-based games to Ambivalence):

In any given year or group of years depending on inferential statistic requirements, is the teacher's level of acceptance of educational computer-based games different from ambivalence based on each dimension of acceptance?

H_0 = There is no difference between the level of acceptance of educational computer-based games and ambivalence for any given dimension.

H_a = There is a difference between level of acceptance of educational computer-based games and ambivalence for any given dimension.

To investigate this hypothesis, each participant was asked to express the strength of his/her response to thirteen questions drawn from Davis's Technology Acceptance Model. These sub-hypotheses can be conceptually grouped into two sub categories: (1) Perceived Ease of Use of educational computer-base games, and (2) Perceived Usefulness of education computer-based games. Strength of acceptance of the question was measured on a scale from 1 to 7 as shown in Table 10 below.

Table 10. TAM Response Scale

1	2	3	4	5	6	7
Extremely Unlikely	Quite Unlikely	Slightly Unlikely	Neither Likely nor Unlikely	Slightly Likely	Quite Likely	Extremely Likely

Responses formed the basis for statistical tests of each sub-hypothesis about the ambivalence of the sample population to that question. Ambivalence is numerically represented by the response four. Questions 8-18 are found in Appendix B. The sub-hypotheses are placed in the sub-categories of Perceived Ease of Use (PEOU) and Perceived Usefulness (PU).

Sub-category Perceived Ease of Use

Sub-hypothesis 1 (LEARN TO OPERATE): For each group, there is no difference between Technology Acceptance Model survey question 8 (SQ T8) and ambivalence (neutral).

Sub-hypothesis 2 (DO WHAT I WANT): For each group, there is no difference between Technology Acceptance Model survey question 9 (SQ T9) and ambivalence (neutral).

Sub-hypothesis 3 (INTERACTION): For each group, there is no difference between Technology Acceptance Model survey question 10 (SQ T10) and ambivalence (neutral).

Sub-hypothesis 4 (BECOME SKILLFUL): For each group, there is no difference between Technology Acceptance Model survey question 11 (SQ T11) and ambivalence (neutral).

Sub-hypothesis 5 (FLEXIBLE): For each group, there is no difference between Technology Acceptance Model survey question 12 (SQ T12) and ambivalence (neutral).

Sub-hypothesis 6 (EASY TO USE): For each group, there is no difference between Technology Acceptance Model survey question 13 (SQ T13) and ambivalence (neutral).

Sub-hypothesis 7 (Overall PEOU): For each group, there is no difference between the PEOU dimension (T8-13) and ambivalence (neutral).

Sub-category Perceived Usefulness

Sub-hypothesis 8 (ACCOMPLISH MORE): For each group, there is no difference between Technology Acceptance Model survey question 14 (SQ T14) and ambivalence (neutral).

Sub-hypothesis 9 (IMPROVE PERFORMANCE): For each group, there is no difference between Technology Acceptance Model survey question 15 (SQ T15) and ambivalence (neutral).

Sub-hypothesis 10 (INCREASE PRODUCTIVITY): For each group, there is no difference between Technology Acceptance Model survey question 16 (SQ T16) and ambivalence (neutral).

Sub-hypothesis 11 (JOB EASIER): For each group, there is no difference between Technology Acceptance Model survey question 17 (SQ T17) and ambivalence (neutral).

Sub-hypothesis 12 (USEFUL IN JOB): For each group, there is no difference between Technology Acceptance Model survey question 18 (SQT18) and ambivalence (neutral).

Sub-hypothesis 13 (Overall PU): For each group, there is no difference between the PU dimension (T14-18) and ambivalence (neutral).

All available data was included for analyzing each sub-hypothesis. As mentioned earlier in this chapter, if a participant answered ACCOMPLISH MORE Survey Question

(SQ) T8 (sub-hypothesis 1 of PEOU) but not DO WHAT I WANT SQ T9 (sub-hypothesis 2 of PEOU), the participant's data would be included to address sub-hypotheses 1 and 3-6 but not 2 and 7 (overall sub-hypothesis for PEOU). Each dimension of level of acceptance, or each TAM question, was evaluated against a hypothesized mean of ambivalence (four) where ambivalence is measured on a seven level ordinal scale used to measure subjective responses. Because data was ordinal, the non-parametric version of the *t*-test, the Wilcoxon signed-rank test, was the test used to determine the statistical significance of inferences for group and dimension combinations. In Cohen's (1977) book, effect sizes are provided for most statistical tests and vary depending on the test. While effect sizes for the non-parametric Wilcoxon signed-rank test were not provided, values for the parametric alternative, the *t*-test, were. A medium effect size means an effect large enough to be seen by the naked eye. For statistical analysis conducted in this research, effect size of medium was chosen. For the Wilcoxon signed-rank test, a medium effect size is .5. G*Power software version 3.1.0 enables one to input alpha, β, and effect size in order to compute actual sample size and power for a given alpha and effect size. For analysis of research question 1, desired sample size estimated by Cohen was based on alpha and β values of .05 and .2, respectively. G*Power 3.1.0 (Faul, et al., 2007) precisely computes minimal sample size given the alpha, power and effect size to satisfy experimental statistical requirements. Figure 5 provides the statistical parameters as calculated by G*Power (Faul et al., 2007) given actual effect size of .5, alpha of .05 and β .01. This resulted in a minimal sample size of

68 and an actual power of over .99. This sample size enabled the responses to be divided into three groups to designate past (1996-1999), middle (2000-2004), and recent (2005-2009) time frames. The full data set is provided in Appendix C.

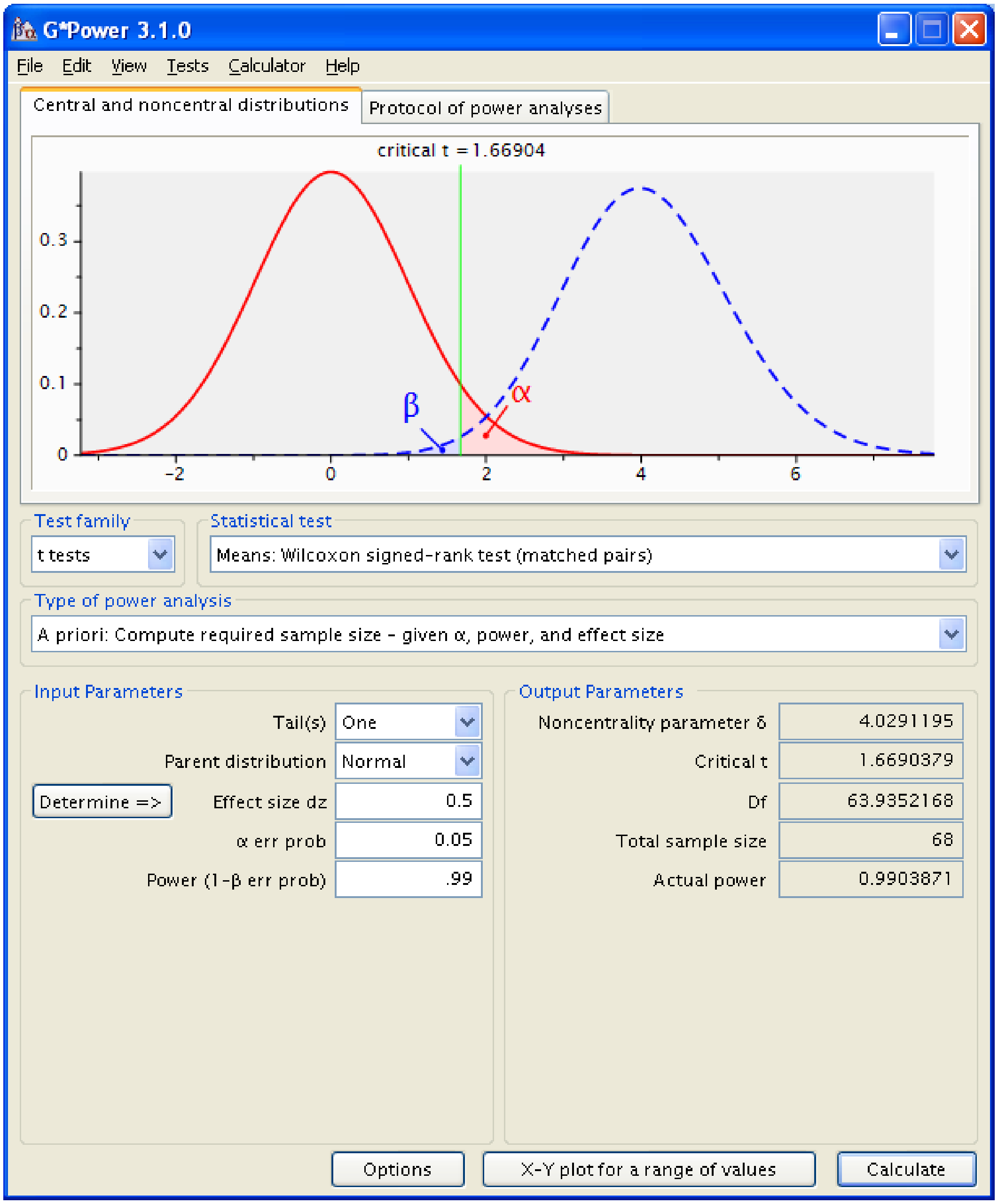

Figure 5. G*Power Calculation for Alpha and Beta Values for Wilcoxon Signed-Rank Test

Table 11 summarizes the G*Power statistical results of the 13 sub-hypotheses given the above input parameters. In the first column are the overall PEOU and PU dimensions. The second column presents the TAM question compared to Neutral, followed by α, significance (*p*), and β values for each of the three groups. In summary, the overall dimensions of PEOU and PU were statistically different from ambivalent. The direction of the response of the subordinate dimensions was across the board positive toward PEOU. This is not true for the PU dimension. The hypotheses of neutrality about PU subordinate dimensions (1) Improve performance; (2) Increase Productivity; and (3) Job easier for year group 2 (2000-2004) and year group 3 (2005 to 2009) could NOT be rejected, though the overall hypothesis of there being a significant difference from ambivalence for PU could be.

Table 11. Results of Sub-hypotheses for RQ1

TAM Dimensions	TAM Questions	G1: 1995-1999		G2: 2000-2004		G3: 2005-2009	
		α = .05 *p* values	β values	α = .05 *p* values	β values	α = .05 *p* values	β values
PEOU	LEARN TO OPERATE to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	DO WHAT I WANT to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	INTERACTION to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	BECOME SKILLFUL to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	FLEXIBLE to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	EASY TO USE to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	PEOU Dimension to Neutral	**$p<.001$**	**0.01**	**$p<.001$**	**0.01**	**$p<.001$**	**0.01**
PU	ACCOMPLISH MORE to Neutral	$p<.001$	0.01	$p=.010$	0.01	$p=.005$	0.01
	IMPROVE PERFORMANCE to Neutral	$p=.001$	0.01	$p=.081$	0.01	$p=.081$	0.01
	INCREASE PRODUCTIVITY to Neutral	$p=.004$	0.01	$p=.333$	0.01	$p=.132$	0.01
	JOB EASIER to Neutral	$p=.001$	0.01	$p=.155$	0.01	$p=.125$	0.01
	USEFUL IN JOB to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	PU Dimension to Neutral	**$p<.001$**	**0.01**	**$p<.001$**	**0.01**	**$p<.001$**	**0.01**

Detailed Analysis of Sub-category Perceived Ease of Use (PEOU) Difference from Ambivalence

When analyzing Perceived Ease of Use, each group of years were isolated and tested for ambivalence toward each relevant sub-hypothesis. Analysis of each sub-hypothesis is presented individually followed by a summarization of the entire sub-category.

PEOU – LEARN TO OPERATE SQ (T8) Difference from Ambivalence

Participant responses for LEARN TO OPERATE SQ T8 compared to Neutral are illustrated in Figure 6. For year group 1 (1996-1999), the Wilcoxon signed-rank test indicates a significant difference between LEARN TO OPERATE SQ T8 and ambivalence, $z = -6.480$, $p < .001$. The mean of the ranks in favor of LEARN TO OPERATE SQ T8 was 5.712 (closest to "Quite Likely"), while the mode was 7 ("Extremely Likely"). For year group 2 (2000-2004), the Wilcoxon signed-rank test indicates a significant difference between LEARN TO OPERATE SQ T8 and ambivalence, $z = -7.525$, $p < .001$. The mean of the ranks in favor of LEARN TO OPERATE SQ T8 was 6.024 (closest to "Quite Likely"), while the mode was 7 ("Extremely Likely"). For year group 3 (2005-2009), the Wilcoxon signed-rank test indicates a significant difference between LEARN TO OPERATE SQ T8 and ambivalence, $z = -8.100$, $p < .001$. The mean of the ranks in favor of LEARN TO OPERATE SQ T8 was 6.211 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely").

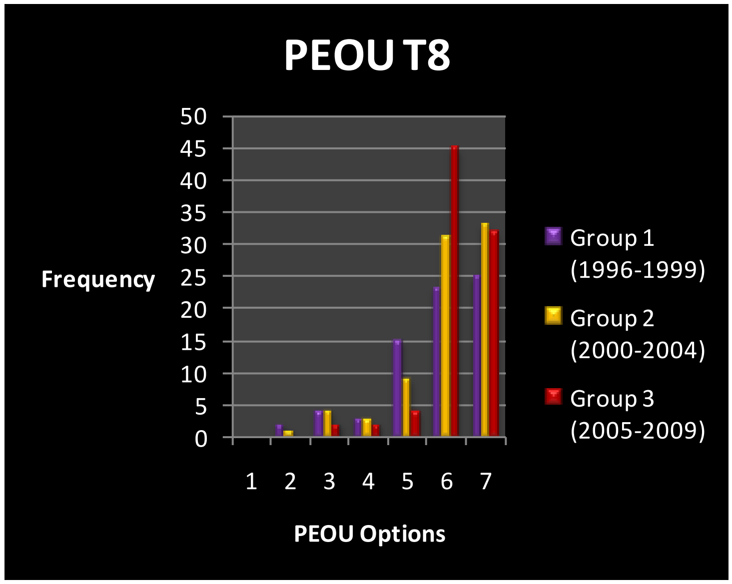

Figure 6. PEOU T8 Compared to Ambivalence

All three groups seem to have similarly high response averages, ranging from 5.712 (closest to "Quite Likely") for year group 1 (1996-1999) to 6.211 (closest to "Quite Likely") for year group 3 (2005-2009). Modes, too, stay close, between 7 ("Extremely Likely") for year group 1 (1996-1999) and year group 2 (2000-2004) and 6 ("Quite Likely") for year group 3 (2005-2009). All three groups also responded very positively on the response scale to LEARN TO OPERATE SQ T8. Overall responses to this question for the entire 14 year period are not ambivalent.

PEOU – DO WHAT I WANT SQ (T9) Difference from Ambivalence

Participant responses for DO WHAT I WANT SQ T9 compared to Neutral are illustrated in Figure 7. For year group 1 (1996-1999), the Wilcoxon signed-rank test indicates a significant difference between DO WHAT I WANT SQ T9 and ambivalence, z = -4.768, p <.001. The mean of the ranks in favor of DO WHAT I WANT SQ T9 was 5.082

(closest to “Slightly Likely”), while the mode was 6 (“Quite Likely”). For year group 2 (2000-2004), the Wilcoxon signed-rank test indicates a significant difference between DO WHAT I WANT SQ T9 and ambivalence, $z = -5.487$, $p < .001$. The mean of the ranks in favor of DO WHAT I WANT SQ T9 was 5.160 (closest to “Slightly Likely”), while the mode was 6 (“Quite Likely”). For year group 3 (2005-2009), the Wilcoxon signed-rank test indicates a significant difference between DO WHAT I WANT SQ T9 and ambivalence, $z = -6.254$, $p < .001$. The mean of the ranks in favor of DO WHAT I WANT SQ T9 was 5.223 (closest to “Slightly Likely”), while the mean in favor of Neutral was 6 (“Quite Likely”).

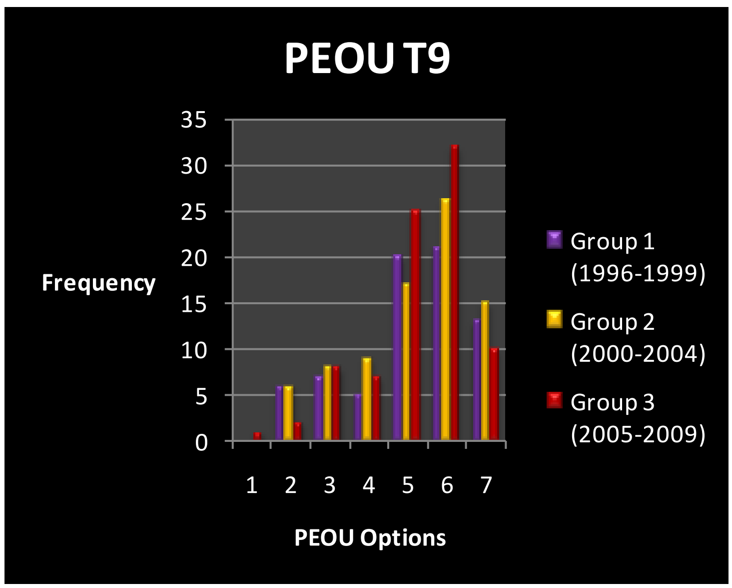

Figure 7. PEOU T9 Compared to Ambivalence

All three groups seem to have similarly high response averages, ranging from 5.082 (closest to “Slightly Likely”) for year group 1 (1996-1999) to 5.223 (closest to “Slightly Likely”) for year group 3 (2005-2009). Modes, too, appear to stay close, at 6 (“Quite Likely”) among all three groups. All three groups also responded very positively on the response scale to DO WHAT I WANT SQ T9. Overall responses to this question for the entire 14 year period are not ambivalent.

PEOU – INTERACTION SQ (T10) Difference from Ambivalence

Participant responses for INTERACTION SQ T10 compared to Neutral are illustrated in Figure 8. For year group 1 (1996-1999), the Wilcoxon signed-rank test indicates a significant difference between INTERACTION SQ T10 and ambivalence, $z = -5.925$, $p < .001$. The mean of the ranks in favor of INTERACTION SQ T10 was 5.425 (closest to "Slightly Likely"), while the mode was 6 ("Quite Likely"). For year group 2 (2000-2004), the Wilcoxon signed-rank test indicates a significant difference between INTERACTION SQ T10 and ambivalence, $z = -6.970$, $p < .001$. The mean of the ranks in favor of INTERACTION SQ T10 was 5.568 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely"). For year group 3 (2005-2009), the Wilcoxon signed-rank test indicates a significant difference between INTERACTION SQ T10 and ambivalence, $z = -7.216$, $p < .001$. The mean of the ranks in favor of INTERACTION SQ T10 was 5.624 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely").

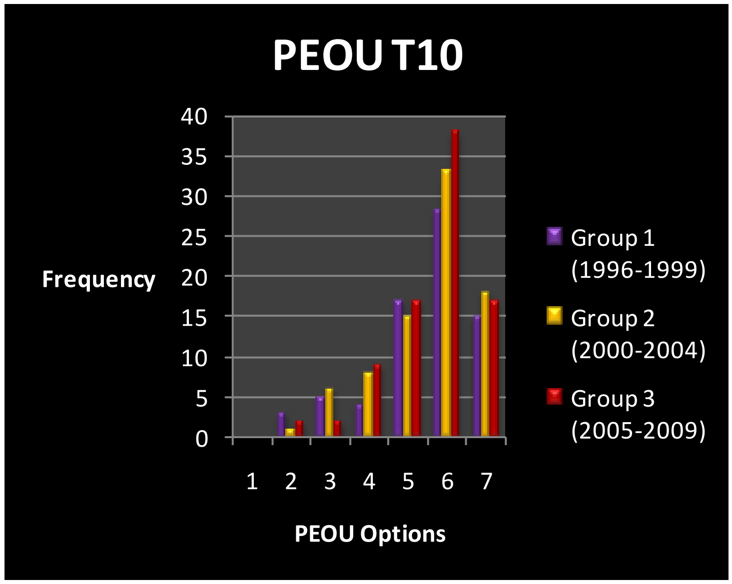

Figure 8. PEOU T10 Compared to Ambivalence

All three groups seem to have similarly high response averages, ranging from 5.425 (closest to "Slightly Likely") for year group 1 (1996-1999) to 5.624 (closest to "Quite Likely") for year group 3 (2005-2009). Modes, too, appear to stay close, at 6 ("Quite Likely")among all three groups. All three year groups also responded very positively on the response scale to INTERACTION SQ T10. Overall responses to this question for the entire 14 year period are not ambivalent.

PEOU – BECOME SKILLFUL SQ (T11) Difference from Ambivalence

Participant responses for BECOME SKILLFUL SQ T11 compared to Neutral are illustrated in Figure 9. For year group 1 (1996-1999), the Wilcoxon signed-rank test indicates a significant difference between BECOME SKILLFUL SQ T11 and ambivalence, $z = -6.841$, $p < .001$. The mean of the ranks in favor of BECOME SKILLFUL SQ T11 was 5.703 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely"). For year group

2 (2000-2004), the Wilcoxon signed-rank test indicates a significant difference between BECOME SKILLFUL SQ T11 and ambivalence, z = -7.690, p <.001. The mean of the ranks in favor of BECOME SKILLFUL SQ T11 was 6.012 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely"). For year group 3 (2005-2009), the Wilcoxon signed-rank test indicates a significant difference between BECOME SKILLFUL SQ T11 and ambivalence, z = -7.800, p <.001. The mean of the ranks in favor of BECOME SKILLFUL SQ T11 was 6.012 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely").

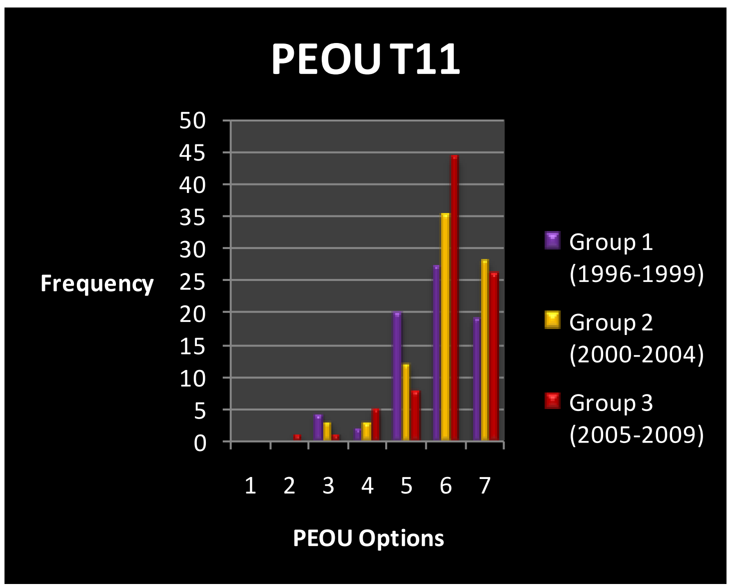

Figure 9. PEOU T11 Compared to Ambivalence

All three groups seem to have similarly high response averages, ranging from 5.703 (closest to "Quite Likely") for year group 1 (1996-1999) to 6.012 (closest to "Quite Likely") for year group 3 (2005-2009). Modes, too, appear to stay close, at 6 ("Quite Likely")among all three groups. All three groups also responded very positively on the response scale to BECOME SKILLFUL SQ T11. Overall responses to this question for the entire 14 year period are not ambivalent.

PEOU – FLEXIBLE SQ (T12) Difference from Ambivalence

Participant responses for FLEXIBLE SQ T12 compared to Neutral are illustrated in Figure 10. For year group 1 (1996-1999), the Wilcoxon signed-rank test indicates a significant difference between FLEXIBLE SQ T12 and ambivalence, $z = -5.823$, $p < .001$. The mean of the ranks in favor of FLEXIBLE SQ T12 was 5.219 (closest to “Slightly Likely”), while the mode was 6 (“Quite Likely”). For year group 2 (2000-2004), the Wilcoxon signed-rank test indicates a significant difference between FLEXIBLE SQ T12 and ambivalence, $z = -6.034$, $p < .001$. The mean of the ranks in favor of FLEXIBLE SQ T12 was 5.235 (closest to “Slightly Likely”), while the mode was 5 (“Slightly Likely”). For year group 3 (2005-2009), the Wilcoxon signed-rank test indicates a significant difference between FLEXIBLE SQ T12 and ambivalence, $z = -6.129$, $p < .001$. The mean of the ranks in favor of FLEXIBLE SQ T12 was 5.259 (closest to “Slightly Likely”), while the mode was 6 (“Quite Likely”).

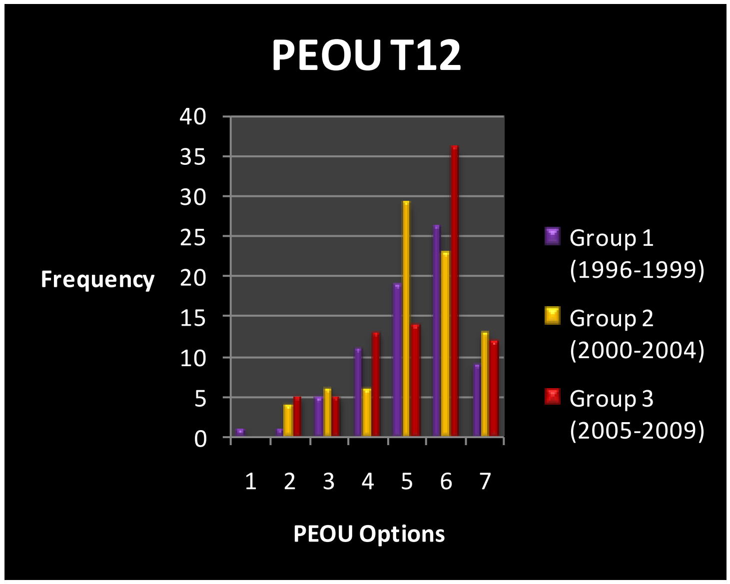

Figure 10. PEOU T12 Compared to Ambivalence

All three groups seem to have similarly high response averages, ranging from 5.219 (closest to “Slightly Likely”) for year group 1 (1996-1999) to 5.259 (closest to “Slightly Likely”) for year group 3 (2005-2009). Modes, too, appear to stay close, at 6 (“Quite Likely”) for year group 1 (1996-1999) and year group 3 (2005-2009) and at 5 (“Slightly Likely”) for year group 2 (2000-2004). All three groups also responded very positively on the response scale to FLEXIBLE SQ T12. Overall responses to this question for the entire 14 year period are not ambivalent.

EASY TO USE SQ (T13) Difference from Ambivalence

Participant responses for EASY TO USE SQ T13 compared to Neutral are illustrated in Figure 11. For year group 1 (1996-1999), the Wilcoxon signed-rank test indicates a significant difference between EASY TO USE SQ T13 and ambivalence, z = -6.519, p <.001. The mean of the ranks in favor of EASY TO USE SQ T13 was 5.50 (closest to “Quite Likely”), while the mode was 6 (“Quite Likely”). For year group 2 (2000-2004), the Wilcoxon signed-rank test indicates a significant difference between EASY TO USE SQ T13 and ambivalence, z = -7.618, p <.001. The mean of the ranks in favor of EASY TO USE SQ T13 was 5.877 (closest to “Quite Likely”), while the mode was 6 (“Quite Likely”). For year group 3 (2005-2009), the Wilcoxon signed-rank test indicates a significant difference between EASY TO USE SQ T13 and ambivalence, z = -7.748, p <.001. The mean of the ranks in favor of EASY TO USE SQ T13 was 5.847 (closest to “Quite Likely”), while the mode was 6 (“Quite Likely”).

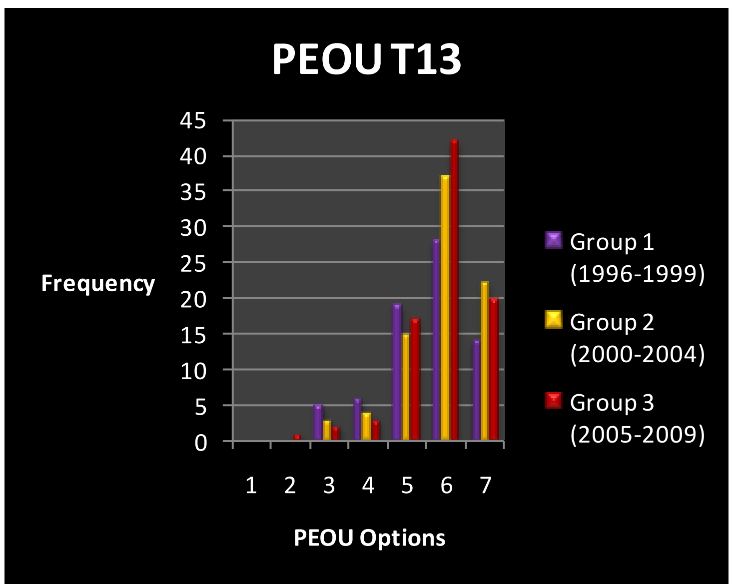

Figure 11. PEOU T13 Compared to Ambivalence

All three groups seem to have similarly high response averages, ranging from 5.50 (closest to “Quite Likely”) for year group 1 (1996-1999) to 5.877 (“Quite Likely”)for year group 2 (2005-2009). Modes, too, appear to stay close, at 6 (“Quite Likely”)for all groups. All groups also responded very positively on the response scale to EASY TO USE

SQ T13. Overall responses to this question for the entire 14 year period are not ambivalent.

PEOU – COMBINATION OF PEOU ATTRIBUTES Difference from Ambivalence

Participant responses for the PEOU dimension compared to Neutral are illustrated in Figure 12. To calculate the combination of PEOU attributes, all individual scores were collected and analyzed using the Wilcoxon signed-rank test; meaning, scores here were not averaged. For year group 1 (1996-1999), the Wilcoxon signed-rank test indicates a significant difference between the PEOU dimension and ambivalence, $z = -15.381$, $p < .001$. The mean of the ranks in favor of the PEOU dimension was 5.491, (closest to "Slightly Likely"), while the mode was 6 ("Quite Likely"). For year group 2 (2000-2004), the Wilcoxon signed-rank test indicates a significant difference between the PEOU dimension and ambivalence, $z = -17.054$, $p < .001$. The mean of the ranks in favor of the PEOU dimension was 5.646 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely"). For year group 3 (2005-2009), the Wilcoxon signed-rank test indicates a significant difference between the PEOU dimension and ambivalence, $z = -17.841$, $p < .001$. The mean of the ranks in favor of the PEOU dimension was 5.646 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely").

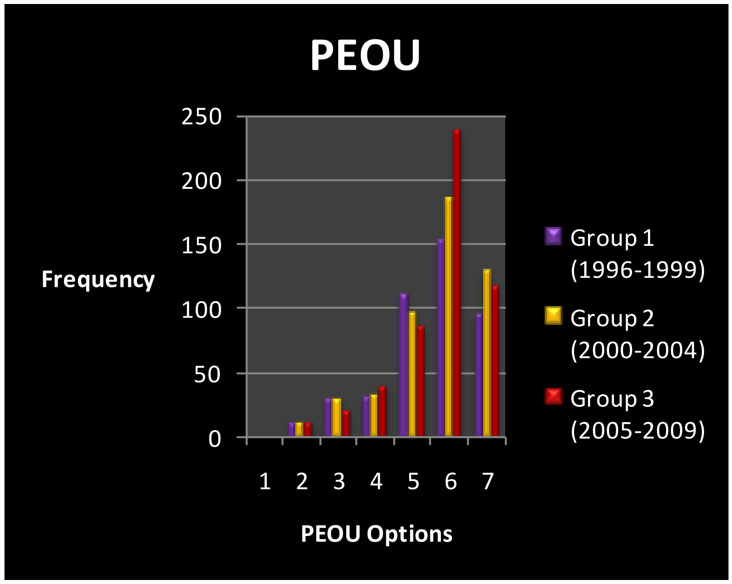

Figure 12. PEOU Compared to Ambivalence

For sub-category PEOU, all groups were significantly different from Neutral showing that they generally perceived the incorporation of educational computer games as easy to use.

Detailed Analysis of Sub-category Perceived Usefulness (PU) Difference from Ambivalence

When analyzing Perceived Usefulness, each group of years were isolated and tested for ambivalence toward each relevant sub-hypothesis. Analysis of each sub-hypothesis is presented individually followed by a summarization of the entire sub-category.

PU – ACCOMPLISH MORE SQ (T14) Difference from Ambivalence

Participant responses for ACCOMPLISH MORE SQ T14 compared to Neutral are illustrated in Figure 13. For year group 1 (1996-1999), the Wilcoxon signed-rank test indicates a significant difference between ACCOMPLISH MORE SQ T14 and ambivalence, $z = -4.690$, $p < .001$. The mean of the ranks in favor of ACCOMPLISH MORE SQ T14 was 4.892, (closest to "Slightly Likely"), while the mode was 5 ("Slightly Likely"). For year group 2 (2000-2004), the Wilcoxon signed-rank test indicates a significant difference between SQ T14 and ambivalence, $z = -2.570$, $p = .01$. The mean of the ranks in favor of ACCOMPLISH MORE SQ T14 was 4.513, (closest to "Slightly Likely"), while the mode was 5("Slightly Likely"). For year group 3 (2005-2009), the Wilcoxon signed-rank test indicates a significant difference between ACCOMPLISH MORE SQ T14 and ambivalence, $z = -2.778$, $p = .005$. The mean of the ranks in favor of ACCOMPLISH MORE SQ T14 was 4.482 (closest to "Slightly Likely")," while the mode was 5, ("Slightly Likely").

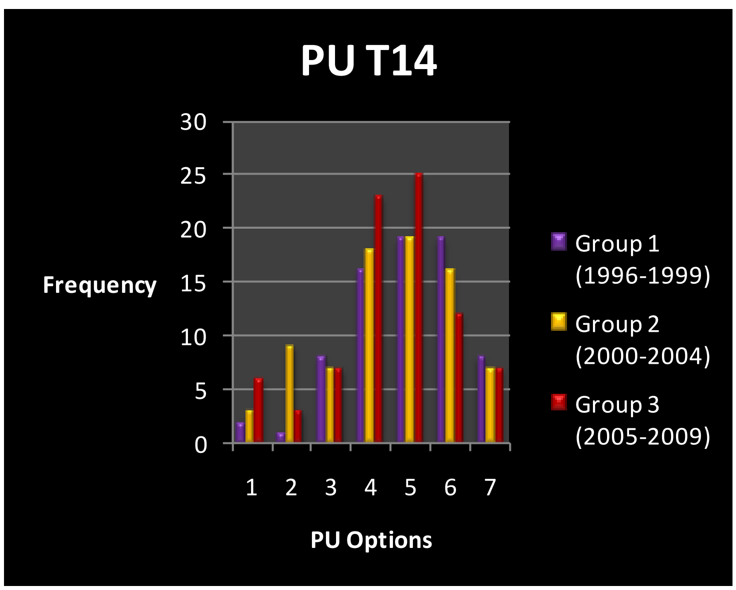

Figure 13. PU T14 Compared to Ambivalence

All three groups have similar response averages, ranging from 4.482 (closest to "Neither Likely nor Unlikely") for year group 3 (2005-2009) to 4.892 (closest to "Slightly

Likely") for year group 1 (1996-1999). Modes, too, stay close at 5 ("Slightly Likely") for all year groups. All year groups also responded positively on the response scale to ACCOMPLISH MORE SQ T14. Overall responses to this question for the entire 14 year period are not ambivalent, although Figure 13 presents all years at, or hovering pretty closely to, response 4 ("Neither Likely nor Unlikely"). Hence the strength of the perception of usability from ambivalence to "Slightly Likely" was less than and unlike the previous sub-hypotheses within the PEOU sub-category.

PU – IMPROVE PERFORMANCE SQ (T15) Difference from Ambivalence

Participant responses for IMPROVE PERFORMANCE SQ T15 compared to Neutral are illustrated in Figure 14. For year group 1 (1996-1999), the Wilcoxon signed-rank test indicates a significant difference between IMPROVE PERFORMANCE SQ T15 and ambivalence, $z = -3.259$, $p < .001$. The mean of the ranks in favor of SQ T15 was 4.548 (closest to "Slightly Likely"), while the mode was 4 ("Neither Likely nor Unlikely"). For year group 2 (2000-2004), the Wilcoxon signed-rank test indicates no significant difference between IMPROVE PERFORMANCE SQ T15 and ambivalence, $z = -1.746$, $p = .081$. The mean of the ranks in favor of IMPROVE PERFORMANCE SQ T15 was 4.333 (closest to "Neither Likely nor Unlikely"), while the mode was 4 ("Neither Likely nor Unlikely"). For year group 3 (2005-2009), the Wilcoxon signed-rank test indicate no significant difference between IMPROVE PERFORMANCE SQ T15 and ambivalence, $z = -1.746$, $p = .081$. The mean of the ranks in favor of IMPROVE PERFORMANCE SQ T15 was

4.294 (closest to “Neither Likely nor Unlikely”), while the mode was 4 (“Neither Likely nor Unlikely”).

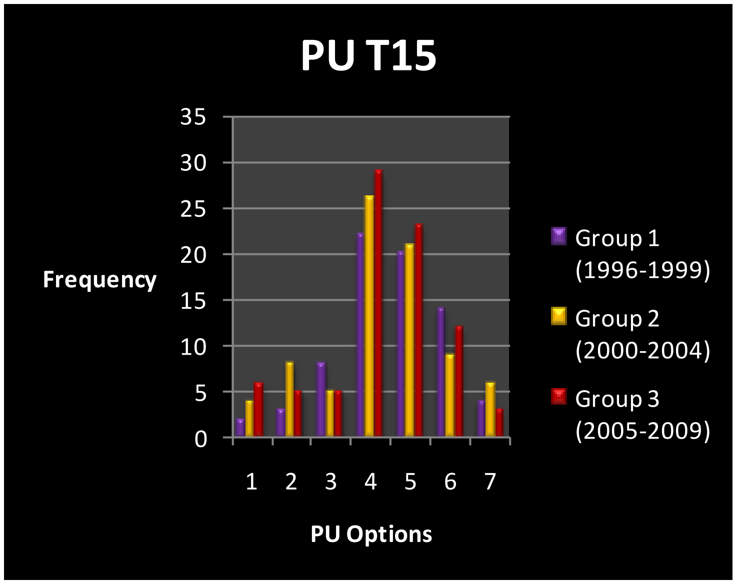

Figure 14. PU T15 Compared to Ambivalence

All three groups have similar response averages, ranging from 4.294 (closest to “Neither Likely nor Unlikely”) for year group 3 (2005-2009) to 4.548 (closest to “Slightly Likely”) for year group 1 (1996-1999). Modes, too, are 4 (“Neither Likely nor Unlikely”) for all year groups. All year groups responded close to Neutral on the response scale to IMPROVE PERFORMANCE SQ T15. Overall responses to this question for the entire 14 year period are mixed, with only year group 1 (1996-1999) being significantly different from ambivalence. Again, Figure 14 presents all years at, or hovering pretty closely to, response 4 (“Neither Likely nor Unlikely”) unlike the previous sub-hypotheses within the PEOU sub-category.

PU – INCREASE PRODUCTIVITY SQ (T16) Difference from Ambivalence

Participant responses for INCREASE PRODUCTIVITY SQ T16 compared to Neutral are illustrated in Figure 15. For year group 1 (1996-1999), the Wilcoxon signed-rank test indicates a significant difference between INCREASE PRODUCTIVITY SQ T16 and ambivalence, z = -2.854, p =.004. The mean of the ranks in favor of INCREASE PRODUCTIVITY SQ T16 was 4.527 (closest to "Slightly Likely"), while the mode was bimodal at 4 ("Neither Likely nor Unlikely") and 5 ("Slightly Likely"). For year group 2 (2000-2004), the Wilcoxon signed-rank test indicates no significant difference between INCREASE PRODUCTIVITY SQ T16 and ambivalence, z = -.968, p =.333. The mean of the ranks in favor of INCREASE PRODUCTIVITY SQ T16 was 4.198 (closest to "Neither Likely nor Unlikely"), while the mode was 4 ("Neither Likely nor Unlikely"). For year group 3 (2005-2009), the Wilcoxon signed-rank test indicates no significant difference between INCREASE PRODUCTIVITY SQ T16 and ambivalence, z = -1.504, p =.132. The mean of the ranks in favor of INCREASE PRODUCTIVITY SQ T16 was 4.250 (closest to "Neither Likely nor Unlikely"), while the mode was 4 (closest to "Neither Likely nor Unlikely").

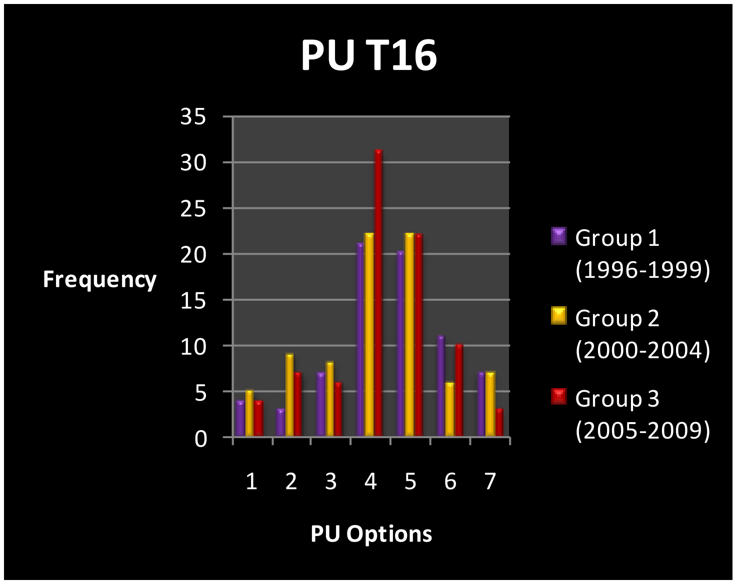

Figure 15. PU T16 Compared to Ambivalence

All three groups have similar response averages, ranging from 4.198 (closest to "Neither Likely nor Unlikely")for year group 2 (2000-2004) to 4.527 (closest to "Slightly Likely") for year group 1 (1996-1999). Modes, too, stay close at 4 ("Neither Likely nor Unlikely") for all year groups with year group 1 (1996-1999) having an additional mode of 5. All year groups responded close to Neutral on the response scale to INCREASE PRODUCTIVITY SQ T16. Overall responses to this question for the entire 14 year period are mixed, with only year group 1 (1996-1999) being significantly different from ambivalence. Figure 15 presents all years at, or hovering pretty closely to, response 4 ("Neither Likely nor Unlikely"), which is unlike the previous sub-hypotheses within the PEOU sub-category.

PU – JOB EASIER SQ (T17) Difference from Ambivalence

Participant responses for JOB EASIER SQ T17 compared to Neutral are illustrated in Figure 16. For year group 1 (1996-1999), the Wilcoxon signed-rank test indicates a significant difference between JOB EASIER SQ T17 and ambivalence, z = -3.251, p =.001. The mean of the ranks in favor of JOB EASIER SQ T17 was 4.581 (closest to “Slightly Likely”), while the mode was 5 (“Slightly Likely”). For year group 2 (2000-2004), the Wilcoxon signed-rank test indicates no significant difference between JOB EASIER SQ T17 and ambivalence, z = -1.423, p =.155. The mean of the ranks in favor of JOB EASIER SQ T17 was 4.275 (closest to “Neither Likely nor Unlikely”), while the mode was 5 (“Slightly Likely”). For year group 3 (2005-2009), the Wilcoxon signed-rank test indicates no significant difference between JOB EASIER SQ T17 and ambivalence, z = -1.533, p =.125. The mean of the ranks in favor of JOB EASIER SQ T17 was 4.247 (closest to “Neither Likely nor Unlikely”), while the mode was 4 (“Neither Likely nor Unlikely”).

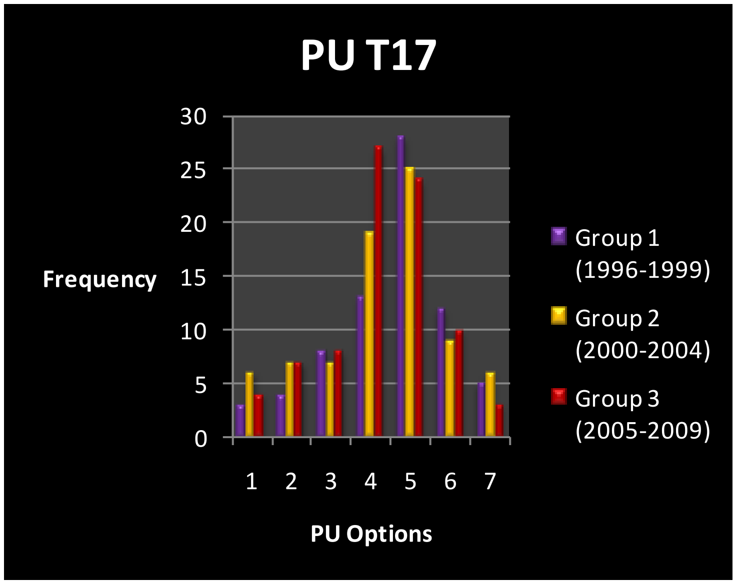

Figure 16. PU T17 Compared to Ambivalence

All three groups have similar response averages, ranging from 4.247 (closest to "Neither Likely nor Unlikely") for year group 3 (2005-2009) to 4.581 (closest to "Slightly Likely") for year group 1 (1996-1999). Modes are 5 ("Slightly Likely") for year group 1 (1996-1999) and year group 2 (2000-2004) and 4 ("Neither Likely nor Unlikely") for year group 3 (2005-2009). All year groups responded close to Neutral on the response scale to JOB EASIER SQ T17. Overall responses to this question for the entire 14 year period are mixed, with only year group 1 (1996-1999) being significantly different from ambivalence. Figure 16 presents all years at, or hovering pretty closely to, response 4 ("Neither Likely nor Unlikely"), which is unlike the previous sub-hypotheses within the PEOU sub-category.

PU – USEFUL IN JOB SQ (T18) Difference from Ambivalence

Participant responses for USEFUL IN JOB SQ T18 compared to Neutral are illustrated in

Figure 17. For year group 1 (1996-1999), the Wilcoxon signed-rank test indicates a significant difference between USEFUL IN JOB SQ T18 and ambivalence, $z = -5.405$, $p < .001$. The mean of the ranks in favor of USEFUL IN JOB SQ T18 was 5.189 (closest to "Slightly Likely"), while the mode was 6 ("Quite Likely"). For year group 2 (2000-2004), the Wilcoxon signed-rank test indicates a significant difference between USEFUL IN JOB SQ T18 and ambivalence, $z = -5.376$, $p < .001$. The mean of the ranks in favor of USEFUL IN JOB SQ T18 was 5.111 (closest to "Slightly Likely"), while the mode was 5 ("Slightly Likely"). For year group 3 (2005-2009), the Wilcoxon signed-rank test indicates a significant difference between SQ T18 and ambivalence, $z = -1.533$, $p < .001$. The mean of the ranks in favor of USEFUL IN JOB SQ T18 was 5.119 (closest to "Slightly Likely"), while the mode was 6 ("Quite Likely").

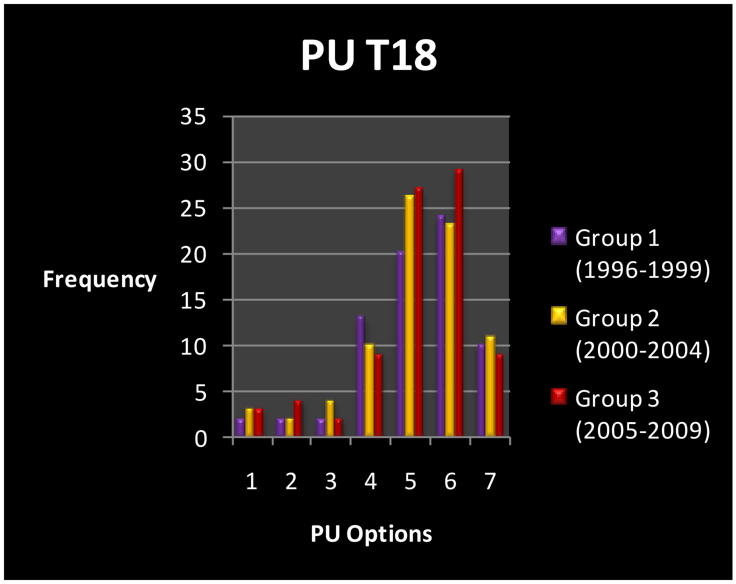

Figure 17. PU T18 Compared to Ambivalence

All three groups have "Slightly Likely" response averages, ranging from 5.111 for year group 2 (2000-2004) to 5.189 for year group 1 (1996-1999). Modes are "Quite Likely"at 6 for year group 1 (1996-1999) and year group 3 (2005-2009) and "Slightly Likely" 5 for year group 2 (2000-2004). Overall responses to this question for the entire 14 year period are not ambivalent.

Figure 17 presents all years higher than response 4 similar to the previous sub-hypotheses within the PEOU sub-category.

PU – COMBINATION OF PU ATTRIBUTES Difference from Ambivalence

Participant responses for the PU dimension compared to Neutral are illustrated in Figure 18. To calculate the combination of PU attributes, all individual scores were collected and analyzed using the Wilcoxon signed-rank test; meaning, scores here were not averaged. For year group 1 (1996-1999), the Wilcoxon signed-rank test indicates a significant difference between the PU dimension and ambivalence, $z = -8.715$, $p < .001$. The mean of the ranks in favor of the PU dimension was 4.742 (closest to "Slightly Likely"), while the mode was 5 ("Slightly Likely"). For year group 2 (2000-2004), the Wilcoxon signed-rank test indicates a significant difference between the PU dimension and ambivalence is significant, $z = -5.325$, $p < .001$. The mean of the ranks in favor of the PU dimension was 4.471 (closest to "Ambivalent"), while the mode was 5 ("Slightly Likely"). For year group 3 (2005-2009), the Wilcoxon signed-rank test indicates a significant difference between the PU dimension and ambivalence is significant, $z = -5.849$, $p < .001$. The mean of the ranks in favor of the PU dimension was 4.465 (closest to "Neither Likely nor Unlikely"), while the mode was 5 ("Slightly likely").

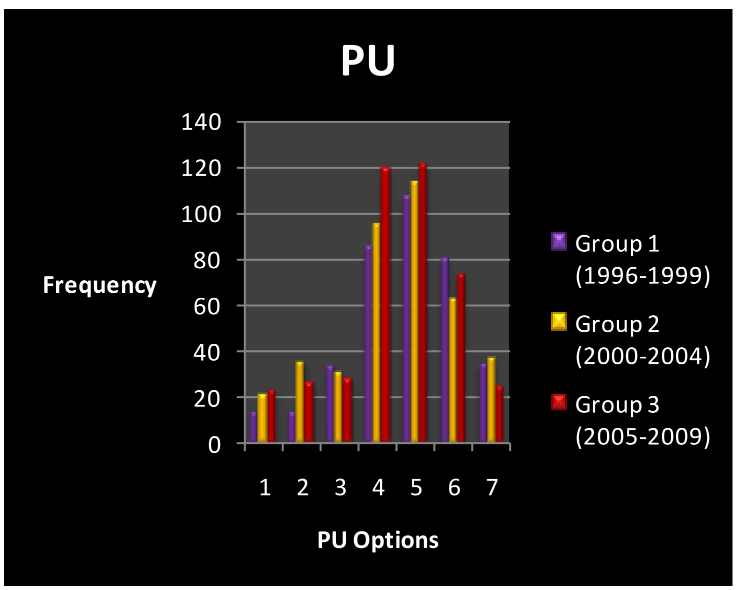

Figure 18. PU Compared to Ambivalence

For sub-category PU, year group 1 (1996-1999) tended to have higher means than any other year group. This may be due to the general lack of technological availability. For the overall PU sub-category, all groups were significantly different from Neutral showing that they generally perceived the incorporation of educational computer games as useful.

Research Question 1 Summary

In general, test participants are not ambivalent about the acceptance of games for instructional purposes. It is interesting to note that for the Perceived Ease Of Use TAM dimension, participants were not ambivalent about all sub-dimensions at statistically significant levels within their groups. Further, PEOU sub-dimensions for educational computer games were for the most part “Quite likely” (6) or higher. All year groups expressed a statistically significant positive perception of ease of use in terms of: learn to operate, could make the game do what they want, would be flexible to interact with, and were easy to use.

Contrasting with strong levels of Perceived Ease Of Use, the Perceived Usefulness TAM dimension did not receive such high levels of positive perception. While PU sub-dimensions were for the most part statistically different from ambivalence, participants in year group 2 (2000-2004) and year group 3 (2005-2009) did not show a significant difference from Neutral when asked if they thought educational computer games would improve job performance, increase productivity, or make their jobs easier.

Yet even with year group 2 (2000-2004) and year group 3 (2005-2009) showing lack of a significant difference in three of the five sub-hypotheses within the PU dimension the results suggest that we can reject the null hypothesis that there is no difference between the level of acceptance of educational computer-based games and ambivalence for either the PEOU or PU dimension. However, the strength of conviction about the perceived “Ease of Use” versus “Usefulness” of computer-based games for instructional purposes differ in mode and measurement with Perceived Ease Of Use being largely “Quite likely” (6) while Perceived Usefulness appear as “Slightly Likely” (5) or even “Neither Likely Nor Unlikely” (4).

Research Question 2 (Level of acceptance of educational computer-based games and year group differences):

In any given year or group of years depending on inferential statistic requirements, are the dimensions of teacher's level of acceptance of educational computer-based games different from each other?

H_0 = There is no difference between the level of acceptance dimensions for use of educational computer-based games for classroom instruction across year groups.

H_a = There is a difference between the level of acceptance dimensions for use of educational computer-based games for classroom instruction across year groups.

To investigate this hypothesis, each participant was asked to express the strength of his/her response to thirteen questions drawn from Davis's Technology Acceptance Model. These sub-hypotheses can be conceptually grouped into two sub-categories: (1) Perceived Ease of Use of educational computer-base games, and (2) Perceived Usefulness of education computer-based games. Strength of acceptance of the question was measured on a scale from 1 to 7 as shown in Table 12.

Table 12. TAM Response Scale

1	2	3	4	5	6	7
Extremely Unlikely	Quite Unlikely	Slightly Unlikely	Neither Likely nor Unlikely	Slightly Likely	Quite Likely	Extremely Likely

Responses formed the basis for statistical tests of each sub-hypothesis about the sample population to that question. Questions 8-18 are found in Appendix B. The sub-hypotheses are placed in the sub-categories of Perceived Ease of Use and Perceived Usefulness.

Sub-category Perceived Ease of Use

Sub-hypothesis 1 (LEARN TO OPERATE): For Technology Acceptance Model survey question 8 (SQ T8), there is no difference among year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009).

Sub-hypothesis 2 (DO WHAT I WANT): For Technology Acceptance Model survey question (SQ T9), there is no difference among year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009).

Sub-hypothesis 3 (INTERACTION): For Technology Acceptance Model survey question 10 (SQ T10), there is no difference among year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009).

Sub-hypothesis 4 (BECOME SKILLFUL): For Technology Acceptance Model survey question 11 (SQ T11), there is no difference among year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009).

Sub-hypothesis 5 (FLEXIBLE): For Technology Acceptance Model survey question 12 (SQ T12), there is no difference among year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009).

Sub-hypothesis 6 (EASY TO USE): For Technology Acceptance Model survey question 13 (SQ T13), there is no difference among year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009).

Sub-category Perceived Usefulness

Sub-hypothesis 7 (ACCOMPLISH MORE): For Technology Acceptance Model survey question 14 (SQ T14), there is no difference among year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009).

Sub-hypothesis 8 (IMPROVE PERFORMANCE): For Technology Acceptance Model survey question 15 (SQ T15), there is no difference among year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009).

Sub-hypothesis 9 (INCREASE PRODUCTIVITY): For Technology Acceptance Model survey question 16 (SQ T16), there is no difference among year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009).

Sub-hypothesis 10 (JOB EASIER): For Technology Acceptance Model survey question 17 (SQ T17), there is no difference among year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009).

Sub-hypothesis 11 (USEFUL IN JOB): For Technology Acceptance Model survey question 18 (SQ T18), there is no difference among year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009).

Sub-hypothesis 12: For year group 1 (1996-1999), there is no difference between the overall PEOU and PU dimensions.

Sub-hypothesis 13: For year group 2 (2000-2004), there is no difference between the overall PEOU and PU dimensions.

Sub-hypothesis 14: For year group 3 (2005-2009), there is no difference between the overall PEOU and PU dimensions.

Sub-hypothesis 15: For all year groups, (year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009)), there is no difference between the overall PEOU and PU dimensions.

Again, as mentioned previously in this chapter, all available data was included for analyzing each sub-hypothesis. So, for example, if a participant in Group 1 answered LEARN TO OPERATE SQ T8 but not DO WHAT I WANT SQ T9, the participant's data would be included to address sub-hypothesis 1 but not 12 or 15. Two different statistical analysis tests were conducted to satisfy inferential statistic requirements for this research question.

For sub-hypothesis 1-11 and because data was ordinal, the non-parametric version of the ANOVA, the Kruskal-Wallis test, was used to determine the statistical significance of inferences for group and dimension combinations. In Cohen's (1977) book, effect sizes are provided for most statistical tests and vary depending on the test. While effect sizes for the non-parametric Kruskal-Wallis test were not provided, values for the parametric alternative, the ANOVA, were. A medium effect size means an effect large enough to be seen by the naked eye. For statistical analysis conducted in this research, effect size of medium was chosen. G*Power software version 3.1.0 was used. G*Power enables one to input alpha, sample size, and effect size while computing actual power for a given alpha and power (1-beta). For analysis of research question 2, desired alpha and β values were .05 and .2, respectively. For the Kruskal-Wallis test, a medium effect size is .25. Actual alpha for Kruskal Wallis test set at .05 and β was computed to be approximately .06, with Power being greater than .94.

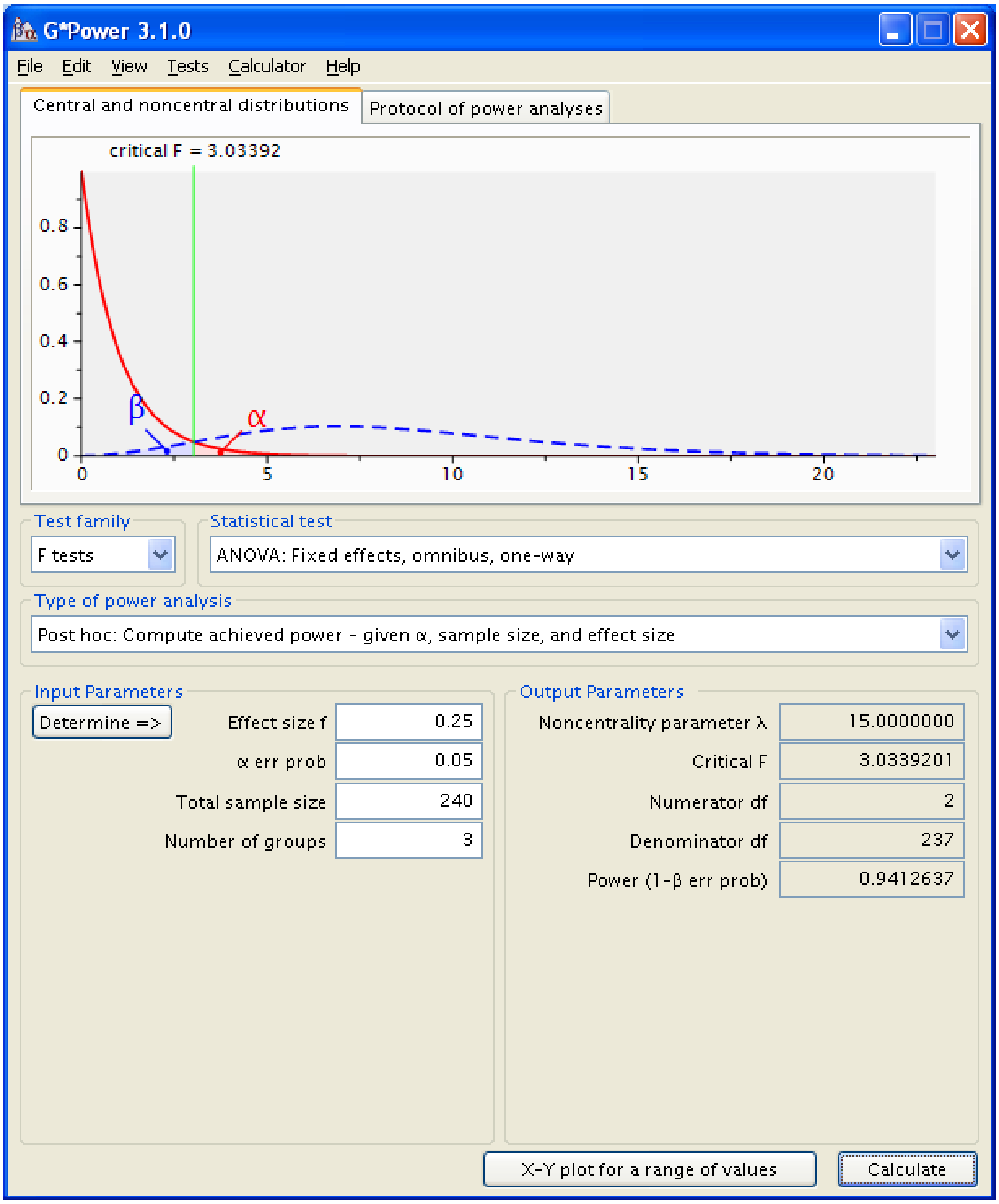

Figure 19 provides the statistical parameters as calculated by G*Power (Faul et al., 2007). The full data set is provided in Appendix C.

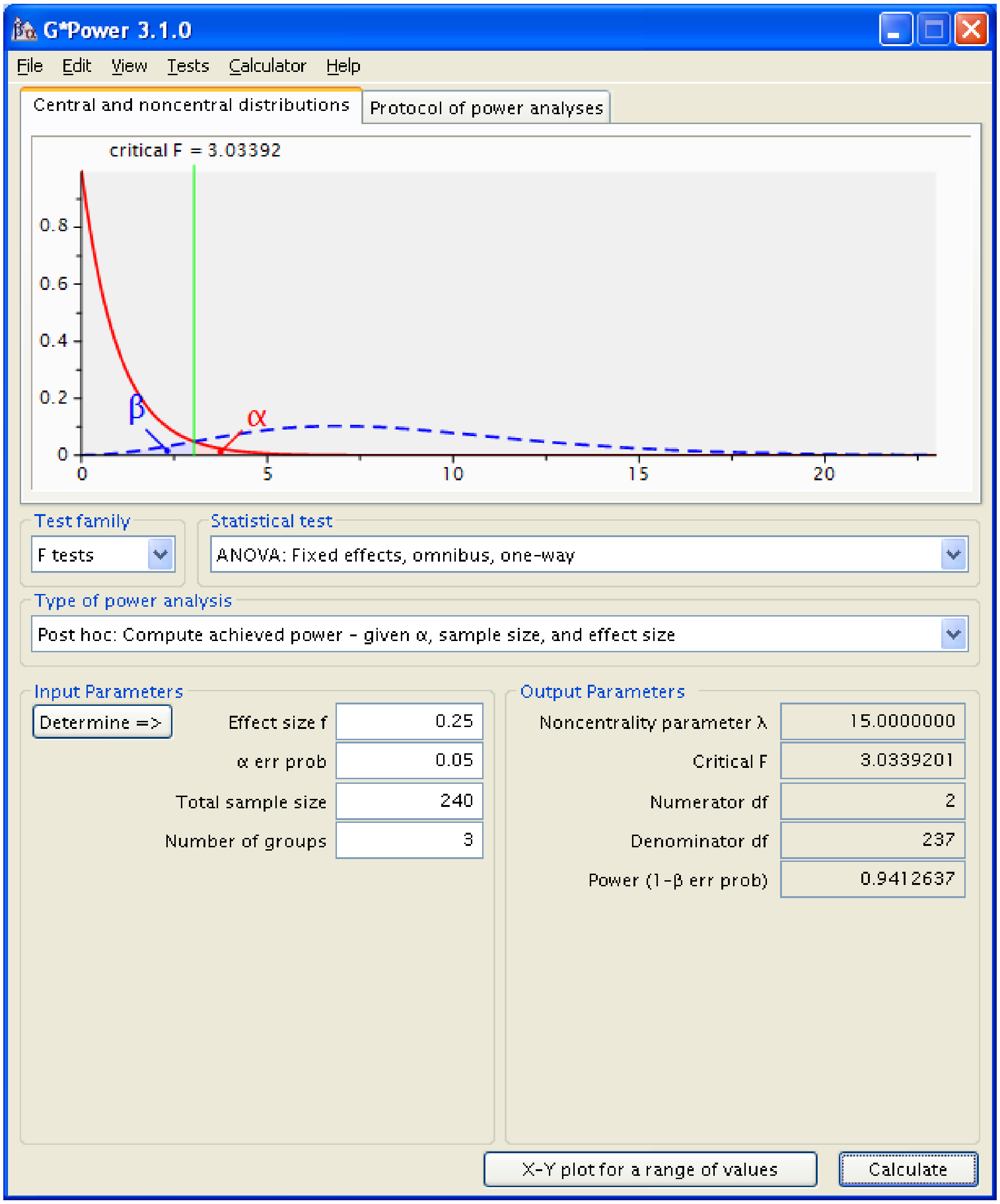

Figure 19. G*Power Calculation for Alpha and Beta Values for Kruskal Wallis Test

For sub-hypotheses 12-15, the Wilcoxon sign-rank test was conducted to compare total PEOU to total PU scores for each group (sub-hypotheses 12-14) and over all groups (sub-hypothesis 15). In Cohen's (1977) book effect sizes are provided for most statistical tests and vary depending on the test. While effect sizes for the non-parametric Wilcoxon signed-rank test were not provided, values for the parametric alternative, the *t*-test, were. A medium effect size means an effect large enough to be seen by the naked eye. For statistical analysis conducted in this research, effect size of medium was chosen. For the Wilcoxon signed-rank test, a medium effect size is .50. Alpha was input as .05 and Beta input as .01. Sample size was computed to be 68 with actual alpha for Wilcoxon signed-rank test of .05 and β .01.

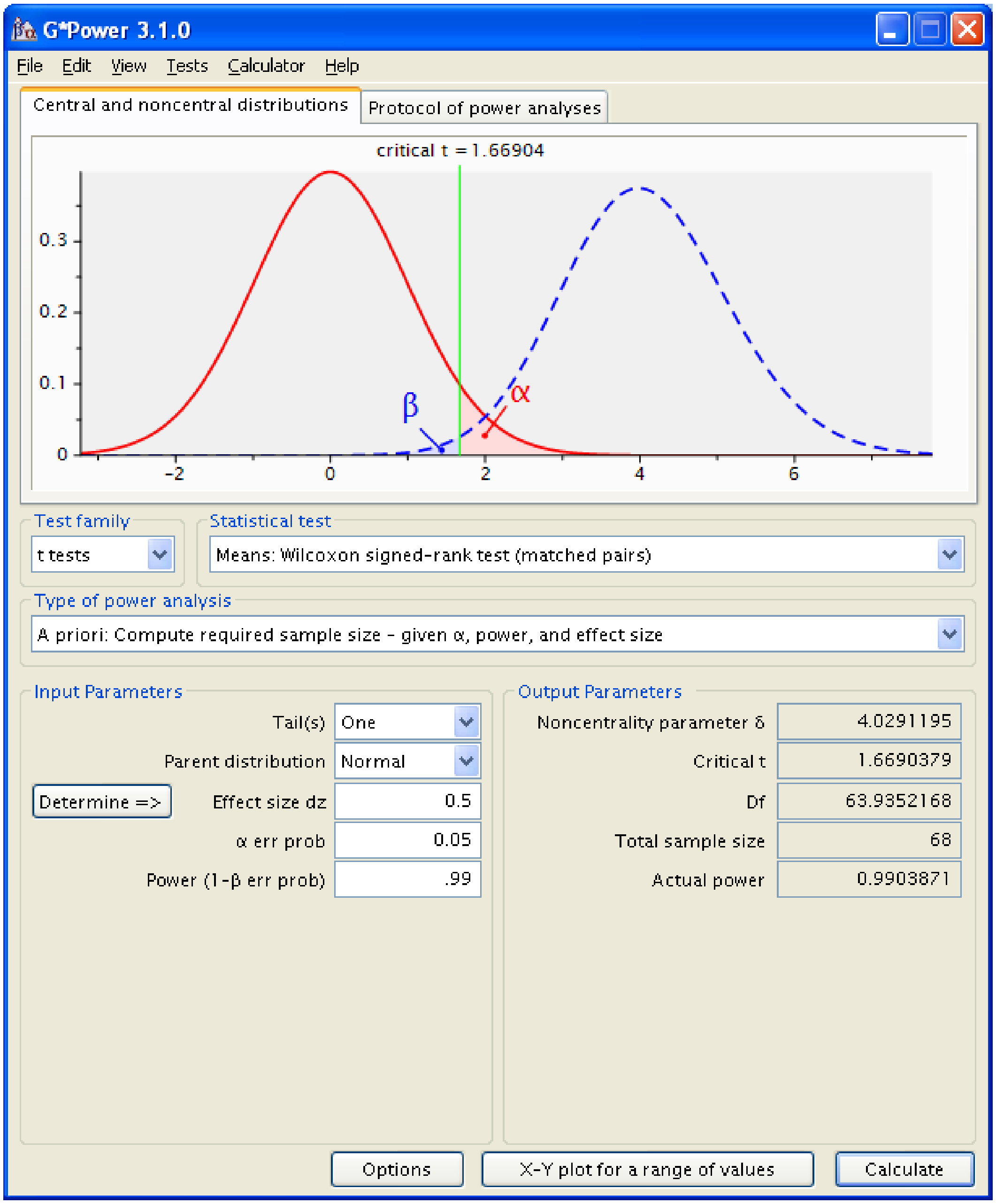

Figure 20 provides the statistical parameters as calculated by G*Power (Faul et al., 2007). The full data set is provided in Appendix C.

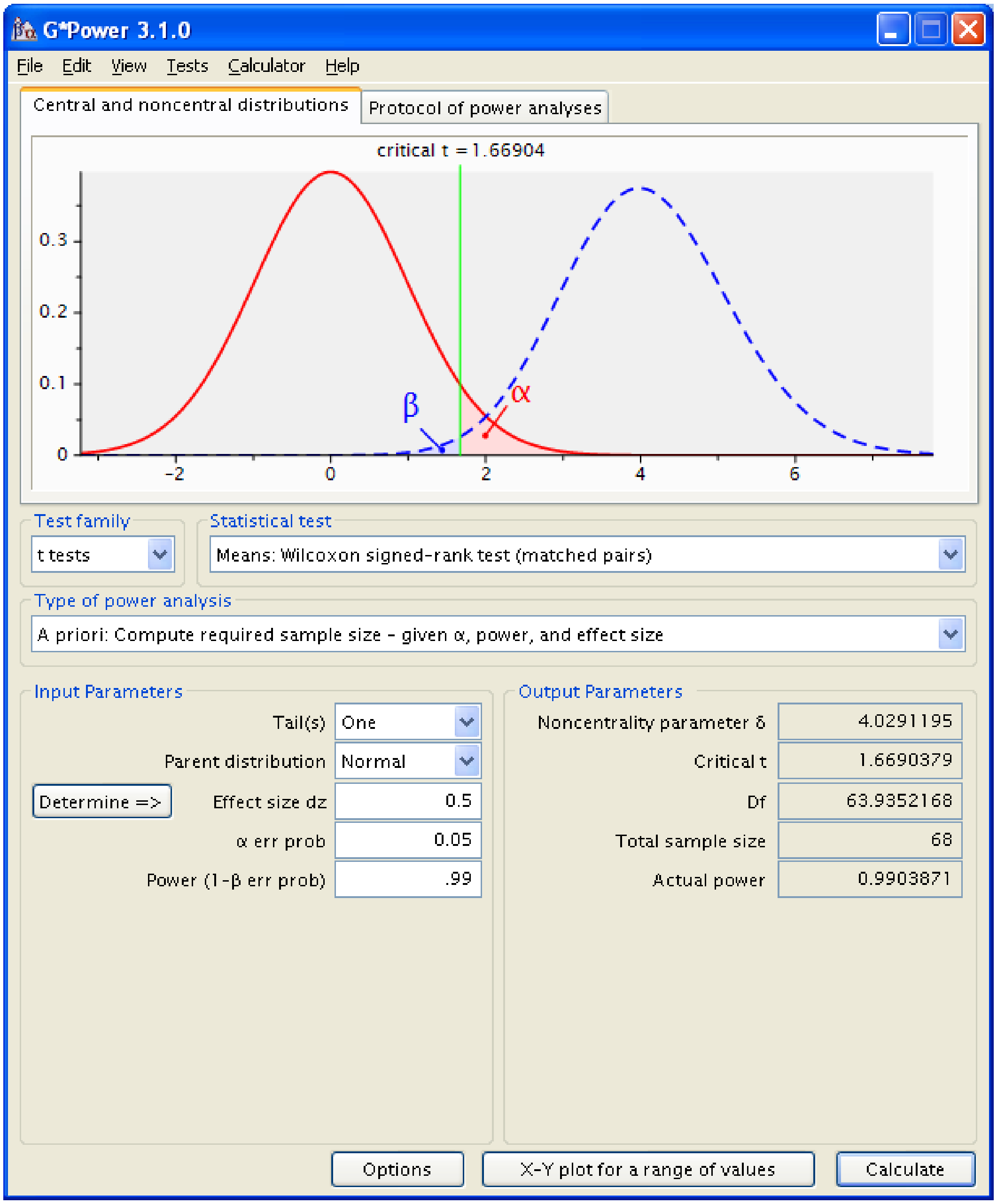

Figure 20. G*Power Calculation for Alpha and Beta Values for Wilcoxon Signed-Rank Test

Table 13 summarizes the statistical results of the first six sub-hypotheses; those that pertain to the PEOU dimension. In the first column are the three year groups followed by the α, significance (*p*), and β values for each TAM question within the dimension. In summary, for PEOU, no year groups were statistically different from each other. The assumption of no differences cannot be rejected on any of the PEOU dimensions by year group.

Table 13. Results of Sub-hypotheses 1-6 for RQ2

PEOU					
TAM Questions	**LEARN TO OPERATE SQ T8**		**TAM Questions**	**DO WHAT I WANT SQ T9**	
Groups	**α = .05 *p* values**	**β values**	**Groups**	**α = .05 *p* values**	**β values**
Year group 1 (1996-1999)			**Year group 1 (1996-1999)**		
Year group 2 (2000-2004)	*p* =.139	0.06	**Year group 2 (2000-2004)**	*p* =.987	0.06
Year group 3 (2005-2009)			**Year group 3 (2005-2009)**		
TAM Questions	**INTERACTION SQ T10**		**TAM Questions**	**BECOME SKILLFUL SQ T11**	
Groups	**α = .05 *p* values**	**β values**	**Groups**	**α = .05 *p* values**	**β values**
Year group 1 (1996-1999)			**Year group 1 (1996-1999)**		
Year group 2 (2000-2004)	*p* =.896	0.06	**Year group 2 (2000-2004)**	*p* =.152	0.06
Year group 3 (2005-2009)			**Year group 3 (2005-2009)**		
TAM Questions	**FLEXIBLE SQ T12**		**TAM Questions**	**EASY TO USE SQ T13**	
Groups	**α = .05 *p* values**	**β values**	**Groups**	**α = .05 *p* values**	**β values**
Year group 1 (1996-1999)			**Year group 1 (1996-1999)**		
Year group 2 (2000-2004)	*p* =.873	0.06	**Year group 2 (2000-2004)**	*p* =.112	0.06
Year group 3 (2005-2009)			**Year group 3 (2005-2009)**		

Table 14 summarizes the statistical results of the mid five sub-hypotheses; those that pertain to the PU dimension. In the first column are the three year groups followed by the α, significance (*p)*, and β values for each TAM question within the dimension. In summary, for PU, no year groups were statistically different from each other. The assumption of no differences cannot be rejected on any of the PU dimensions by year group.

Table 14. Results of Sub-hypotheses for 7-11 for RQ2

PU				
TAM Questions	**ACCOMPLISH MORE SQ T14**		**IMPROVE PERFORMANCE SQ T15**	
Groups	**α = .05 *p* values**	**β values**	**α = .05 *p* values**	**β values**
Year group 1 (1996-1999)				
Year group 2 (2000-2004)	p =.180	0.06	p =.531	0.06
Year group 3 (2005-2009)				
TAM Questions	**INCREASE PRODUCTIVITY SQ T16**		**JOB EASIER SQ T17**	
Groups	**α = .05 *p* values**	**β values**	**α = .05 *p* values**	**β values**
Year group 1 (1996-1999)				
Year group 2 (2000-2004)	p =.305	0.06	p =.205	0.06
Year group 3 (2005-2009)				
TAM Questions	**USEFUL IN JOB SQ T18**			
Groups	**α = .05 *p* values**	**β values**		
Year group 1 (1996-1999)				
Year group 2 (2000-2004)	p =.976	0.06		
Year group 3 (2005-2009)				

Table 15 summarizes the statistical results of the final four sub-hypotheses; that there is a difference between PEOU and PU dimensions within each year group and across all year groups combined. In the first column of the table are the two dimensions

(PEOU and PU) followed by the α, significance (*p)*, and β values for each year group and combined year groups. In summary, the means for PEOU were consistently larger than the means for PU – for each year group and across all year groups. The assumption of no differences can be rejected for each year group and the alternative hypothesis that there is a difference between PEOU and PU within year groups as well as overall year groups can be accepted.

Table 15. Results of Sub-hypotheses 12-15 for RQ2

TAM Dimensions by Year Groups	PEOU (individual scores averaged)	PU (individual scores averaged)
Year group 1 (1996-1999)	α = .05 p <.001	
	β values 0.01	
Year group 2 (2000-2004)	α=.05 p <.001	
	β values 0.01	
Year group 3 (2005-2009)	α=.05 p <.001	
	β values 0.01	
All year groups (1996-2009)	α=.05 p <.001	
	β values 0.01	

Analysis of Sub-category Perceived Ease of Use (PEOU) and Year Group Differences

When analyzing Perceived Ease of Use, each question was isolated and compared to all three year groups toward each relevant sub-hypothesis. Analysis of each sub-hypothesis is presented individually followed by a summarization of the entire sub-category.

PEOU – LEARN TO OPERATE Year Group Differences

Participant responses for LEARN TO OPERATE SQ T8 compared to all groups is illustrated in Figure 21. For Technology Acceptance Model question 8 (LEARN TO OPERATE SQ T8), there is no difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). The Kruskal-Wallis test, which corrected for tied ranks, indicated no significant difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009), $\chi^2(2, N=238) = 3.952$, $p = .139$.

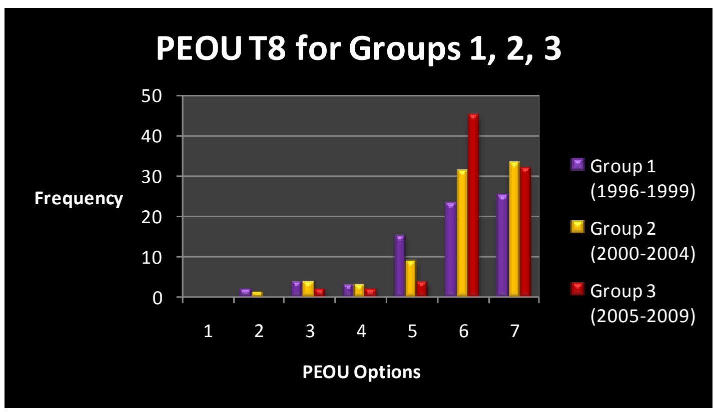

Figure 21. PEOU T8 Compared to All Year Groups

PEOU – DO WHAT I WANT Year Group Differences

Participant responses for DO WHAT I WANT SQ T9 compared to all groups is illustrated in Figure 22. For Technology Acceptance Model question 9 (DO WHAT I WANT SQ T9), there is no difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). The Kruskal-Wallis test, which corrected for tied ranks, indicated no significant difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009), $\chi^2(2, N=238) = 3.025$, $p = .987$.

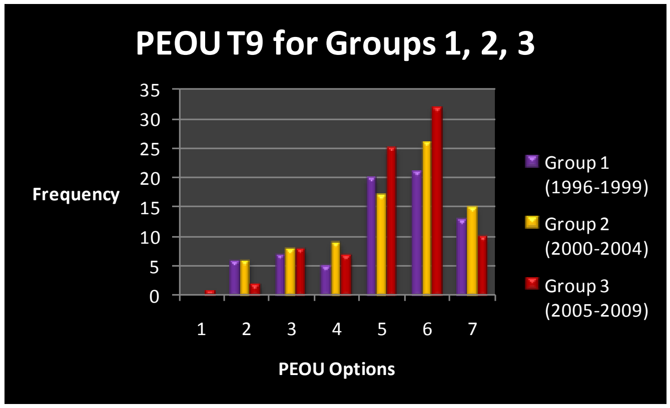

Figure 22. PEOU T9 Compared to All Year Groups

PEOU – INTERACTION Year Group Differences

Participant responses for INTERACTION SQ T10 compared to all groups is illustrated in Figure 23. For Technology Acceptance Model question 10 (INTERACTION SQ T10), there is no difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). The Kruskal-Wallis test, which corrected for tied ranks, indicated no significant difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009), $\chi^2(2, N=238) = .219$, $p = .896$.

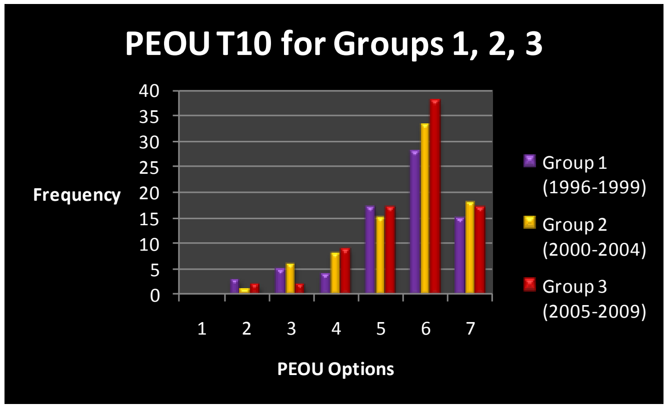

Figure 23. PEOU T10 Compared to All Year Groups

PEOU – BECOME SKILLFUL Year Group Differences

Participant responses for BECOME SKILLFUL SQ T11 compared to all groups is illustrated in Figure 24. For Technology Acceptance Model question 11 (BECOME SKILLFUL SQ T11), there is no difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). The Kruskal-Wallis test, which corrected for tied ranks, indicated no significant difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009), $\chi^2(2, N=238) = 3.770$, $p = .152$.

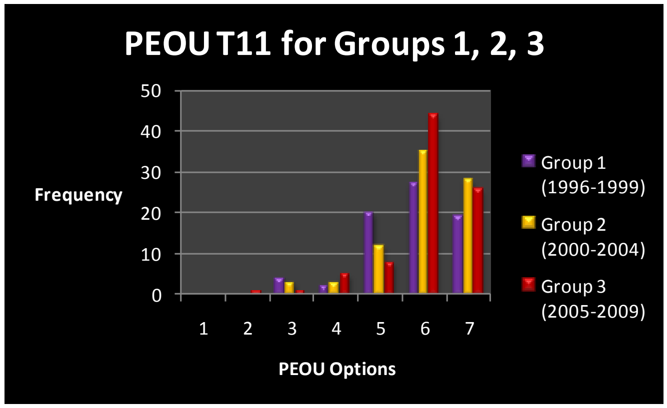

Figure 24. PEOU T11 Compared to All Year Groups

PEOU – FLEXIBLE Year Group Differences

Participant responses for FLEXIBLE SQ T12 compared to all groups is illustrated in Figure 25. For Technology Acceptance Model question 12 (FLEXIBLE SQ T12), there is no difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). The Kruskal-Wallis test, which corrected for tied ranks, indicated no significant difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009), $\chi^2(2, N=238) = .271$, $p = .873$.

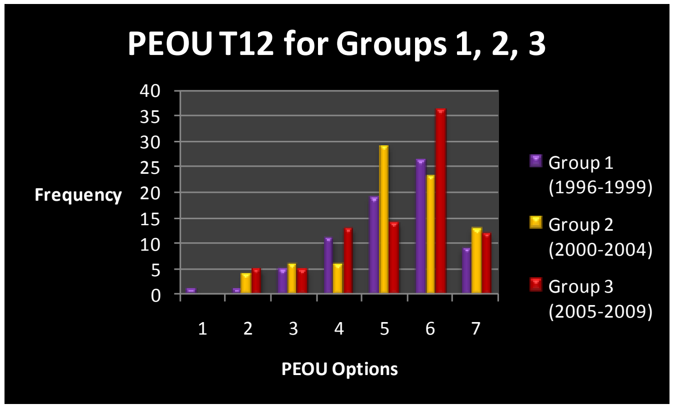

Figure 25. PEOU T12 Compared to All Year Groups

PEOU – EASY TO USE Year Group Differences

Participant responses for EASY TO USE SQ T13 compared to all groups is illustrated in

Figure 26. For Technology Acceptance Model question 13 (EASY TO USE SQ T13), there is no difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). The Kruskal-Wallis test, which corrected for tied ranks, indicated no significant difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009), $\chi^2(2, N=238) = 4.377$, $p = .112$.

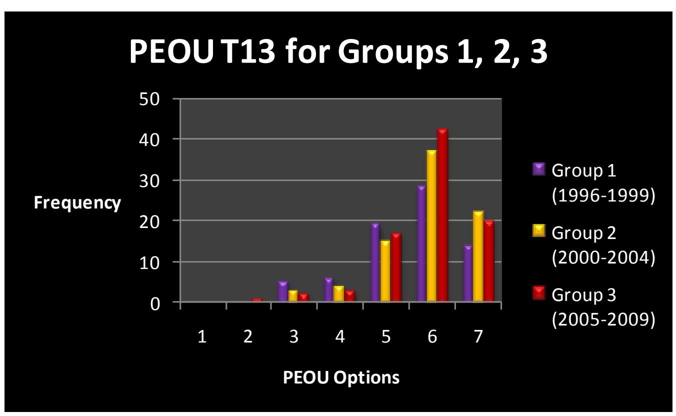

Figure 26. PEOU T13 Compared to All Year Groups

For sub-category PEOU, there was no significant difference among any year group for each individual question within the PEOU dimension. Over the 14 year span, all groups felt similar about this dimension.

Analysis of Sub-category Perceived Usefulness (PU) and Year Group Differences

When analyzing Perceived Usefulness, each group of years were isolated and tested for ambivalence toward each relevant sub-hypothesis. Analysis of each sub-hypothesis is presented individually followed by a summarization of the entire sub-category.

PU – ACCOMPLISH MORE Year Group Differences

Participant responses for ACCOMPLISH MORE SQ T14 compared to all groups is illustrated in Figure 27. For Technology Acceptance Model question 14 (ACCOMPLISH MORE SQ T14), there is no difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). The Kruskal-Wallis test, which corrected for tied ranks, indicated no significant difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009), $\chi^2(2, N=235) = 3.429$, $p = .180$.

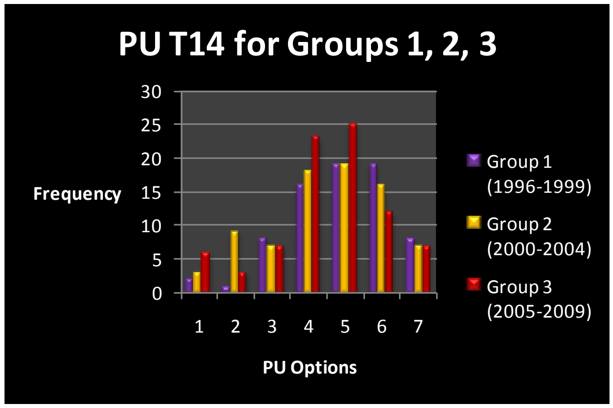

Figure 27. PU T14 Compared to All Year Groups

PU – IMPROVE PERFORMANCE Year Group Differences

Participant responses for IMPROVE PERFORMANCE SQ T15 compared to all groups is illustrated in

Figure 28. For Technology Acceptance Model question 15 (IMPROVE PERFORMANCE SQ T15), there is no difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). The Kruskal-Wallis test, which corrected for tied ranks, indicated no significant difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009), $\chi^2(2, N=235) = 1.268$, p =.531.

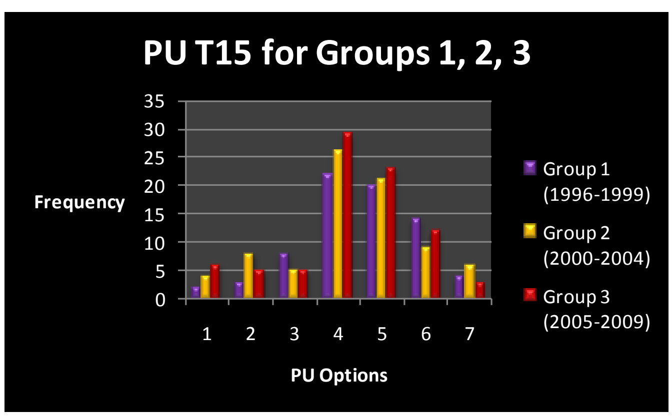

Figure 28. PU T15 Compared to All Year Groups

PU – INCREASE PRODUCTIVITY Year Group Differences

Participant responses for INCREASE PRODUCTIVITY SQ T16 compared to all groups is illustrated in Figure 29. For Technology Acceptance Model question 16 (INCREASE PRODUCTIVITY SQ T16), there is no difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). The Kruskal-Wallis test, which corrected for tied ranks, indicated no significant difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009), $\chi^2(2, N=235) = 2.373$, p =.305.

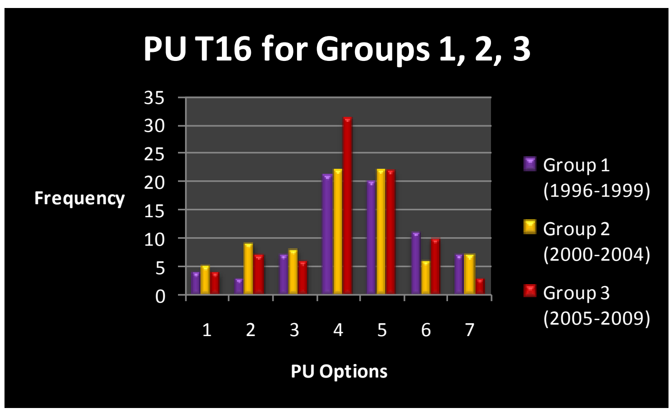

Figure 29. PU T16 Compared to All Year Groups

PU – JOB EASIER Year Group Differences

Participant responses for JOB EASIER SQ T17 compared to all groups is illustrated in Figure 30. For Technology Acceptance Model question 17 (JOB EASIER SQ T17), there is no difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). The Kruskal-Wallis test, which corrected for tied ranks, indicated no significant difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009), $\chi^2(2, N=235) = 3.145$, p =.208.

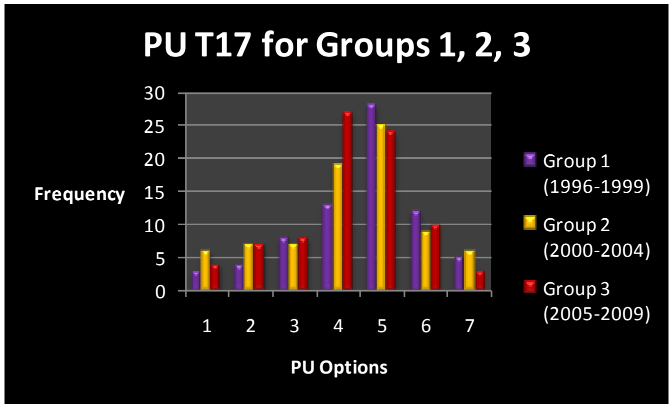

Figure 30. PU T17 Compared to All Year Groups

PU – USEFUL IN JOB Year Group Differences

Participant responses for USEFUL IN JOB SQ T18 compared to all groups is illustrated in

Figure 31. For Technology Acceptance Model question 18 (USEFUL IN JOB SQ T18), there is no difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). The Kruskal-Wallis test, which corrected for tied ranks, indicated no significant difference between year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009), $\chi^2(2, N=235) = .049$, p =.976.

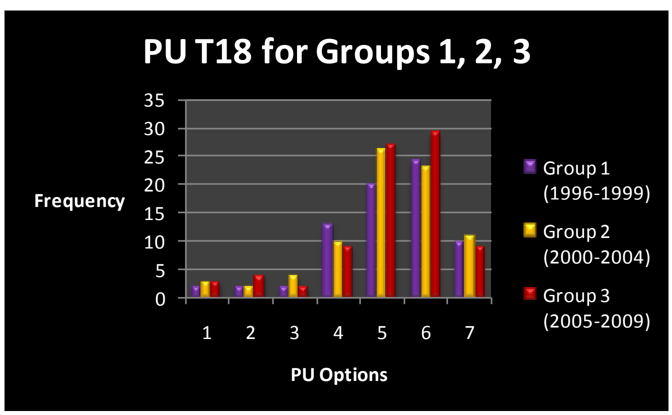

Figure 31. PU T18 Compared to All Year Groups

For sub-category PU, there was no significant difference among any year group for each individual question within the PEOU dimension. It appears that over the 14 year span, all groups felt similar about this dimension.

PEOU to PU Year Group 1 Year Group Differences

Participant responses for PEOU compared to PU for year group 1 (1996-1999) is illustrated in Figure 32. The Wilcoxon signed-rank test indicates a significant difference between the overall PEOU and PU dimensions, $z = -4.543$, $p < .001$. The mean of the ranks in favor of PEOU for year group 1 (1996-1999) was 5.48 (closest to "Slightly Likely"), while the mode was 6 ("Quite Likely"). The mean in favor of PU for year group 1 (1996-1999) was 4.75 (closest to "Slightly Likely"), while the mode was 5 ("Slightly Likely").

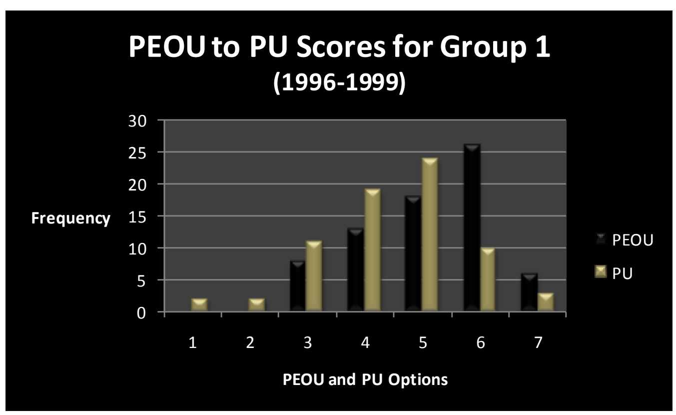

Figure 32. PEOU Compared to PU for Year Group 1 (1996-1999)

PEOU to PU Year Group 2 Year Group Differences

Participant responses for PEOU compared to PU for year group 2 (2000-2004) is illustrated in Figure 33. The Wilcoxon signed-rank test indicates a significant difference between the overall PEOU and PU dimensions, $z = -6.2403$, $p < .001$. The mean of the ranks in favor of PEOU for year group 2 (2000-2004) was 5.63 (closest to “Quite Likely”), while the mode was bimodal at 5.83 (closest to “Quite Likely”) and 6 (“Quite Likely”). The mean in favor of PU for year group 2 (2000-2004) was 4.47 (closest to “Slightly Likely”), while the mode was 4.20 (closest to “Neither Likely nor Unlikely”).

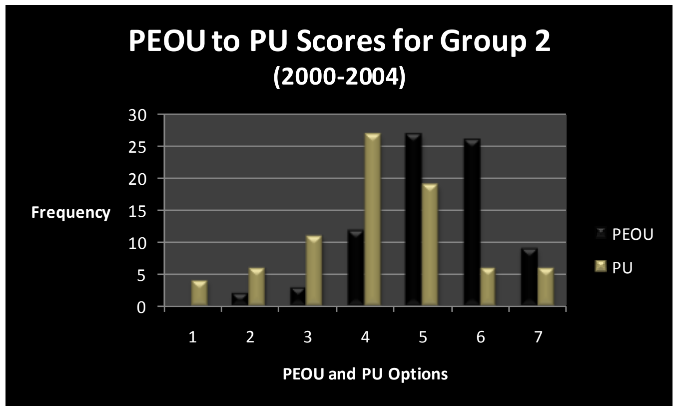

Figure 33. PEOU Compared to PU for Year Group 2 (2000-2004)

PEOU to PU Year Group 3 Year Group Differences

Participant responses for PEOU compared to PU for year group 3 (2005-2009) is illustrated in Figure 34. The Wilcoxon signed-rank test indicates a significant difference between the overall PEOU and PU dimensions, z = -7.497, p <.001. The mean of the ranks in favor of PEOU for year group 3 (2005-2009) was 5.69 (closest to “Quite Likely”), while the mode was 5.83 (closest to “Quite Likely”). The mean in favor of PU for year group 3 (2005-2009) was 4.47 (closest to “Neither Likely nor Unlikely”), while the mode was 4.20 (closest to “Neither Likely nor Unlikely”).

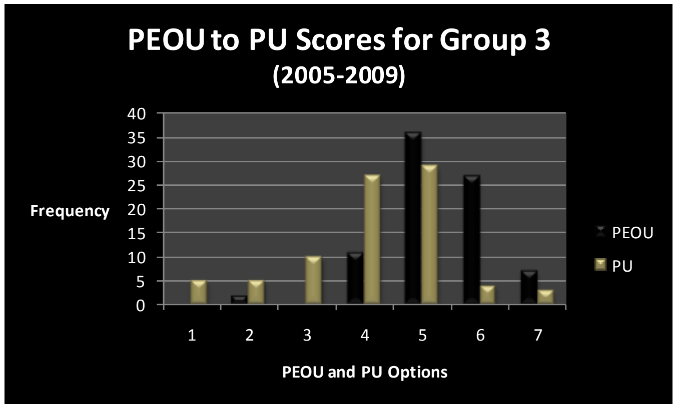

Figure 34. PEOU Compared to PU for Year Group 3 (2005-2009)

PEOU to PU Year Groups 1-3 Year Group Differences

Participant responses for PEOU compared to PU for all three year groups (1996-2009) is illustrated in

Figure 35. For all 14 years, the Wilcoxon signed-rank test indicates a significant difference between the overall PEOU and PU dimensions, z = -10.697, p <.001. The mean in favor of PEOU for all three year groups was 5.61 (closest to "Quite Likely"), while the mode was bimodal at 5.83 (closest to "Quite Likely") and 6 ("Quite Likely"). The mean in favor of PU for all three year groups was 4.55 (closest to "Slightly Likely"), while the mode was 5 ("Slightly Likely").

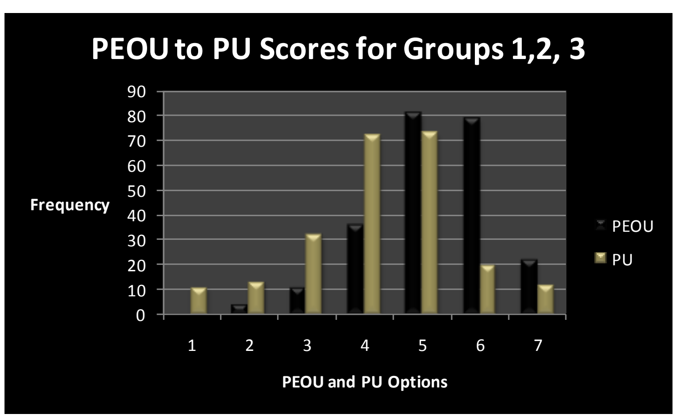

Figure 35. PEOU Compared to PU for All Year Groups

Research Question 2 Summary

While research question 1 examined differences of responses from ambivalence for each TAM dimension among year group, research question 2 examined differences of responses between PEOU and PU among year groups.

The Kruskal-Wallis analyses showed that, across all year groups, each sub-dimension within PEOU and PU were not statistically significantly different between year groups. That is to say, between year groups, individual sub-dimensions within PEOU were not statistically different from each other. Likewise, between year groups, individual sub-dimensions within PU were not statistically different from each other.

On the other hand, Wilcoxon signed-rank analysis of individual averaged scores per year group indicates that the PEOU and PU dimension for each year group were significantly different from each other. Likewise across all year groups the means for PEOU were consistently larger than the means for PU. Overall year groups, PEOU averages consistently ranged from “Slightly Likely” (5) to “Quite Likely” (6) while PU averages consistently ranged from “Neither Likely Nor Unlikely” (4) to “Slightly Likely” (5).

Within all year groups, the group response indicated at statistically significant levels that educational computer games would be easier to use (PEOU) than actually be useful (PU) in their classroom.

Thus, we cannot reject the null hypothesis that there is no difference across year groups between the level of acceptance of individual sub-dimensions within PEOU and within PU for use educational computer-based games for classroom instruction. On the other hand, for PEOU and PU dimensions themselves, each year groups and across all year groups responses were statistically different from each other. The assumption of no differences can be rejected for each year group and the alternative hypothesis that there is a difference between the PEOU and PU dimension within year groups as well as overall year groups can be accepted.

Research Question 3 (Level of acceptance of educational computer-based games versus actual use):

In any given year or group of years depending on inferential statistic requirements, is there a difference in level of acceptance dimensions between instructor populations that use or do not use educational computer-based games in their instruction?

H_0 = There is no difference between levels of acceptance between instructor populations that use or do not use educational computer-based games in their instruction.

H_a = There is a difference between levels of acceptance between instructor populations that use or do not use educational computer-based games in their instruction.

To investigate this hypothesis, each participant was asked to express the strength of his/her response to thirteen questions drawn from Davis's Technology Acceptance Model. These sub-hypotheses can be conceptually grouped into two sub categories: (1) Perceived Ease of Use versus Actual Use, and (2) Perceived Usefulness versus Actual Use. Strength of acceptance of the question was measured on a scale from 1 to 7 as shown in Table 16 below.

Table 16. TAM Response Scale

1	2	3	4	5	6	7
Extremely Unlikely	Quite Unlikely	Slightly Unlikely	Neither Likely nor Unlikely	Slightly Likely	Quite Likely	Extremely Likely

For the actual use values, each participant was also asked to respond yes or no to whether or not educational computer games were used as an instructional strategy in the year they won the Milken Educator Award.

Responses formed the basis for statistical tests of each sub-hypothesis about the sample population to that question. Questions 8-18 are found in Appendix B. The sub-hypotheses are placed in the sub-categories of Perceived Ease of Use versus Actual Use and Perceived Usefulness versus Actual Use.

Sub-category Perceived Ease of Use versus Actual Use

Sub-hypothesis 1: There is no difference within the PEOU dimension of level of acceptance between instructor populations that use or do not use educational computer-based games in their instruction for year group 1 (1996-1999).

Sub-hypothesis 2: There is no difference within the PEOU dimension of level of acceptance between instructor populations that use or do not use educational computer-based games in their instruction for year group 2 (2000-2004).

Sub-hypothesis 3: There is no difference within the PEOU dimension of level of acceptance between instructor populations that use or do not use educational computer-based games in their instruction for year group 3 (2005-2009).

Sub-hypothesis 4: There is no difference within the PEOU dimension of level of acceptance between instructor populations that use or do not use educational computer-based games in their instruction across all year groups (year group 1 (1996-1999), year group 2 (2000-2004), year group 3 (2005-2009)).

Sub-category Perceived Usefulness versus Actual Use

Sub-hypothesis 5: There is no difference within the PU dimension of level of acceptance between instructor populations that use or do not use educational computer-based games in their instruction for year group 1 (1996-1999).

Sub-hypothesis 6: There is no difference within the PU dimension of level of acceptance between instructor populations that use or do not use educational computer-based games in their instruction for year group 2 (2000-2004).

Sub-hypothesis 7: There is no difference within the PU dimension of level of acceptance between instructor populations that use or do not use educational computer-based games in their instruction for year group 3 (2005-2009).

Sub-hypothesis 8: There is no difference within the PU dimension of level of acceptance between instructor populations that use or do not use educational computer-based games in their instruction all year groups (year group 1 (1996-1999), year group 2 (2000-2004), year group 3 (2005-2009)).

Participants who responded to all PEOU, PU, and actual use (AU) questions were included in the analysis. Bath, Geeganage, Gray, Collier, and Pocock (2008) found the Mann Whitney U test to be the most efficient test for analyzing variables of independent means compared to other statistical analyses. Beth et al. (2008) found the Mann Whitney U provides more sensitivity when analyzing ordinal and nominal data than other analysis, for example, the Chi-squared test. For this research, the level of acceptance scales (PEOU and PU) are ordinal and independent from actual use (AU), which is binary (yes/no). As in previous analyses, desired alpha and β values for research question 3 were .05 and .2, respectively. In Cohen's (1977) book, effect sizes are provided for most statistical tests and vary depending on the test. While effect sizes for the non-parametric Mann Whitney U test were not provided, values for comparing two independent means were. A medium effect size means an effect large enough to be seen by the naked eye. For statistical analysis conducted in this research, effect size of medium was chosen. For the Mann Whitney U test, a medium effect size is .5. Inputs into G*Power of effect size of .5, alpha values for Mann Whitney U test of .05, and beta values of .1 resulted in actual alpha of .05 and beta of .1 with sample size of 70 in each group.

Figure 36 provides the statistical parameters as calculated by G*Power (Faul et al., 2007). The full data set is provided in Appendix C.

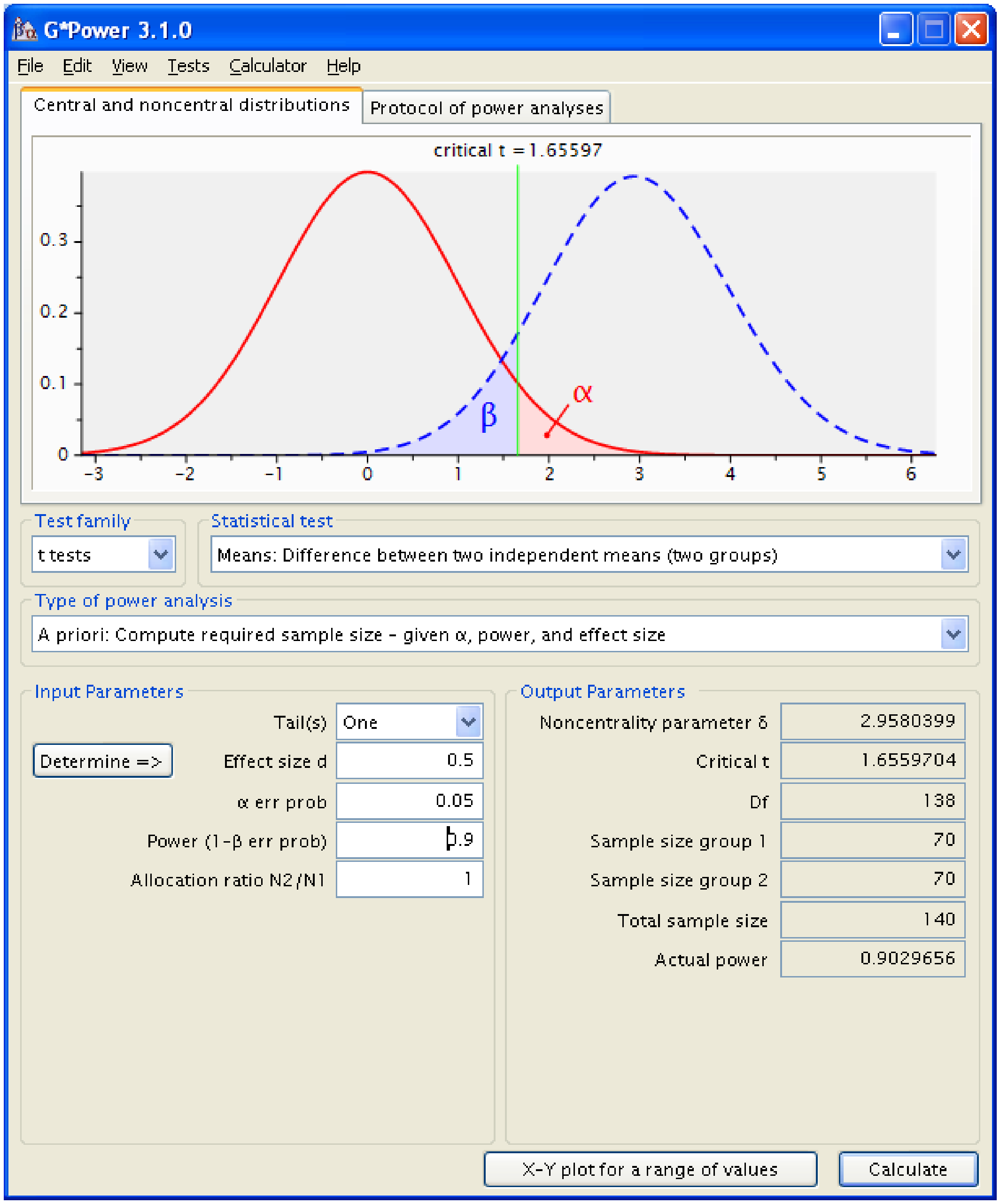

Figure 36. G*Power Calculation for Alpha and Beta Values for Mann Whitney U Test

Table 17 summarizes the statistical results of sub-hypotheses one through four for the PEOU dimension, where the two populations that are being compared for Perceived Ease of Use are differentiated from one another based on whether individuals either actually reported use of computer-based for instruction or did not. In the first column are the year groups. The second column presents the α and significance (p), followed by β values for each sub-hypothesis. The analysis shows a significant difference when comparing PEOU scores of AU populations to non-AU populations within year groups as well as over all year groups. Because results are significantly different from each other and noting the direction of the difference, computer-based game actual use instructor populations exhibit statistically higher PEOU scores than non actual use instructor populations.

Table 17. Results of Sub-hypotheses 1-4 Perceived Ease of Use versus Actual Use

<table>
<tr><th>TAM Dimensions by Year Groups</th><th>PEOU (individual scores averaged)</th><th>AU (Actual Use)</th></tr>
<tr><td rowspan="2">Year group 1 (1996-1999)</td><td colspan="2">α = .05
p <.02</td></tr>
<tr><td colspan="2">β values
0.01</td></tr>
<tr><td rowspan="2">Year group 2 (2000-2004)</td><td colspan="2">α=.05
p= .001</td></tr>
<tr><td colspan="2">β values
0.01</td></tr>
<tr><td rowspan="2">Year group 3 (2005-2009)</td><td colspan="2">α=.05
p= .001</td></tr>
<tr><td colspan="2">β values
0.01</td></tr>
<tr><td rowspan="2">All year groups (1996-2009)</td><td colspan="2">α=.05
p <.001</td></tr>
<tr><td colspan="2">β values
0.01</td></tr>
</table>

Table 18 summarizes the statistical results of the sub-hypotheses five through eight for the PU dimension versus actual use (AU). In the first column are the year groups. The second column presents the α and significance (p), followed by β values for each sub-hypothesis. The analysis shows a significant difference when comparing PU scores between AU and non-AU instructor populations within year groups as well as over all year groups. Again, because results are significantly different from each other, and noting the direction of the difference, computer-based games actual use populations exhibit statistically higher PU scores than non actual use instructor populations.

Table 18. Results of Sub-hypotheses 5-8 Perceived Usefulness versus Actual Use

TAM Dimensions by Year Groups	**PU (individual scores averaged)**	**AU (Actual Use)**
Year group 1 (1996-1999)	α = .05 p =.007	
	β values 0.01	
Year group 2 (2000-2004)	α=.05 p<.001	
	β values 0.01	
Year group 3 (2005-2009)	α=.05 p<.001	
	β values 0.01	
All year groups (1996-2009)	α=.05 p <.001	
	β values 0.01	

Analysis of Sub-category Perceived Ease of Use (PEOU) versus Actual Use

Participant responses for PEOU scores for those who did use games compared to those who did not for year group 1 (1996-1999) is illustrated in Figure 37. For PEOU for year group 1 (1996-1999), the Mann Whitney U results were significant, z = -2.326, p =

.02. The average rank of PEOU scores for those who did use games was 5.94 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely"). The average rank of PEOU scores for those who did not use games was 5.26 (closest to "Slightly Likely"), while the mode was also 6 ("Quite Likely").

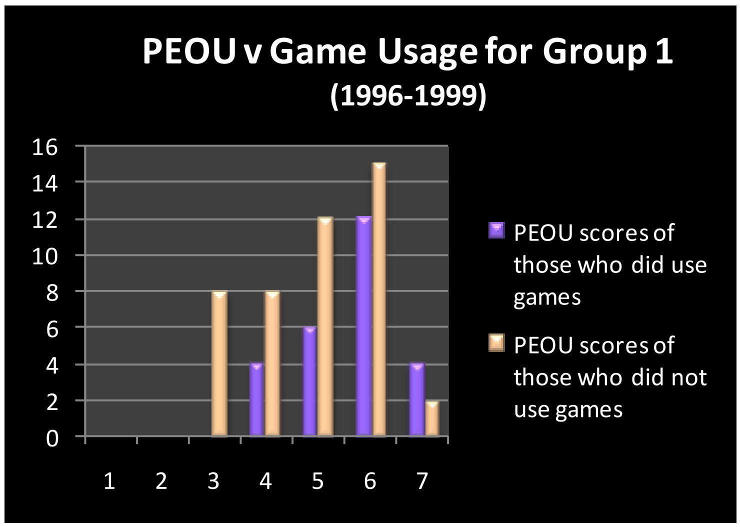

Figure 37. Year Group 1 (1996-1999) PEOU Scores and Actual Use

Participant responses for PEOU scores for those who did use games compared to those who did not for year group 2 (2000-2004) is illustrated in Figure 38. For PEOU for year group 2 (2000-2004), the Mann Whitney U results were significant, $z = -3.293$, $p = .001$. The average rank of PEOU scores for those who did use games was 6.06 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely"). The average rank of PEOU scores for those who did not use games was 5.30 (closest to "Slightly Likely"), while the mode was multimodal at 5 ("Slightly Likely").

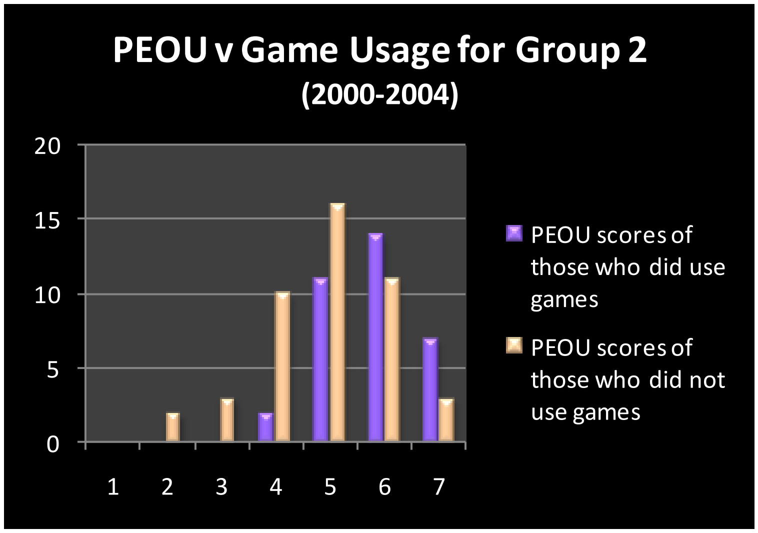

Figure 38. Year Group 2 (2000-2004) PEOU Scores and Actual Use

Participant responses for PEOU scores for those who did use games compared to those who did not for year group 3 (2005-2009) is illustrated in Figure 39. For PEOU for year group 3 (2005-2009), the Mann Whitney U results were significant, z = -3.420, p = .001. The average rank of PEOU scores for those who did use games was 6.04 (closest to “Quite Likely”), while the mode was 6 (“Quite Likely”). The average rank of PEOU scores for those who did not use games was 5.41 (closest to “Slightly Likely”), while the mode was 5 (“Slightly Likely”).

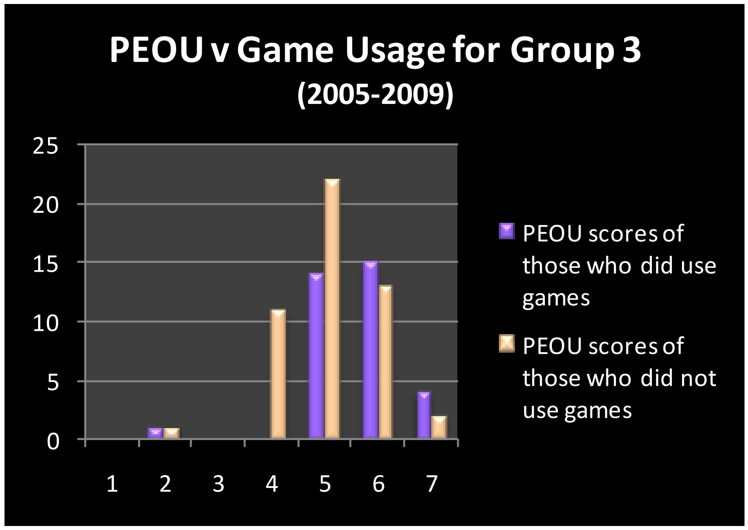

Figure 39. Year Group 3 (2005-2009) PEOU Scores and Actual Use

Participant responses for PEOU scores for those who did use games compared to those who did not for all year groups (year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009)) is illustrated in Figure 40. For PEOU for all year groups (year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009)), the Mann Whitney U results were significant, z = -5.177, p <.001. The average rank of PEOU scores for those who did use games was 6.02 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely"). The average rank of PEOU scores for those who did not use games was 5.33 (closest to "Slightly Likely"), while the mode was 5 ("Slightly Likely").

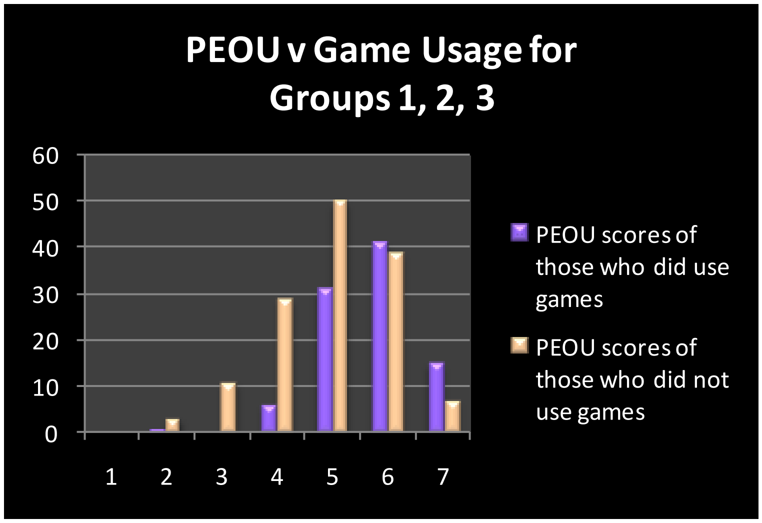

Figure 40. All Year Groups (Year Group 1 (1996-1999), Year Group 2 (2000-2004), and Year Group 3 (2005-2009)) PEOU Scores and Actual Use

For the sub-category PEOU, the lower averages tended to be in the group of those that did not incorporate games into their classrooms, with averages in the 'did use games' category ranged from 5.94 – 6.06 (closest to "Quite Likely"), while averages in the 'did not use games' category ranging from 5.26 – 5.41 (closest to "Slightly Likely").

Analysis of Sub-category Perceived Usefulness (PU) versus Actual Use

Participant responses for PU scores for those who did use games compared to those who did not are illustrated in Figure 41. For PU for year group 1 (1996-1999), the Mann Whitney U results were significant, z = -2.698, p = .007. The average rank of PU scores for those who did use games was 5.30 ("Slightly Likely"), while the mode was 5 ("Slightly Likely"). The average rank of PU scores for those who did not use games was 4.47 (closest to "Neither Likely nor Unlikely"), while the mode was 4 ("Neither Likely nor Unlikely").

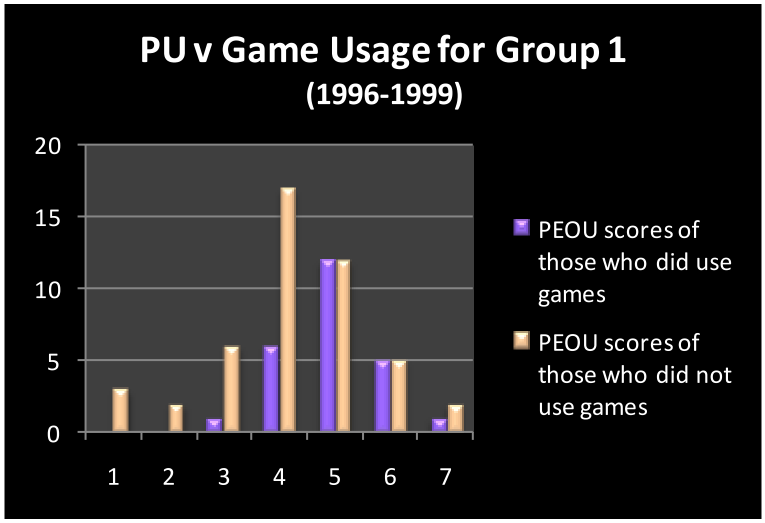

Figure 41. Year Group 1 (1996-1999) Scores and Actual Use

Participant responses for PU scores for those who did use games compared to those who did not for year group 2 (2000-2004) is illustrated in Figure 42. For PU for year group 2 (2000-2004), the Mann Whitney U results were significant, $z = -3.818$, $p < .001$. The average rank of PU scores for those who did use games was 5.12 (closest to "Slightly Likely"), while the mode was 5 ("Slightly Likely"). The average rank of PU scores for those who did not use games was 3.95 (closest to "Neither Likely nor Unlikely"), while the mode was 4 ("Neither Likely nor Unlikely").

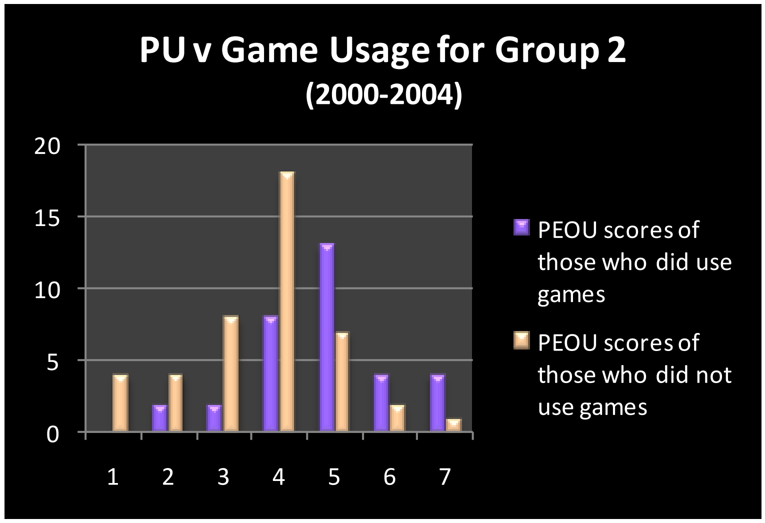

Figure 42. Year Group 2 (2000-2004) PU Scores and Actual Use

Participant responses for PU scores for those who did use games compared to those who did not for year group 3 (2005-2009) is illustrated in Figure 43. For PU for year group 3 (2005-2009), the Mann Whitney U results were significant, $z = -3.98$, $p < .001$. The average rank of PU scores for those who did use games was 5.10 (closest to "Slightly Likely"), while the mode was 5 ("Slightly Likely"). The average rank for PU scores for those who did not use games was 4.01 (closest to "Neither Likely nor Unlikely"), while the mode was 4 ("Neither Likely nor Unlikely").

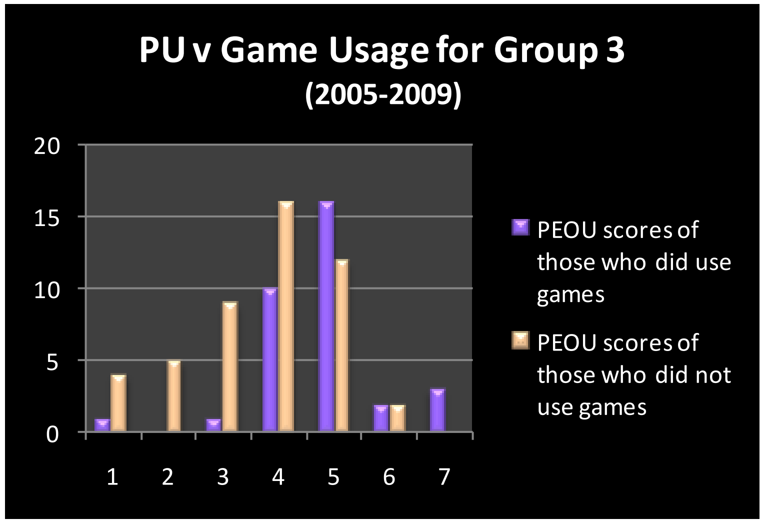

Figure 43. Year Group 3 (2005-2009) PU Scores and Actual Use

Participant responses for PU scores for those who did use games compared to those who did not all year groups (year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009)) is illustrated in Figure 44. For PU for all year groups (year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009)), the Mann Whitney U results were significant, $z = -6.016$, $p < .001$. The average rank of PU scores for those who did use games was 5.16 (closest to "Slightly Likely"), while the mode was 5 ("Slightly Likely"). The average rank of PU scores for those who did not use games was 4.15 (closest to "Neither Likely nor Unlikely"), while the mode was 4 ("Neither Likely nor Unlikely").

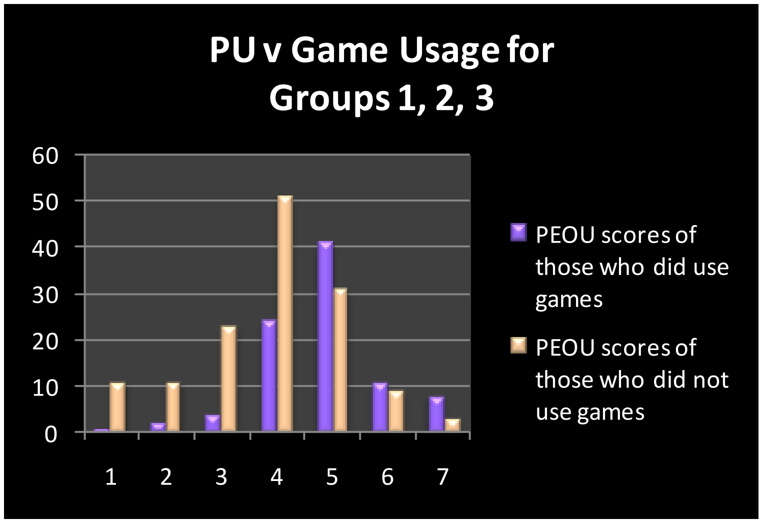

Figure 44. All Year Groups (Year Group 1 (1996-1999), Year Group 2 (2000-2004), and Year Group 3 (2005-2009)) PU Scores and Actual Use

For the sub-category PU also, lower averages tended to be in the group of those that did not incorporate games into their classrooms, with averages in the 'did use games' category ranged from 5.10 – 5.30 (closest to "Slightly Likely"), while averages in the 'did not use games' category ranging from 3.95 – 4.47 (closest to "Neither Likely nor Unlikely").

Research Question 3 Summary

All analyses resulted in significance values within the .05 limit, ranging from <.001 - .02, thus, suggesting that we can reject the null hypothesis that there is no difference in dimensions of level of acceptance by instructor populations that differ based on use or non-use of educational computer-based games in the classroom. Rather, we accept the alternative hypotheses that those who perceived games as easier to use (PEOU) or more useful (PU) are more likely to actually use games in the classroom. Overall, PEOU averaged scores were higher than PU averaged scores among those instructors who actually used games as well as among those instructors who actually did not use games.

Research question 4 (Trend in level of acceptance of educational computer-based games):

How has the trend in each dimension of level of acceptance toward educational computer-based games in classroom instruction changed over time?

H_0 = There is no trend in acceptance of educational computer-based games in classroom instruction over time.

H_a = There is a trend in acceptance of educational computer-based games in classroom instruction over time.

To investigate this hypothesis, each participant was asked to express the strength of his/her response to thirteen questions drawn from Davis's Technology Acceptance Model. The sub-hypotheses, arising from the TAM questions, can be conceptually grouped into two sub categories: (1) Trend in Perceived Ease of Use of educational computer-base games, and (2) Trend in Perceived Usefulness of the education computer-based games. Strength of acceptance of the question was measured on a scale from 1 to 7 as shown in Table 19 below.

Table 19. TAM Response Scale

1	2	3	4	5	6	7
Extremely Unlikely	Quite Unlikely	Slightly Unlikely	Neither Likely nor Unlikely	Slightly Likely	Quite Likely	Extremely Likely

Responses formed the basis for statistical tests of each sub-hypothesis about the sample population to that question. Questions 8-18 are found in Appendix B. The sub-hypotheses are placed in the sub-categories of Trend in Perceived Ease of Use and Trend in Perceived Usefulness.

Sub-category Trend in Perceived Ease of Use

Sub-hypothesis 1 (LEARN TO OPERATE): There is no trend in acceptance of educational computer-based games in classroom instruction for Technology Acceptance Model survey question 8 (SQ T8) over time.

Sub-hypothesis 2 (DO WHAT I WANT): There is no trend in acceptance of educational computer-based games in classroom instruction for Technology Acceptance Model survey question 9 (SQ T9) over time.

Sub-hypothesis 3 (INTERACTION): There is no trend in acceptance of educational computer-based games in classroom instruction for Technology Acceptance Model survey question 10 (SQ T10) over time.

Sub-hypothesis 4 (BECOME SKILLFUL): There is no trend in acceptance of educational computer-based games in classroom instruction for Technology Acceptance Model survey question 11 (SQ T11) over time.

Sub-hypothesis 5 (FLEXIBLE): There is no trend in acceptance of educational computer-based games in classroom instruction for Technology Acceptance Model survey question 12 (SQ T12) over time.

Sub-hypothesis 6 (EASY TO USE): There is no trend in acceptance of educational computer-based games in classroom instruction for Technology Acceptance Model survey question 13 (SQ T13) over time.

Sub-hypothesis 7 (Overall PEOU): There is no trend in acceptance of educational computer-based games in classroom instruction for the PEOU dimension over time.

Sub-category Trend in Perceived Usefulness

Sub-hypothesis 8 (ACCOMPLISH MORE): There is no trend in acceptance of educational computer-based games in classroom instruction for Technology Acceptance Model survey question 14 (SQ T14) over time.

Sub-hypothesis 9 (IMPROVE PERFORMANCE): There is no trend in acceptance of educational computer-based games in classroom instruction for Technology Acceptance Model survey question 15 (SQ T15) over time.

Sub-hypothesis 10 (INCREASE PRODUCTIVITY): There is no trend in acceptance of educational computer-based games in classroom instruction for Technology Acceptance Model survey question 16 (SQ T16) over time.

Sub-hypothesis 11 (JOB EASIER): There is no trend in acceptance of educational computer-based games in classroom instruction for Technology Acceptance Model survey question 17 (SQ T17) over time.

Sub-hypothesis 12 (USEFUL IN JOB): There is no trend in acceptance of educational computer-based games in classroom instruction for Technology Acceptance Model survey question 18 (SQ T18) over time.

Sub-hypothesis 13 (Overall PU): There is no trend in acceptance of educational computer-based games in classroom instruction for the PU dimension over time.

Participants who responded to all associated questions were included in the analysis. The Cox-Stuart test was used to analyze data for this research question. The Cox-Stuart analysis is used to detect trends among observations (Conover, 1971). The procedure for determining trend includes listing variables in a particular order, then dividing the list in half, pairing the values, and finally analyzing the pairs for significant differences. The Cox-Stuart test for trend was conducted to determine if a trend existed among individual scores. To confirm results, the Cox-Stuart test for trend was conducted a second time to determine if a trend existed among grouped scores. For this research question, a 'group' is any one year. Following the procedure explained above, all responses (from 1996-2009) were divided in two – one set from 1996-2002 and another from 2003-2009.

The first, individual, analysis was conducted using participants' individual scores. For example, the year 1996 received 15 responses. These 15 responses were utilized in this analysis, along with the individual scores for the other 13 years. The second, group, analysis conducted was by averaging years' scores. Again, using 1996 as an example, these 15 scores were averaged and the one average score became the number used in the analysis, with the other 13 years following this approach.

Values were compared such that an upward trend was exhibited if the value of the later observations (those from 2003-2009) tended to be greater than those of the earlier observations (those from 1996-2002). The data exhibited a downward trend if the earlier observations (those from 1996-2002) tend to be larger than the later observations (those from 2003-2009). Alpha was set to 05. Because the Cox Stuart statistical test is based off of the binomial distribution formula, β and ES minimums were unavailable in both Cohen's (1977) book and the G*Power (Faul et al., 2007) software and, therefore, not calculated. The full data set is provided in Appendix C.

Individual Analysis for Trend

Table 20 summarizes the statistical results of the 13 sub-hypotheses on trend. In the first column are the overall PEOU and PU dimensions. The second column presents the TAM question. The third column presents the α and significance (*p)* values, followed by total trials, total positives, and total negatives used in the Cox Stuart analysis of trend for PEOU.

For the individual trend analysis within the PEOU dimension, only LEARN TO OPERATE and the PEOU dimension itself was significant. For the individual trend analysis within the PU dimension, INCREASE PRODUCTIVITY, JOB EASIER, and the PU dimension itself was significant. This means a trend exists for the elements mentioned, but not for the others. We can reject the hypotheses of NO trend in the sub-dimension of level of acceptance and for overall PEOU and PU dimensions. That indicates that the alternative hypothesis of a trend in perceived ease of use (PEOU) and perceived usefulness (PU) IS present. Key sub-dimensions that contribute to the trend are increasing perception of "learn to operate" in terms of PEOU and "increased productivity" and "job easier" in terms of PU.

Table 20. Results of Sub-hypotheses Individual Trend Analysis

TAM Dimensions	TAM Question	α = .05 *p* values	Total Trials	Total Positives	Total Negatives
PEOU	LEARN TO OPERATE	p = .036	79	48	31
	DO WHAT I WANT	p = .500	101	51	50
	INTERACTION	p = .417	91	47	44
	BECOME SKILLFUL	p = .075	82	48	34
	FLEXIBLE	p = .416	89	43	46
	EASY TO USE	p = .060	81	48	33
	PEOU Dimension	p = .022	523	285	238
PU	ACCOMPLISH MORE	p = .242	100	46	54
	IMPROVE PERFORMANCE	p = .111	97	55	42
	INCREASE PRODUCTIVITY	p = .041	96	57	39
	JOB EASIER	p = .022	90	55	35
	USEFUL IN JOB	p = .201	91	50	41
	PU Dimension	p = .010	474	263	211

Group Analysis for Trend

The result of the group analysis for trend is inconsistent with the individual analysis for the PU dimension. Differences between individual and group analyses are most likely due to the availability of less power in the group analysis. Table 21 summarizes the statistical results of the 13 sub-hypotheses for the group analyses. In the first column are the overall PEOU and PU dimensions. The second column presents the TAM question. The third column presents the α and significance (*p)* values, followed by total trials, total positives, and total negatives used in the Cox Stuart analysis.

For the group trend analysis within the PEOU dimension, only the PEOU dimension itself was statistically different, consistent with the individual analysis. This means a trend existed for this element only, but no others. For the group trend analysis within the PU dimension, no significance was observed either within any sub-category or in the overall PU dimension, inconsistent with the individual analysis.

Table 21. Results of Sub-hypotheses Group Trend Analysis

TAM Dimensions	TAM Question	α = .05 *p* values	Total Trials	Total Positives	Total Negatives
PEOU	LEARN TO OPERATE	*p* = .063	7	6	1
	DO WHAT I WANT	*p* = .500	7	4	3
	INTERACTION	*p* = .227	7	5	2
	BECOME SKILLFUL	*p* = .227	7	5	2
	FLEXIBLE	*p* = .500	7	4	3
	EASY TO USE	*p* = .063	7	6	1
	PEOU Dimension	*p* = .004	42	30	12
PU	ACCOMPLISH MORE	*p* = .500	7	3	4
	IMPROVE PERFORMANCE	*p* = .227	7	2	5
	INCREASE PRODUCTIVITY	*p* = .500	7	3	4
	JOB EASIER	*p* = .227	7	2	5
	USEFUL IN JOB	*p* = .500	7	4	3
	PU Dimension	*p* = .155	35	14	21

Trend Analysis of Sub-category Perceived Ease of Use (PEOU)

Participant responses for NO trend for PEOU individual scores are illustrated in Figure 45.

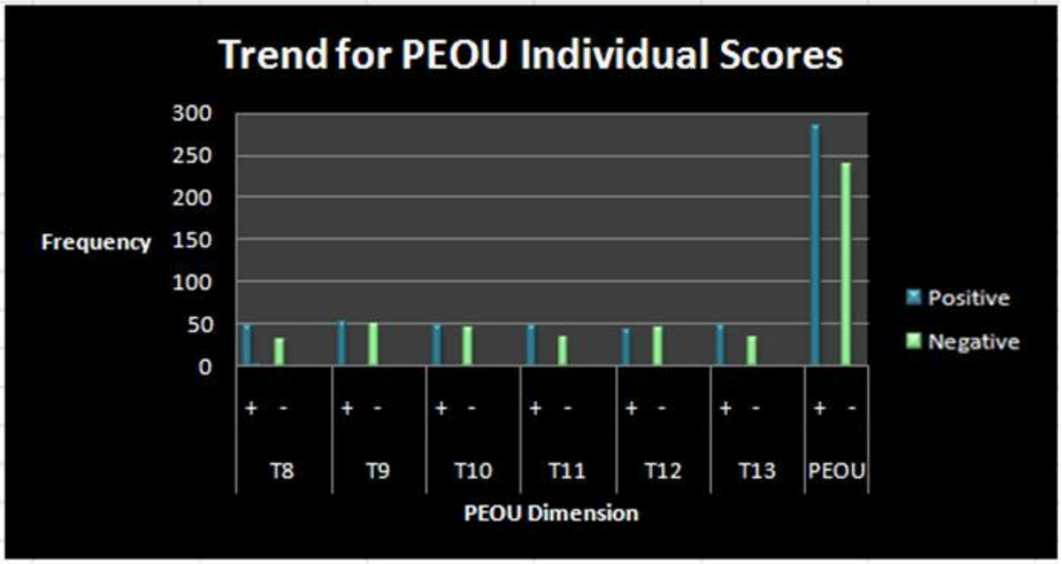

Figure 45. Trend for PEOU Individual Scores

Participant responses for NO trend for PEOU group scores are illustrated in Figure 46.

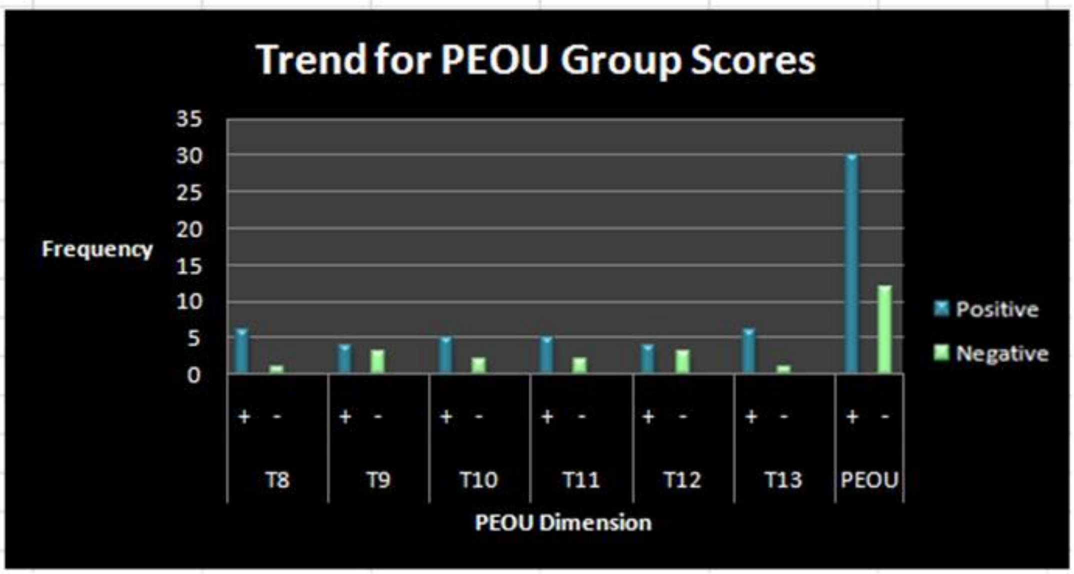

Figure 46. Trend for PEOU Group Scores

For Technology Acceptance Model question 8 (LEARN TO OPERATE SQ T8), the Cox-Stuart **individual** test indicated a significant difference across trials, N=119, *p* = .036.

This means there were significantly higher PEOU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002). However, the Cox-Stuart **group** test indicated no significant difference across trials, N=7, *p* = .063. This means at the alpha levels cited there were no significantly higher PEOU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002).

For Technology Acceptance Model question 9 (DO WHAT I WANT SQ T9), the Cox-Stuart individual test indicated no significant difference across trials, N=119, *p* = .500. Similarly, the Cox-Stuart group test indicated no significant difference across trials, N=7, *p* = .500. This means there were no significantly higher PEOU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002).

For Technology Acceptance Model question 10 (INTERACTION SQ T10), the Cox-Stuart individual test indicated no significant difference across trials, N=119, *p* = .417. Similarly, the Cox-Stuart group test indicated no significant difference across trials, N=7, *p* = .227. This means there were no significantly higher PEOU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002).

For Technology Acceptance Model question 11 (BECOME SKILLFUL SQ T11), the Cox-Stuart individual test indicated no significant difference across trials, N=119, *p* = .075. Similarly, the Cox-Stuart group test indicated no significant difference across trials, N=7, *p* = .227. This means there were no significantly higher PEOU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002).

For Technology Acceptance Model question 12 (FLEXIBLE SQ T12), the Cox-Stuart individual test indicated no significant difference across trials, N=119, $p = .416$. Similarly, the Cox-Stuart group test indicated no significant difference across trials, N=7, $p = .500$. This means there were no significantly higher PEOU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002).

For Technology Acceptance Model question 13 (EASY TO USE SQ T13), the Cox-Stuart individual test indicated no significant difference across trials, N=120, $p = .057$. Similarly, the Cox-Stuart group test indicated no significant difference across trials, N=7, $p = .063$. This means there were no significantly higher PEOU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002).

For the PEOU dimension (SQ T8-13), the Cox-Stuart individual test indicated a significant difference across trials, N=714, $p = .022$. This means there were significantly higher PEOU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002). This may also mean that LEARN TO OPERATE SQ T8, the only significant outcome within the PEOU dimension in the individual analysis, may be a stronger indicator of trend than the other outcomes within the PEOU dimension. Similarly, the Cox-Stuart group test indicated a significant difference across trials, N=42, $p = .004$.

Trend Analysis of Sub-category Perceived Usefulness (PU)

Participant responses for NO trend for PU individual scores are illustrated in Figure 47.

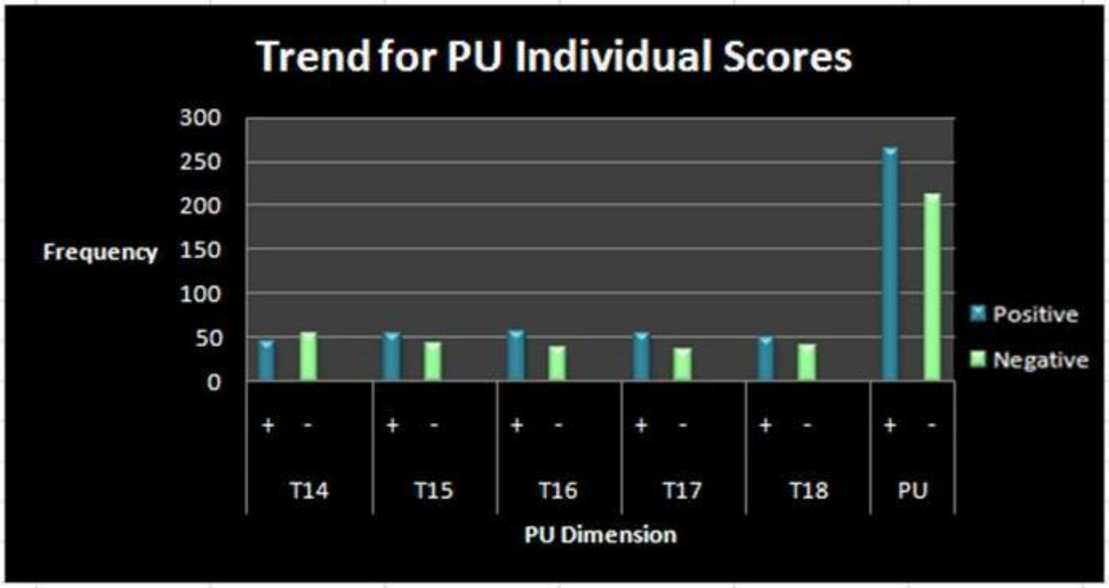

Figure 47. Trend for PU Individual Scores

Participant responses for NO trend for PU group scores are illustrated in **Error! Reference source not found.**.

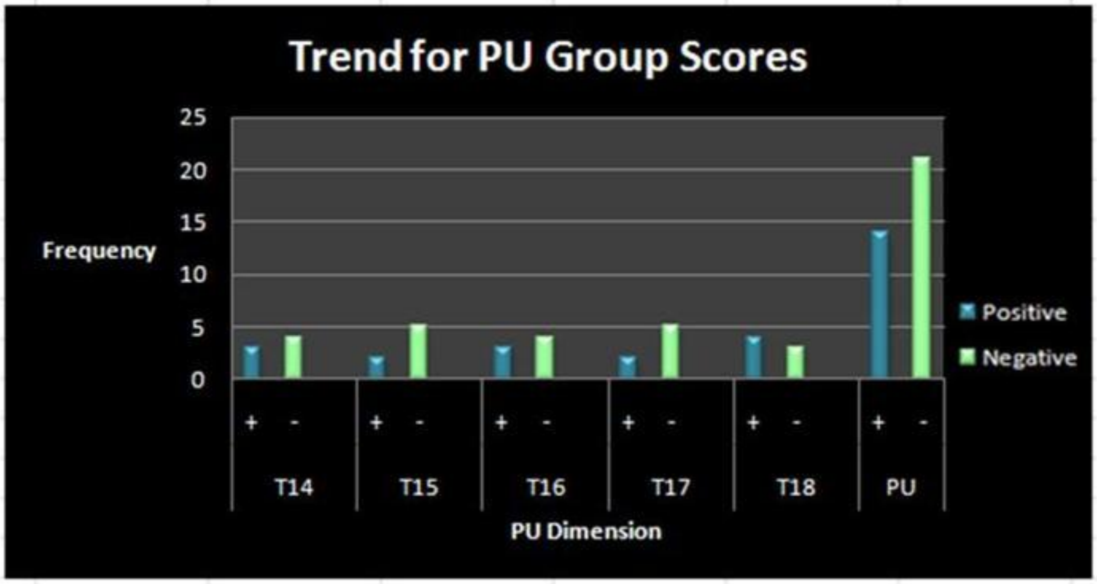

Figure 48. Trend for PU Group Scores

For Technology Acceptance Model question 14 (ACCOMPLISH MORE SQ T14), the Cox-Stuart individual test indicated no significant difference across trials, N=117, p = .242. Similarly, the Cox-Stuart group test indicated no significant difference across trials, N=7, p = .500. This means there were no significantly higher PU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002).

For Technology Acceptance Model question 15 (IMPROVE PERFORMANCE SQ T15), the Cox-Stuart individual test indicated no significant difference across trials, N=118, p = .111. Similarly, the Cox-Stuart group test indicated no significant difference across trials, N=7, p = .227. This means there were no significantly higher PU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002).

For Technology Acceptance Model question 16 (INCREASE PRODUCTIVITY SQ T16), the Cox-Stuart individual test indicated a significant difference across trials, N=117, *p* = .041*.* This means there were significantly higher PU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002). However, the Cox-Stuart group test indicated a significant difference across trials, N=7, *p* = .500*.* This means there were no significantly higher PEOU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002).

For Technology Acceptance Model question 17 (JOB EASIER SQ T17), the Cox-Stuart individual test indicated a significant difference across trials, N=118, *p* = .022*.* This means there were significantly higher PU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002). However, the Cox-Stuart group test indicated a significant difference across trials, N=7, *p* = .227*.* This means there were no significantly higher PU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002).

For Technology Acceptance Model question 18 (USEFUL IN JOB SQ T18), the Cox-Stuart individual test indicated no significant difference across trials, N=117, *p* = .201*.* Similarly, the Cox-Stuart group test indicated no significant difference across trials, N=7, *p* = .500*.* This means there were no significantly higher PU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002).

For the PU dimension (SQ T14-18), the Cox-Stuart individual test indicated a significant difference across trials, N=587, *p* = .010*.* This means there were significantly higher PEOU scores in second half of the time period (2003-2009) than in the first half of the time period (1996-2002). This may also mean that SQ T16 and T17, the two significant outcomes within the PU dimension in the individual analysis, may be stronger indicators of trend than the other outcomes within the PU dimensions. However, the Cox-Stuart group test indicated no significant difference across trials, N=35, p = .155.

Research Question 4 Summary

The hypothesis of NO trend in acceptance of educational computer-based games in classroom instruction over time was evaluated in terms of each dimension of perceived ease of use (PEOU) and each dimension in perceived usefulness (PU). For the individual trend analysis within the PEOU dimension, only LEARN TO OPERATE and the PEOU dimension itself was significant. For the individual trend analysis within the PU dimension, INCREASE PRODUCTIVITY, JOB EASIER, and the PU dimension itself was significant. For the group trend analysis within the PEOU dimension, only the PEOU dimension itself was statistically different. For the group trend analysis within the PU dimension, no significance was observed either within any sub-category or in the overall PU dimension.

It is interesting that within the PEOU dimension analyzed individually, the LEARN TO OPERATE (SQ T8) score indicated a significant difference across trials, but the group analysis did not. This is probably related to the increased power made possible by dealing with more data through working with individual scores rather than averaged group scores. Also unique is the significant result of the overall PEOU dimension with both individual and group analyses.

For the overall PEOU dimension, although values varied, both individual and group analyses showed significant differences but only in the overall PEOU dimension. Again, this appears to be made possible by the increased power created by taking all the individual scores into one large analysis rather than the lesser power available from the smaller number of responses for each sub-dimension. Therefore, for the PEOU dimension, we can reject the null hypothesis that there is no trend in PEOU acceptance of educational computer-based games in classroom instruction over time in terms of perceived ease of use and accept the alternate hypothesis that there is a trend in acceptance of educational computer-based games in classroom instruction over time. Increased perception of ease of use is logical over time as literature indicates computer-based games have permeated American society to the extent that even grandparents play computer and console-based games with their grandchildren (Gee, 2003).

Within the PU dimension, INCREASE PRODUCTIVITY (SQ T16), JOB EASIER (SQ T17), and the overall PU dimension scores indicated a significant difference when analyzed individually, but not so when analyzed as a group. Because group values were averaged, observations decreased, thereby decreasing power. The individual observations provided more observations and therefore more power to discern differences. With the PU dimension, the null hypothesis of NO trend can be rejected and the alternative hypothesis that there is a trend in acceptance of educational computer-based games in classroom instruction over time in PU overall, productivity and job easier can be accepted.

Research Question 5 (Use of educational computer games over time):

How has the level of use of educational computer-based games changed over time?

H_0 = There is no increase of educational computer-based game usage over time.

H_a = There is an increase of educational computer-based game usage over time.

To investigate this hypothesis, three responses were asked of participants: 1) whether or not educational computer games were used as an instructional strategy in the year they won the Milken Educator Award (E19 DID YOU USE GAMES), 2) to list the names of the educational computer games that were used (part one of E20 NAMES AND HOURS OF GAMES USED), and 3) to provide the approximate total number of hours allotted for student use on each game listed for the year they won the Milken Educator Award (part two of E20 NAMES AND HOURS OF GAMES USED).

Responses formed the basis for statistical tests of each sub-hypothesis about the sample population to that question. Questions 19 and 20 are found in Appendix B. The sub-hypotheses are placed in the sub-categories of Change in percentage of users and Change measured by hours of use.

Sub-category Change in percentage of users

Sub-hypothesis 1: There will be no change in the level (percentage) of instructors using educational computer-based games in the classroom between year group (year group 1 (1996-1999), year group 2 (2000-2004), year group 3 (2005-2009)).

Sub-category Change in game usage as measured by quantity of games and hours of use by instructors using games

Sub-hypothesis 2: There will be no change in the quantity of educational computer-based games used by instructors in the classroom between year group (year group 1 (1996-1999), year group 2 (2000-2004), or year group 3 (2005-2009)).

Sub-hypothesis 3: There will be no change in the level of educational computer-based games usage as measured by change in amount of hours allocated per student in the classroom by an individual instructor over time.

All available data was included for analyzing each sub-hypothesis. This means all valid responses to E19 DID YOU USE GAMES, part one of E20 NAMES AND HOURS OF GAMES USED, and part two of E20 NAMES AND HOURS OF GAMES USED were included.

For analysis of this research question, desired alpha and beta values were .05 and .2, respectively. Actual alpha values were .05, while actual beta values were .011. The Chi-squared was the initial test and conducted to determine if observed differed significantly from expected levels (Conover, 1971) of educational computer-based game usage over time. This test analyzed the results in survey question E19 DID YOU USE GAMES. In Cohen's (1977) book effect sizes are provided for most statistical tests and vary depending on the test. Effect sizes for the non-parametric Chi-squared test were provided. A medium effect size means an effect large enough to be seen by the naked eye. For statistical analysis conducted in this research, effect size of medium was chosen. For the Chi-squared test, a medium effect size is .3.

Figure 49 provides the statistical parameters as calculated by G*Power (Faul et al., 2007) for the Chi-squared test conducted on all three groups.

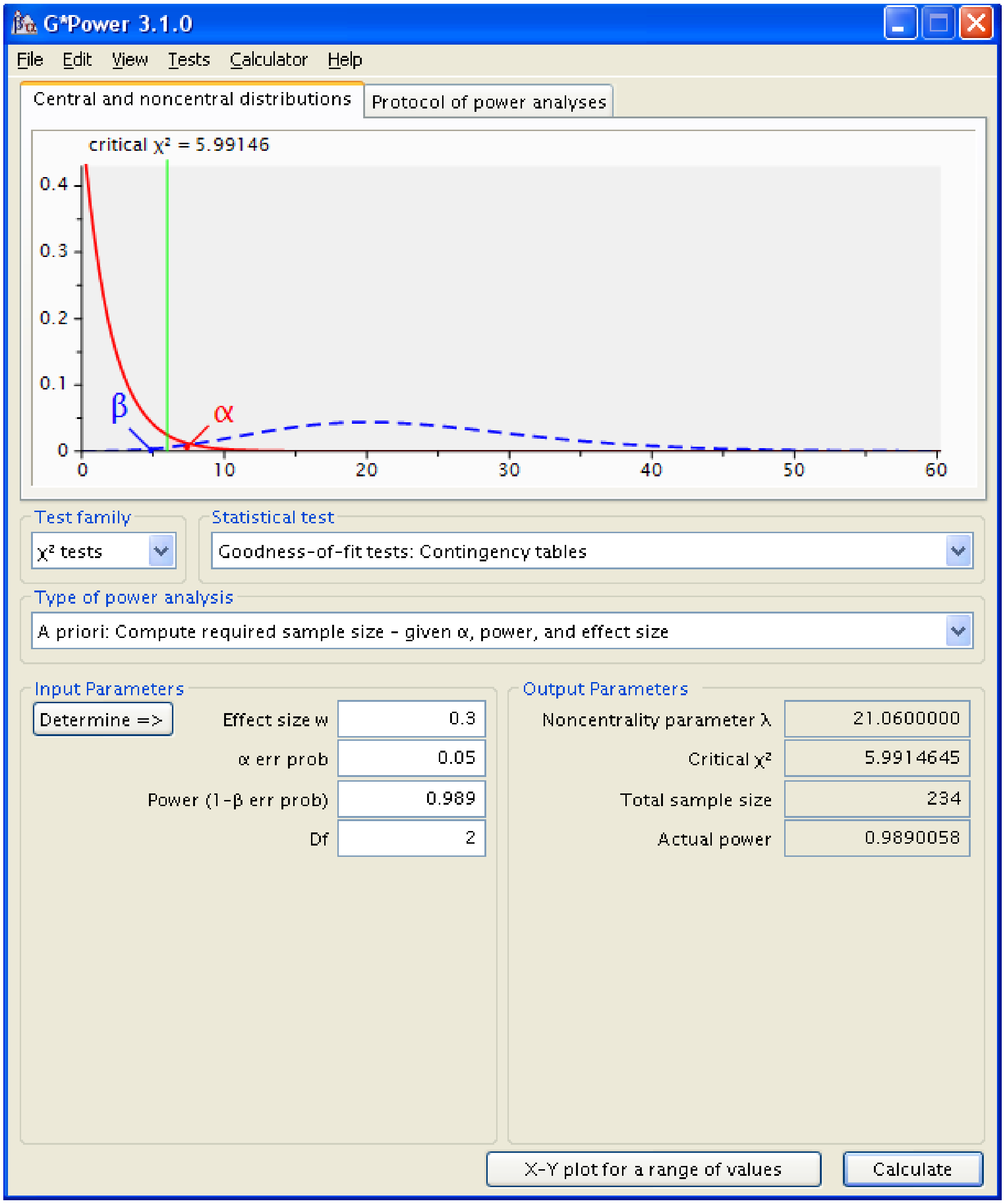

Figure 49. G*Power Calculation for Alpha and Beta Values for Chi-squared Test for year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009)

Additional analyses were conducted to compare any two groups to each other. So, year group 1 (1996-1999) was compared to year group 2 (2000-2004) then to year group 3 (2005-2009). Year group 2 (2000-2004) was also compared to year group 3 (2005-2009).

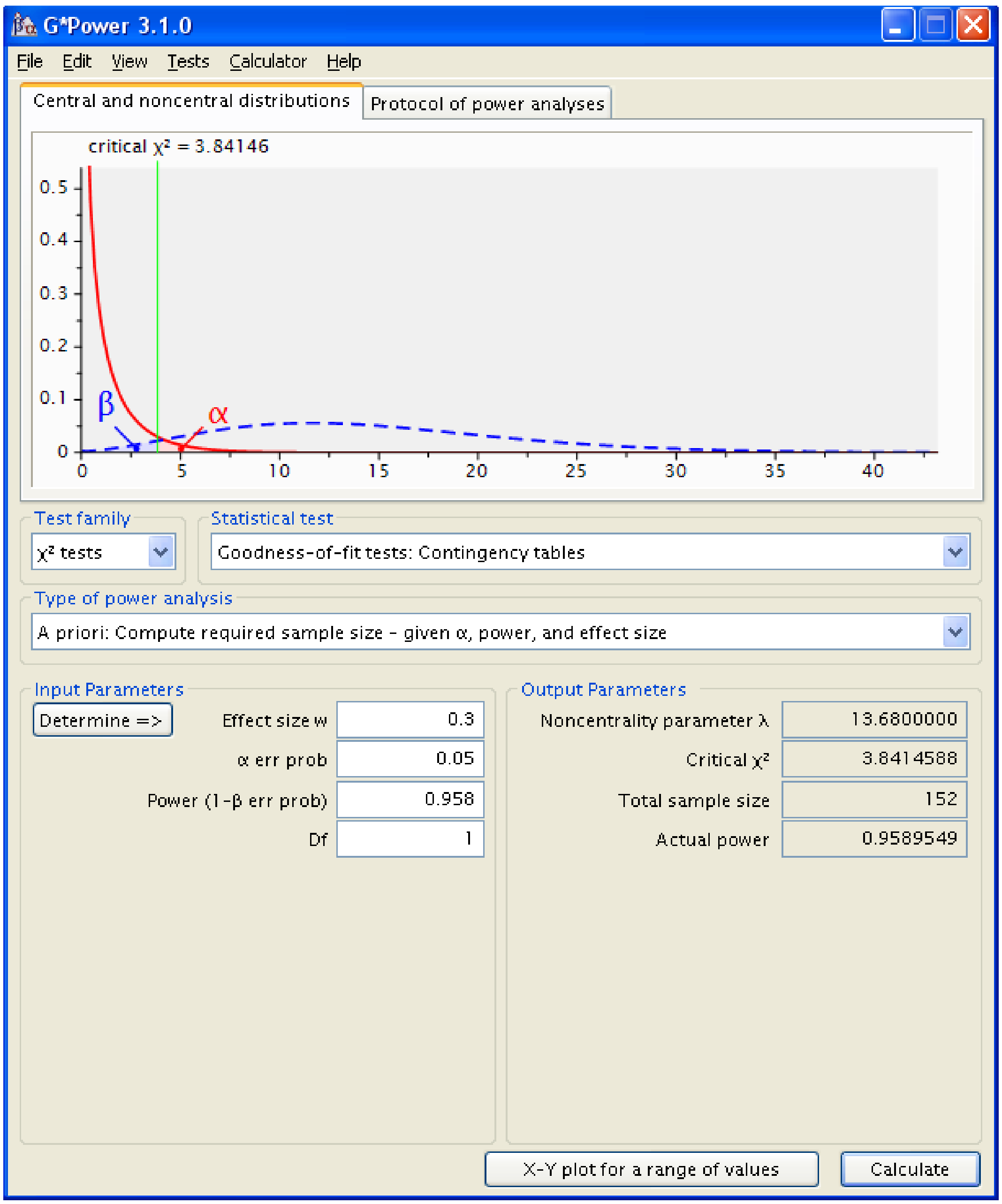

Figure 50 provides the statistical parameters as calculated by G*Power (Faul et al., 2007) to conduct the Chi-squared test on any two of the three groups. The full data set is provided in Appendix C.

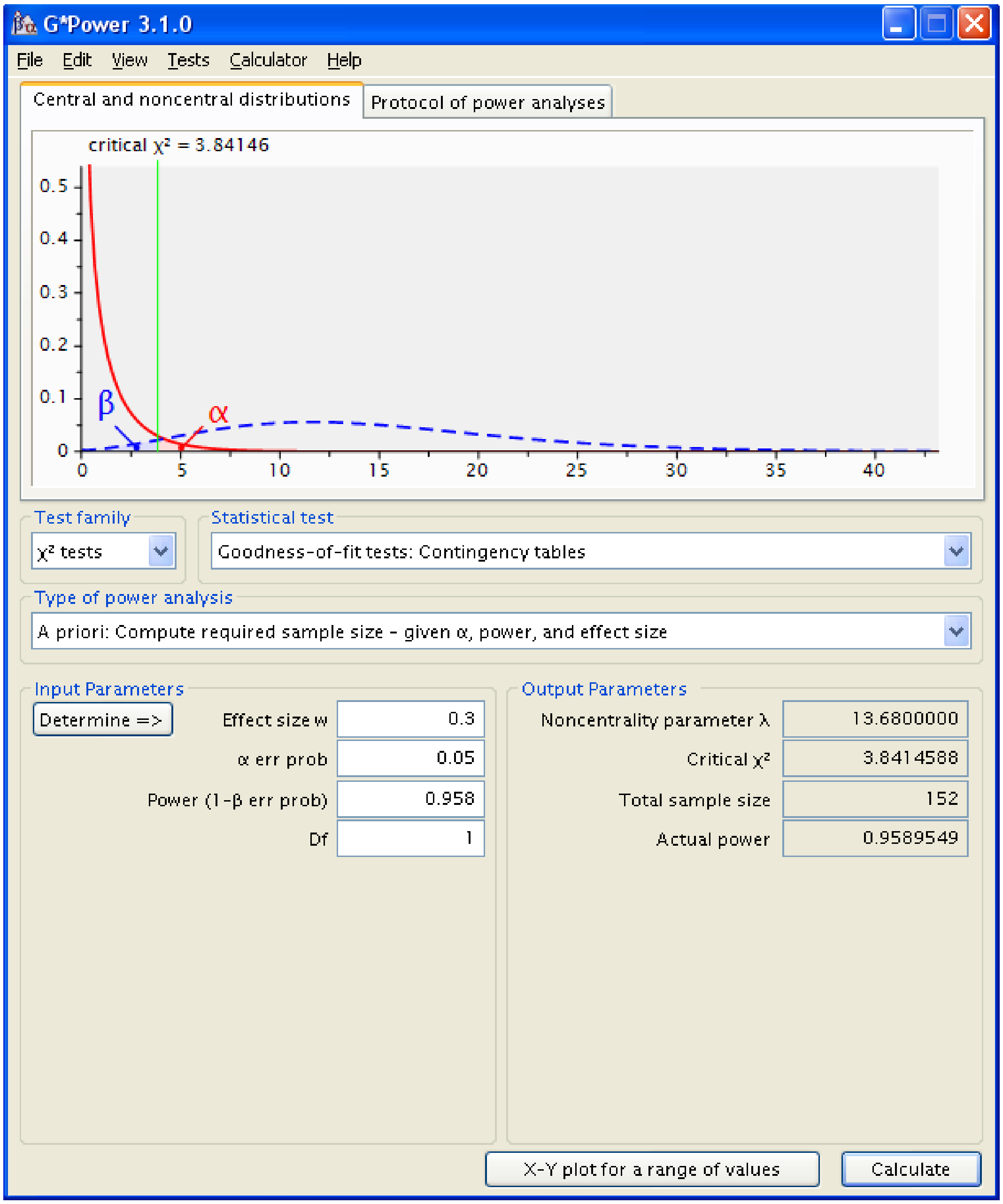

Figure 50. G*Power Calculation for Alpha and Beta Values for Chi-squared Test for Any Two of Three Year Groups

Homogeneity Test Analysis

Homogeneity tests were conducted to validate the response rate of those who responded to E19 DID YOU USE GAMES and those who responded to part one of E20 NAMES AND HOURS OF GAMES USED. Homogeneity tests are used to determine whether frequency counts are distributed identically across different populations (Conover, 1971). When comparing responses of E19 DID YOU USE GAMES to part one of E20 NAMES AND HOURS OF GAMES USED, counts were not significant, meaning, they were homogeneous, Pearson $\chi 2$ (2, N = 94) = 4.977, p=.083, Cramérs V = .230. The proportions of level of game usage per level was .16 and .84, respectively. What this means is that the responses to part one of E20 NAMES AND HOURS OF GAMES USED are representative of those who responded to E19 DID YOU USE GAMES. Counts are illustrated in Table 22.

Table 22. Number of Games Users to Number of Users who Listed Games

		No of games users to No of users who listed games		Total
		No of games users (Expected)	No of users who listed games (Observed)	
Year Group 1 (1996-1999)	Count	7	19	26
	Expected Count	4.1	21.9	26.0
	% within Group	26.9%	73.1%	100.0%
Year Group 2 (2000-2004)	Count	6	28	34
	Expected Count	5.4	28.6	34.0
	% within Group	17.6%	82.4%	100.0%
Year Group 3 (2005-2009)	Count	2	32	34
	Expected Count	5.4	28.6	34.0
	% within Group	5.9%	94.1%	100.0%
Total	Count	15	79	94
	Expected Count	15.0	79.0	94.0
	% within Group	16.0%	84.0%	100.0%

Follow up homogeneity tests were conducted to validate the response rate of those who responded to E19 DID YOU USE GAMES and those who responded to part two of E20 NAMES AND HOURS OF GAMES USED. When comparing responses of E19 DID YOU USE GAMES to part two of E20 NAMES AND HOURS OF GAMES USED, counts were significant, meaning, not homogeneous, Pearson $\chi 2$ (2, N = 94) = 7.503, p=.023, Cramérs V = .283. The proportions of level of game usage per level was .223 and .777, respectively. What this means is that responses to part two of E20 NAMES AND HOURS OF GAMES USED are not representative of those who responded to E19 DID YOU USE GAMES. Counts are presented in Table 23.

Table 23. Number of Games Users to Number of Users who Cited Hours of Game Use in Classroom

		No of games users to No of users who cited hours of game use in classroom		Total
		No of games users (Expected)	No of users who cited hours of game use in classroom (Observed)	
Year Group 1 (1996-1999)	Count	10	16	26
	Expected Count	5.8	20.2	26.0
	% within Group	38.5%	61.5%	100.0%
Year Group 2 (2000-2004)	Count	8	26	34
	Expected Count	7.6	26.4	34.0
	% within Group	23.5%	76.5%	100.0%
Year Group 3 (2005-2009)	Count	3	31	34
	Expected Count	7.6	26.4	34.0
	% within Group	8.8%	91.2%	100.0%
Total	Count	21	73	94
	Expected Count	21.0	73.0	94.0
	% within Group	22.3%	77.7%	100.0%

Detailed Analysis of sub-category Change in percentage of users

When analyzing Change in percentage of users, responses to survey question E19 DID YOU USE GAMES and part one of E20 NAMES AND HOURS OF GAMES USED were analyzed. Addressing sub-hypothesis one required two sets of Chi-squared tests and one regression analysis; each analysis is presented individually followed by a summarization of the entire sub-category.

DID YOU USE GAMES Group Differences

An initial two-way contingency table analysis was conducted to evaluate whether actual usage of educational computer-based games changed over time. Participant responses for DID YOU USE GAMES were investigated. There were two variables: group and actual use. The group variable was segmented into three levels: year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). The actual usage of educational computer-based games variable was segmented into two levels: those who did use games and those who did not. Overall, group and actual game usage were found to not be significantly related, Pearson χ^2 (2, *N* = 236) = .895, *p*=.639, Cramérs *V* = .062. The proportions of level of game usage per level was .398 and .602, respectively. Counts are presented in Table 24 below.

Table 24. Level (percentage) of Instructors Using Educational Computer-Based Games in the Classroom for All Year Groups

		Used Games		Total
		Yes	No	
Year group 1 (1996-1999)	Count	26	47	73
	Expected Count	29.1	43.9	73.0
	% within group	35.6%	64.4%	100.0%
Year group 2 (2000-2004)	Count	34	45	79
	Expected Count	31.5	47.5	79.0
	% within group	43.0%	57.0%	100.0%
Year group 3 (2005-2009)	Count	34	50	84
	Expected Count	33.5	50.5	84.0
	% within group	40.5%	59.5%	100.0%
Total	Count	94	142	236
	Expected Count	94.0	142.0	236.0
	% within group	39.8%	60.2%	100.0%

Additional analyses were conducted to compare any two groups to each other. When comparing year group 1 (1996-1999) to year group 2 (2000-2004), there was no significance indicated, Pearson χ^2 (1, *N* = 152) = .875, *p*=.350, Cramérs *V* = .076. Counts are presented in Table 25.

Table 25. Level (percentage) of Instructors Using Educational Computer-Based Games in the Classroom for Year Group 1 (1996-1999) to Year Group 2 (2000-2004)

		Used Games		Total
		Yes	No	
Year group 1 (1996-1999)	Count	26	47	73
	Expected Count	28.8	44.2	73.0
	% within group	35.6%	64.4%	100.0%
Year group 2 (2000-2004)	Count	34	45	79
	Expected Count	31.2	47.8	79.0
	% within group	43.0%	57.0%	100.0%
Total	Count	60	92	152
	Expected Count	60.0	92.0	152.0
	% within group	39.5%	60.5%	100.0%

Similarly, when comparing year group 1 (1996-1999) to year group 3 (2005-2009), no significance was indicated, Pearson χ^2 (1, *N* = 157) = .391, *p*=.532, Cramérs *V* = .050. Counts are presented in Table 26.

Table 26. Level (percentage) of Instructors Using Educational Computer-Based Games in the Classroom for Year Group 1 (1996-1999) to Year Group 3 (2005-2009)

		Used Games		Total
		Yes	No	
Year group 1 (1996-1999)	Count	26	47	73
	Expected Count	27.9	45.1	73.0
	% within group	35.6%	64.4%	100.0%
Year group 3 (2005-2009)	Count	34	50	84
	Expected Count	32.1	51.9	84.0
	% within group	40.5%	59.5%	100.0%
Total	Count	60	97	157
	Expected Count	60.0	97.0	157.0
	% within group	38.2%	61.8%	100.0%

Finally, comparing year group 2 (2000-2004) to year group 3 (2005-2009) also yielded results that were not significant, Pearson χ2 (1, N = 163) = .110, p=.740, Cramérs V = .026. Counts are presented in Table 27.

Table 27. Level (percentage) of Instructors Using Educational Computer-Based Games in the Classroom for Year Group 2 (2000-2004) to Year Group 3 (2005-2009)

		Used Games		Total
		Yes	No	
Year group 2 (2000-2004)	Count	34	45	79
	Expected Count	33.0	46.0	79.0
	% within group	43.0%	57.0%	100.0%
Year group 3 (2005-2009)	Count	34	50	84
	Expected Count	35.0	49.0	84.0
	% within group	40.5%	59.5%	100.0%
Total	Count	68	95	163
	Expected Count	68.0	95.0	163.0
	% within group	41.7%	58.3%	100.0%

In conclusion of the first Chi-squared test analysis, observed counts were very close to expected counts, yielding results that were not significant. Over all 14 years, the level (percentage) of instructors who used educational computer-based games did not change significantly.

Part One of E20 NAMES AND HOURS OF GAMES USED – Analysis 1

A second two-way contingency table analysis was conducted to evaluate whether people who cited games differed from those who responded to the survey. Participant responses for part one of E20 NAMES AND HOURS OF GAMES USED were investigated. The two variables were segmented into three groups (year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009)). Responses from the individuals fell into two categories: those who cited games for the year group and those who did not cite games (total responses to the survey minus those who cited games for the year group). Overall, group and cited games to overall survey responses were found to not be significantly related, Pearson χ^2 (2, N = 259) = 3.728, p=.155, Cramérs V = .120. The proportions of cited games to overall survey responses per level was .309 and .691, respectively. Counts are presented in Table 28.

Table 28. Level (percentage) of Cited Game Respondents to All Survey Respondents for year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009)

		Number or participants who cited games	Responses to the survey minus number of participants who cited games	Total
Year Group 1 (1996-1999)	Count	19	64	83
	Expected Count	25.6	57.4	83.0
	% within group	22.9%	77.1%	100.0%
Year Group 2 (2000-2004)	Count	29	57	86
	Expected Count	26.6	59.4	83.0
	% within group	33.7%	66.3%	100.0%
Year Group 3 (2005-2009)	Count	32	58	90
	Expected Count	27.8	62.2	90.0
	% within group	35.6%	64.4%	100.0%
Total	Count	80	179	259
	Expected Count	80.0	179.0	259.0
	% within group	30.9%	69.1%	100.0%

Additional analyses were conducted to compare any two groups to each other. When comparing year group 1 (1996-1999) to year group 2 (2000-2004), there was no significance indicated, Pearson χ^2 (1, N = 169) = 2.436, p=.119, Cramérs V = .120. Counts are presented in Table 29.

Table 29. Level (percentage) of Cited Game Respondents to All Survey Respondents for year group 1 (1996-1999) to year group 2 (2000-2004)

		Number or participants who cited games	Responses to the survey minus number of participants who cited games	Total
Year Group 1 (1996-1999)	Count	19	64	83
	Expected Count	23.6	59.4	83.0
	% within group	22.9%	77.1%	100.0%
Year Group 2 (2000-2004)	Count	29	57	86
	Expected Count	24.4	61.6	86.0
	% within group	33.7%	66.3%	100.0%
Total	Count	48	121	169
	Expected Count	48.0	121.0	169.0
	% within group	28.4%	71.6%	100.0%

Similarly, when comparing year group 1 (1996-1999) to year group 3 (2005-2009), no significance was indicated, Pearson χ^2 (1, *N* = 173) = 3.331, *p*=.068, Cramérs *V* = .139. Counts are presented in Table 30.

Table 30. Level (percentage) of Cited Game Respondents to All Survey Respondents for year group 1 (1996-1999) to year group 3 (2005-2009)

		Number or participants who cited games	Responses to the survey minus number of participants who cited games	Total
Year Group 1 (1996-1999)	Count	19	64	83
	Expected Count	24.5	58.5	83.0
	% within group	22.9%	77.1%	100.0%
Year Group 3 (2005-2009)	Count	32	58	90
	Expected Count	26.5	63.5	90.0
	% within group	35.6%	64.4%	100.0%
Total	Count	51	122	173
	Expected Count	51.0	122.0	173.0
	% within group	29.5%	70.5%	100.0%

Finally, comparing year group 2 (2000-2004) to year group 3 (2005-2009) also yielded results that were not significant, Pearson χ^2 (1, N = 173) = .065, p=.798, Cramérs V = .019. Counts are presented in Table 31.

Table 31. Level (percentage) of Cited Game Respondents to All Survey Respondents for year group 2 to year group 3 (2005-2009)

		Number or participants who cited games	Responses to the survey minus number of participants who cited games	Total
Year Group 2 (2000-2004)	Count	29	57	86
	Expected Count	29.8	56.2	86.0
	% within group	33.7%	66.3%	100.0%
Year Group 3 (2005-2009)	Count	32	58	90
	Expected Count	31.2	58.8	90.0
	% within group	35.6%	64.4%	100.0%
Total	Count	61	115	176
	Expected Count	61.0	115.0	176.0
	% within group	34.7%	65.3%	100.0%

In conclusion of the second Chi-squared test analysis, observed counts were very close to expected counts, yielding results that were not significant. Over all 14 years, the level (percentage) of cited game respondents to those who answered the survey did not change significantly.

Part One of E20 NAMES AND HOURS OF GAMES USED – Analysis 2

Additional analysis of part one of survey question E20 NAMES AND HOURS OF GAMES USED was conducted using a regression analysis on number of people who cited games. The purpose of regression analysis is to generate a formula that fits the relationship between both variables, so that the formula can be used to predict dependent variable values when only the independent variable value is known (Conover, 1971). Alpha and beta values were not provided for the regression analyses.

A linear regression equation was performed on the three year groups' data to determine if there was a significant relationship between year groups and number of people who cited games within each year group. The t-statistic for the slope was not significant at the .05 critical alpha level, $F(2)=10.35$, $p=.19$. For this analysis, we conclude that there is no significance between number of games used per year group. The equation and data points are presented in Figure 51.

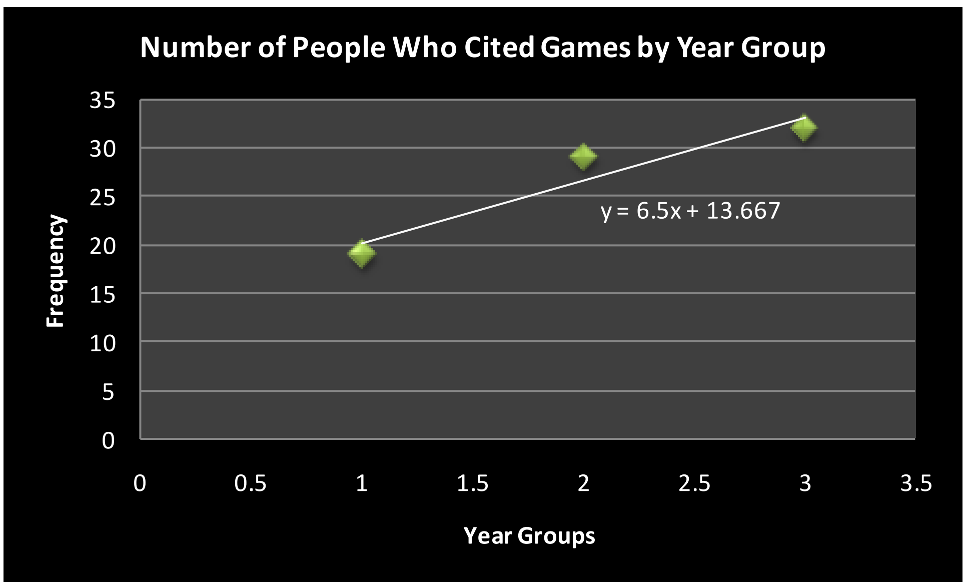

Figure 51. Number of People who Cited Games by Year Group

An additional regression analysis was performed on each individual year group's data to determine if there was a significant relationship between the individual year groups and number of people who cited games within each year. The t-statistic for the slope was not significant at the .05 critical alpha level, $F(13)=.55$, $p=.47$. For this analysis, we conclude that there is no significance between number of people who cited games per individual year. The equation and data points are presented in Figure 52.

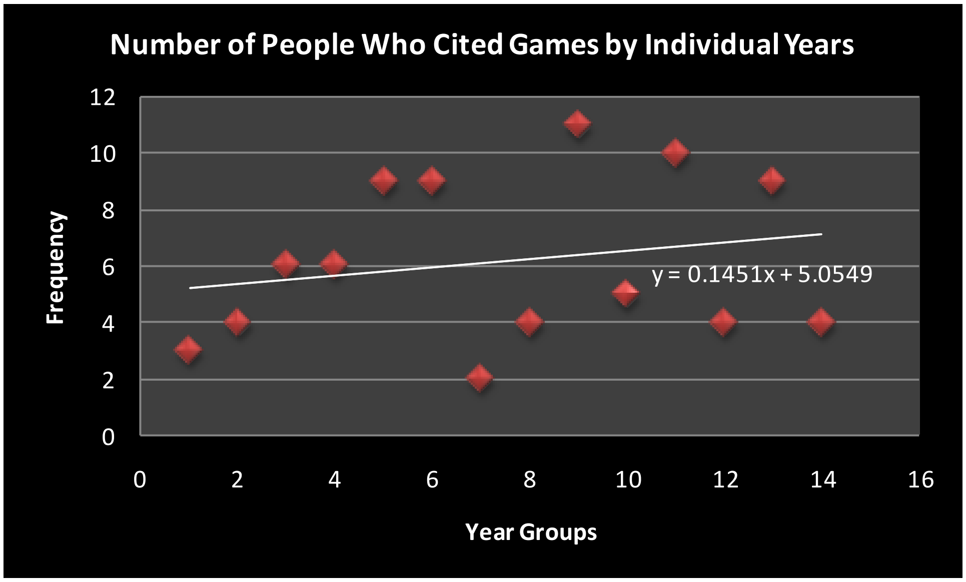

Figure 52. Number of People who Cited Games by Individual Years

To conclude analysis of sub-hypothesis 1, each of the above analyses have demonstrated no significant change in the level as indicated by the percentage of instructor who cite use of educational computer-based game usage in the classroom either divided by year group (year group 1 (1996-1999), year group 2 (2000-2004), year group 3) or within individual years. We cannot reject sub-hypothesis one, that there is no change in the level (percentage) of instructors using educational computer-based games in the classroom between year group (year group 1 (1996-1999), year group 2 (2000-2004), year group 3 (2005-2009)).

Detailed Analysis of sub-category Change in game usage as measured by quantity of games and hours of use by instructors using games

Addressing sub-hypothesis two required one regression analysis and a Fisher's Exact Test; each analysis is presented individually.

Addressing sub-hypothesis three required the Kruskal Wallis analysis. This analysis is presented followed by a summarization of the sub-category.

Quantity of Games – Sub-hypothesis 2

When analyzing the quantity of games portion of the above sub-category, responses to part one of survey question E20 NAMES AND HOURS OF GAMES USED were analyzed. Each analysis is presented individually followed by a summarization of the entire sub-category.

Part One of E20 NAMES AND HOURS OF GAMES USED – Analysis 1

Analysis of part one of survey question E20 NAMES AND HOURS OF GAMES USED was conducted using a regression analysis on number of games used. The purpose of regression analysis is to generate a formula that fits the relationship between both variables, so that the formula can be used to predict dependent variable values when only the independent variable value is known (Conover, 1971). Alpha and beta values were not provided for the regression analyses.

A linear regression equation was performed on the three year groups' data to determine if there was a significant relationship between year groups and number of games used within each year group. The t-statistic for the slope was not significant at the .05 critical alpha level, F(2)=4.32, p=.29. For this analysis, we conclude that there is no significance between number of games used per year group. The equation and data points are presented in Figure 53.

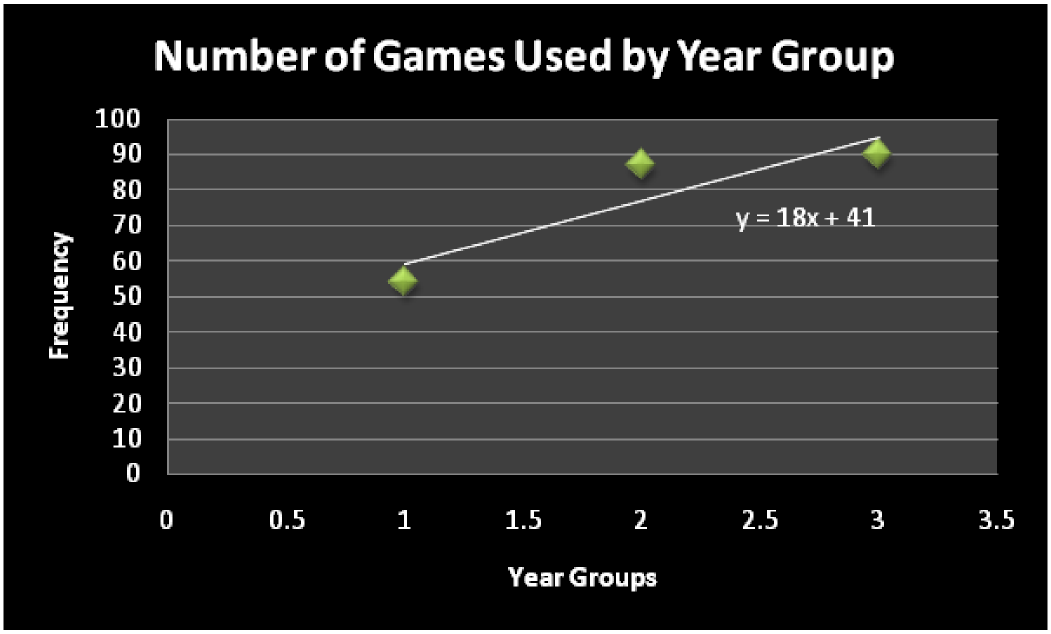

Figure 53. Number of Games Used by Year Group

An additional regression analysis was performed on each individual year group's data to determine if there was a significant relationship between the individual year groups and number of games used within each year. The t-statistic for the slope was not significant at the .05 critical alpha level, $F(13)=.38$, $p=.55$. For this analysis, we conclude that there is no significance between number of games used per individual year. The equation and data points are presented in Figure 54.

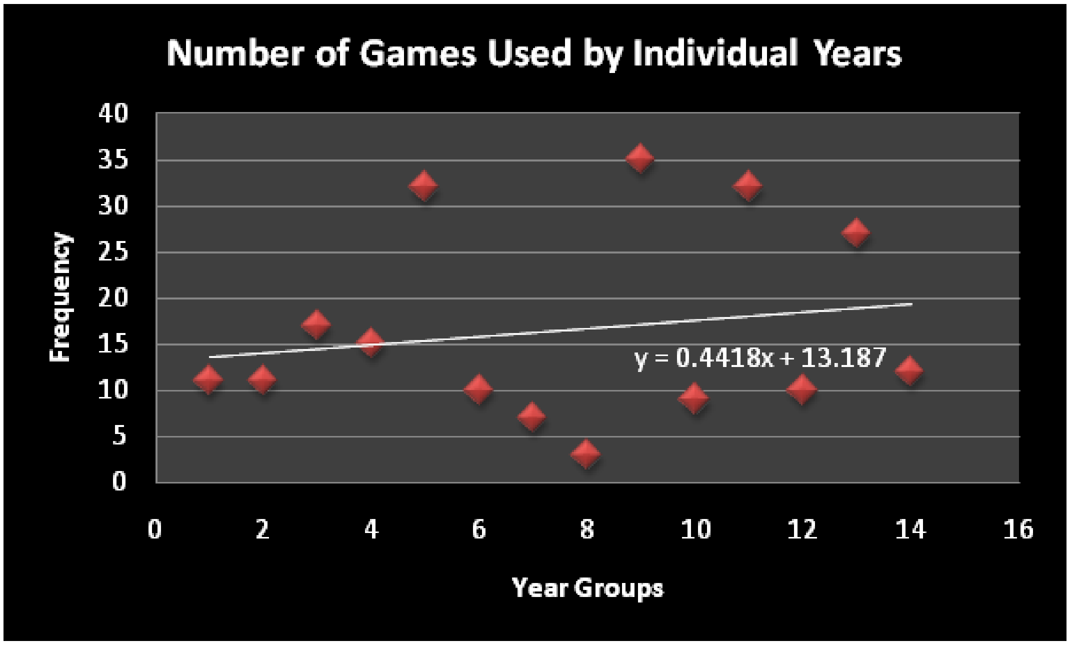

Figure 54. Number of Games Used by Individual Years

Part One of E20 NAMES AND HOURS OF GAMES USED – Analysis 2

Additional analysis of part one of survey question E20 NAMES AND HOURS OF GAMES USED was conducted using Fisher's Exact Test on survey respondents for each of the four subjects (Language Arts, Math, Science, and Social Studies) for each year group. The Fisher's Exact Test is used when sample sizes are too small or unbalanced to use the Chi-squared test (Children's Mercy Hospitals & Clinics, 2010).

A two-way contingency table analysis was conducted to evaluate whether number of educational computer-based games used within each subject area differed per year group. Participant responses for E20 NAMES AND HOURS OF GAMES USED were investigated. There were two variables: group and subject. The group variable was segmented into three levels: year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). Each of the four subjects (Language Arts, Math, Science, and Social Studies) was segmented into two levels: survey responses and number of games used.

For Language Arts, results yielded no significant relationships. Comparing all three year groups, Fisher's Exact Test *p* = .301, alpha = .05, beta not available. Comparing year group 1 (1996-1999) to year group 2 (2000-2004), Fisher's Exact Test *p* = .704, alpha = .05, beta = .08. Comparing year group 1 (1996-1999) to year group 3 (2005-2009), Fisher's Exact Test *p* = .196, alpha = .05, beta = .30. Comparing year group 2 (2000-2004) to year group 3 (2005-2009), Fisher's Exact Test *p* = .300, alpha = .05, beta = .18. Counts are presented in Table 32.

Table 32. Number of Survey Responses and Educational Computer-Based Games Used for Language Arts

Language Arts		
	Survey Responses	Number of Games Used
Group 1 (1996-1999)	24	18
Group 2 (2000-2004)	43	40
Group 3 (2005-2009)	43	55
Group 1, 2, 3	110	113

For Math, results yielded no significant relationships. Comparing all three year groups, Fisher's Exact Test *p* = .352, alpha = .05, beta not available. Comparing year group 1 (1996-1999) to year group 2 (2000-2004), Fisher's Exact Test *p* = .350, alpha = .05, beta = .16. Comparing year group 1 (1996-1999) to year group 3 (2005-2009), Fisher's Exact Test *p* = .805, alpha = .05, beta = .06. Comparing year group 2 (2000-

2004) to year group 3 (2005-2009), Fisher's Exact Test *p* = .165, alpha = .05, beta = .30. Counts are presented in Table 33.

Table 33. Number of Survey Responses and Educational Computer-Based Games Used for Math

Math		
	Survey Responses	Number of Games Used
Group 1 (1996-1999)	19	14
Group 2 (2000-2004)	17	20
Group 3 (2005-2009)	22	13
Group 1, 2, 3	58	47

For Science, results yielded no significant relationships. Comparing all three year groups, Fisher's Exact Test *p* = .633, alpha = .05, beta not available. Comparing year group 1 (1996-1999) to year group 2 (2000-2004), Fisher's Exact Test *p* = .461, alpha = .05, beta = .13. Comparing year group 1 (1996-1999) to year group 3 (2005-2009), Fisher's Exact Test *p* = .479, alpha = .05, beta = .13. Comparing year group 2 (2000-2004) to year group 3 (2005-2009), Fisher's Exact Test *p* = 1.000, alpha = .05, beta = .03. Counts are presented in Table 34.

Table 34. Number of Survey Responses and Educational Computer-Based Games Used for Science

Science		
	Survey Responses	Number of Games Used
Group 1 (1996-1999)	20	15
Group 2 (2000-2004)	14	16
Group 3 (2005-2009)	17	19
Group 1, 2, 3	51	50

For Social Studies, results yielded no significant relationships. Comparing all three year groups, Fisher's Exact Test p = .111, alpha = .05, beta not available. Comparing year group 1 (1996-1999) to year group 2 (2000-2004), Fisher's Exact Test p = .058, alpha = .05, beta = .45. Comparing year group 1 (1996-1999) to year group 3 (2005-2009), Fisher's Exact Test p = .272, alpha = .05, beta = .25. Comparing year group 2 (2000-2004) to year group 3 (2005-2009), Fisher's Exact Test p = 1.000, alpha = .05, beta = .06. Counts are presented in Table 35.

Table 35. Number of Survey Responses and Educational Computer-Based Games Used for Social Studies

Social Studies		
	Survey Responses	Number of Games Used
Group 1 (1996-1999)	12	2
Group 2 (2000-2004)	8	8
Group 3 (2005-2009)	3	2
Group 1, 2, 3	23	12

Over all year groups, there were no significant relationships between subject and number of games used. The only area that approached significance was when year group 1 was compared to year group 2 for Social Studies, $p = .058$. We cannot reject sub-hypothesis two, that there is no change in the quantity of educational computer-based games used by instructors in the classroom between year group (year group 1 (1996-1999), year group 2 (2000-2004), or year group 3 (2005-2009)).

Hours of Use – Sub-hypothesis 3

When analyzing the hours of use portion of the above sub-category, responses to part two of survey question E20 NAMES AND HOURS OF GAMES USED were analyzed.

The non-parametric version of the ANOVA, the Kruskal-Wallis test, was used to determine the statistical significance of inferences for group and hours of games used per year group. In Cohen's (1977) book, effect sizes are provided for most statistical tests and vary depending on the test. While effect sizes for the non-parametric Kruskal-

Wallis test were not provided, values for the parametric alternative, the ANOVA, were. A medium effect size means an effect large enough to be seen by the naked eye. For statistical analysis conducted in this research, effect size of large was chosen due to the smaller sample size. G*Power software version 3.1.0 was used. G*Power enables one to input alpha, sample size, and effect size while computing actual power for a given alpha and power (1-beta). For analysis of this research question, desired alpha and β values were .05 and .2, respectively. For the Kruskal-Wallis test, a large effect size is .4. Actual alpha for Kruskal Wallis test set at .1 and β was computed to be approximately .2, with Power being greater than .8. Figure 55 provides the statistical parameters as calculated by G*Power (Faul et al., 2007). The full data set is provided in Appendix C.

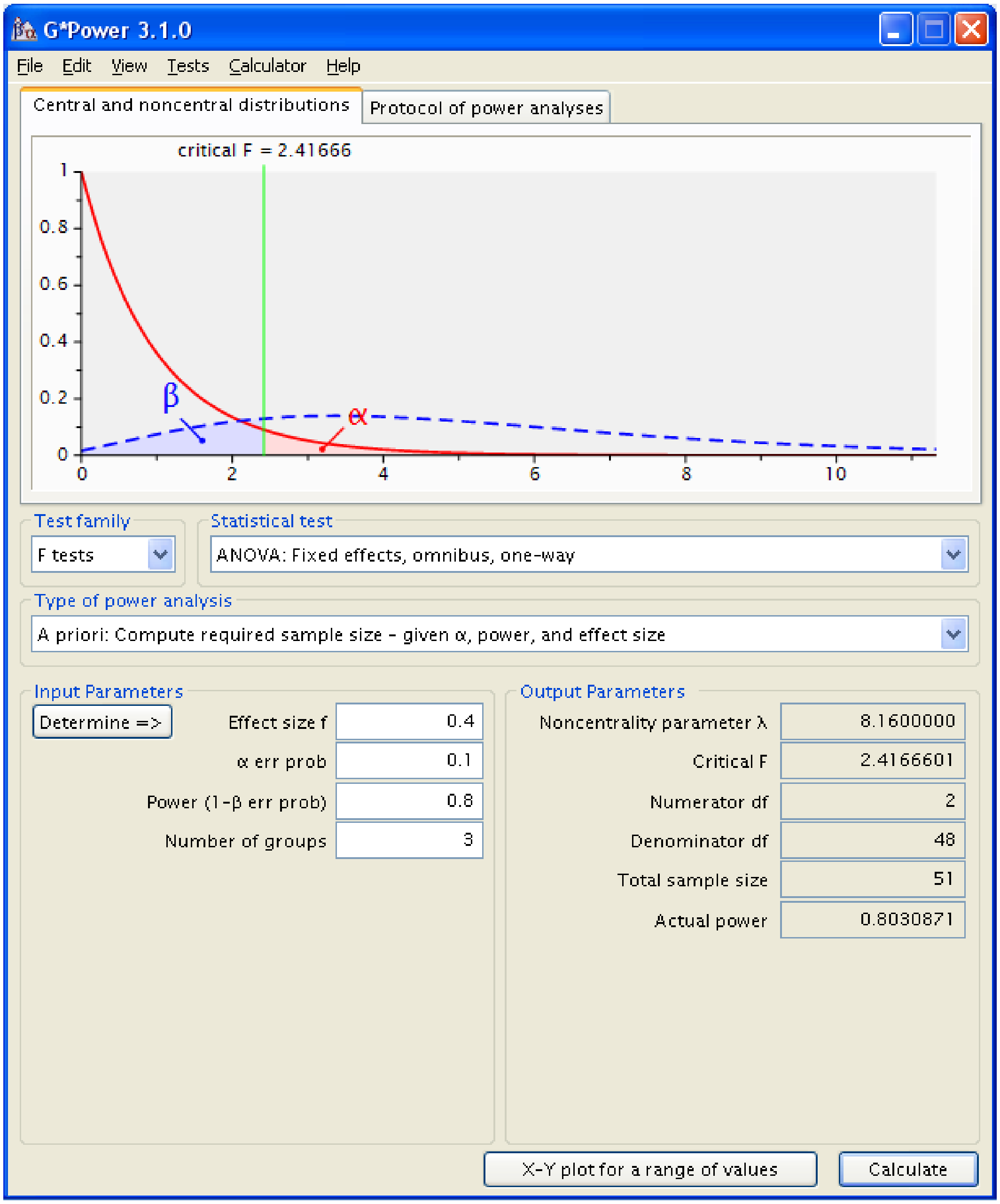

Figure 55. G*Power Calculation for Alpha and Beta Values for Kruskal-Wallis Test

The Kruskal-Wallis analysis indicated no significance difference between year groups and hours of game used, $\chi^2(2, N=73) = 3.609$, $p = .165$. We cannot reject sub-hypothesis three, that there is no change in the level of educational computer-based games usage as measured by change in amount of hours allocated per student in the classroom by an individual instructor over time.

Research Question 5 Summary

For the first sub-hypothesis, change in level (percentage) of educational computer-based game use, results were not significant; there was no change in use over time. For the second sub-hypothesis, change in quantity of educational computer-based games used by instructors, again, results were not significant; there was no change in the quantity of games used over time. Finally, for the third sub-hypothesis, change in level of educational computer-based game usage as measured by hours allocated for student use, once again, results were not significant; there was no change in the amount of hours allocated per student in the classroom by individual instructor over time. Because each sub-hypothesis yielded results that were not significant, the null hypothesis must be accepted: there was no increase of educational computer-based games over time. However, there is one possible caveat to this conclusion. Since we know that responses per year group are not homogeneous, we know they cannot be representative of the year group. Because the response rate is bias, the nature of the survey itself may reflect a bias in those participating in the survey.

Research question 6 (Access to computer educational games over time):

How has the level of access students have to computers with educational computer-based games to meet subject objectives changed over time?

H_0 = There is no change of access students have to computers with educational computer-based games to meet subject objectives over time.

H_a = There is a change of access students have to computers with educational computer-based games to meet subject objectives over time.

To investigate this hypothesis, each participant was asked to express the strength of his/her response to three questions about their students' access to educational computer-based games in the classroom or media center. These sub-hypotheses can be conceptually grouped into two sub categories: (1) Access in the classroom, and (2) Access in the media center. Strength of access to classroom educational computer based game usage was measured on a scale from 1 to 4 as shown in Table 36 below.

Table 36. Classroom Response Scale

1	2	3	4
*No, students **did not** have access to computers with educational computer-based games in the classroom.*	*Yes, students did have access in my classroom: There was **one computer** with educational computer-based games in the classroom for **all students** in my class.*	*Yes, students did have access in my classroom: There was **more than one computer** with educational computer-based games in the classroom that was **shared by all students** in my class.*	*Yes, students did have access in my classroom: There was **one computer** with educational computer-based games in the classroom for **each student** in my class.*

Strength of access to media center educational computer based game usage was measured on a scale from 1 to 4 as shown in Table 37 below.

Table 37. Media Center Response Scale

1	2	3	4
No, students ***did not*** *have access to computers with educational computer-based games in the media center/open computer laboratory/library.*	*Yes, students did have access at the media center/open computer laboratory/library: There was* ***one computer*** *with educational computer-based games in the media center/open computer laboratory/library for* ***all students*** *in my class.*	*Yes, students did have access at the media center/open computer laboratory/library: There was* ***more than one computer*** *with educational computer-based games in the media center/open computer laboratory/library that was* ***shared by students*** *in my class.*	*Yes, students did have access at the media center/open computer laboratory/library: There was* ***one computer*** *with educational computer-based games in the media center/computer laboratory/library for* ***each student*** *in my class.*

If participants responded positively to the media center question, they were also asked how many hours a week students had access. Hours of access to media center educational computer based game usage was measured on a scale from 1 to 8 as shown in Table 38 below.

Table 38. Hours of Media Center Access Response Scale

1	2	3	4	5	6	7	8
Less than 1 hour per week	*1 to 2 hours per week*	*2 to 3 hours per week*	*3 to 4 hours per week*	*4 to 5 hours per week*	*5 to 10 hours per week*	*10 or more hours per week*	*Does not apply*

Responses formed the basis for statistical tests of each sub-hypothesis about the sample population to that question. Questions 5-7 are found in Appendix B. The sub-hypotheses are placed in the sub-categories of Access in the classroom, and Access in the media center.

Sub-category Access in the classroom

Sub-hypothesis 1 (ACCESS IN CLASSROOM): There will be no change in access to educational computer based games in the classroom over time.

Sub-category Access in the media center

Sub-hypothesis 2 (ACCESS IN MEDIA CENTER): There will be no change in access to educational computer based games in the media center over time.

Participants who responded to all Access questions were included in the analysis. The Chi-squared test was conducted to determine if observed differed significantly from expected levels of educational computer-based game usage over time (Conover, 1971). In Cohen's (1977) book, effect sizes are provided for most statistical tests and vary depending on the test. Effect sizes for the non-parametric Chi-squared test were provided. A medium effect size means an effect large enough to be seen by the naked eye. For statistical analysis conducted in this research, effect size of medium was chosen. For the Chi-squared test, a medium effect size is .3. For analysis of research question 6, desired alpha and β values were .05 and .2, respectively. Where appropriate, G*Power software (Faul et al., 2007) results will be provided. Actual alpha values for the Chi-squared test was .05. Actual β values ranged from .05-.22 due to sample response per survey question.

Detailed Analysis of sub-category Access in the classroom

ACCESS IN CLASSROOM survey question 5 (SQ A5) was analyzed to address this sub-hypothesis. β values ranged from .05-.11. Figure 56 provides the highest β values and other statistical parameters as calculated by G*Power (Faul et al., 2007) for analysis of ACCESS IN CLASSROOM (SQ A5).

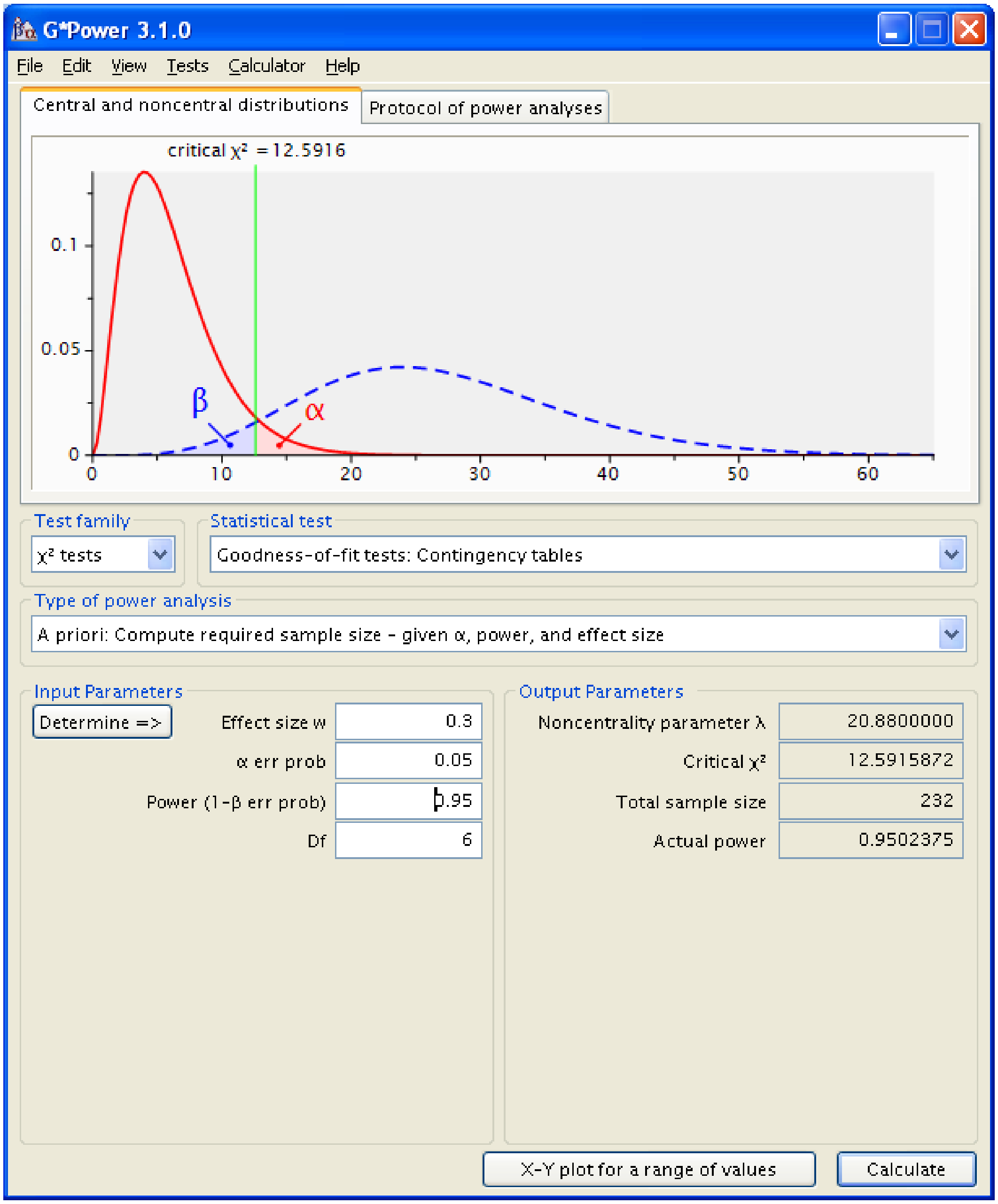

Figure 56. G*Power Calculation for High Beta Values for Chi-squared Test for Change in ACCESS IN CLASSROOM Over Time (SQ A5)

Figure 57 provides the highest and lowest β values and other statistical parameters as calculated by G*Power (Faul et al., 2007) for analysis of ACCESS IN CLASSROOM (SQ A5).

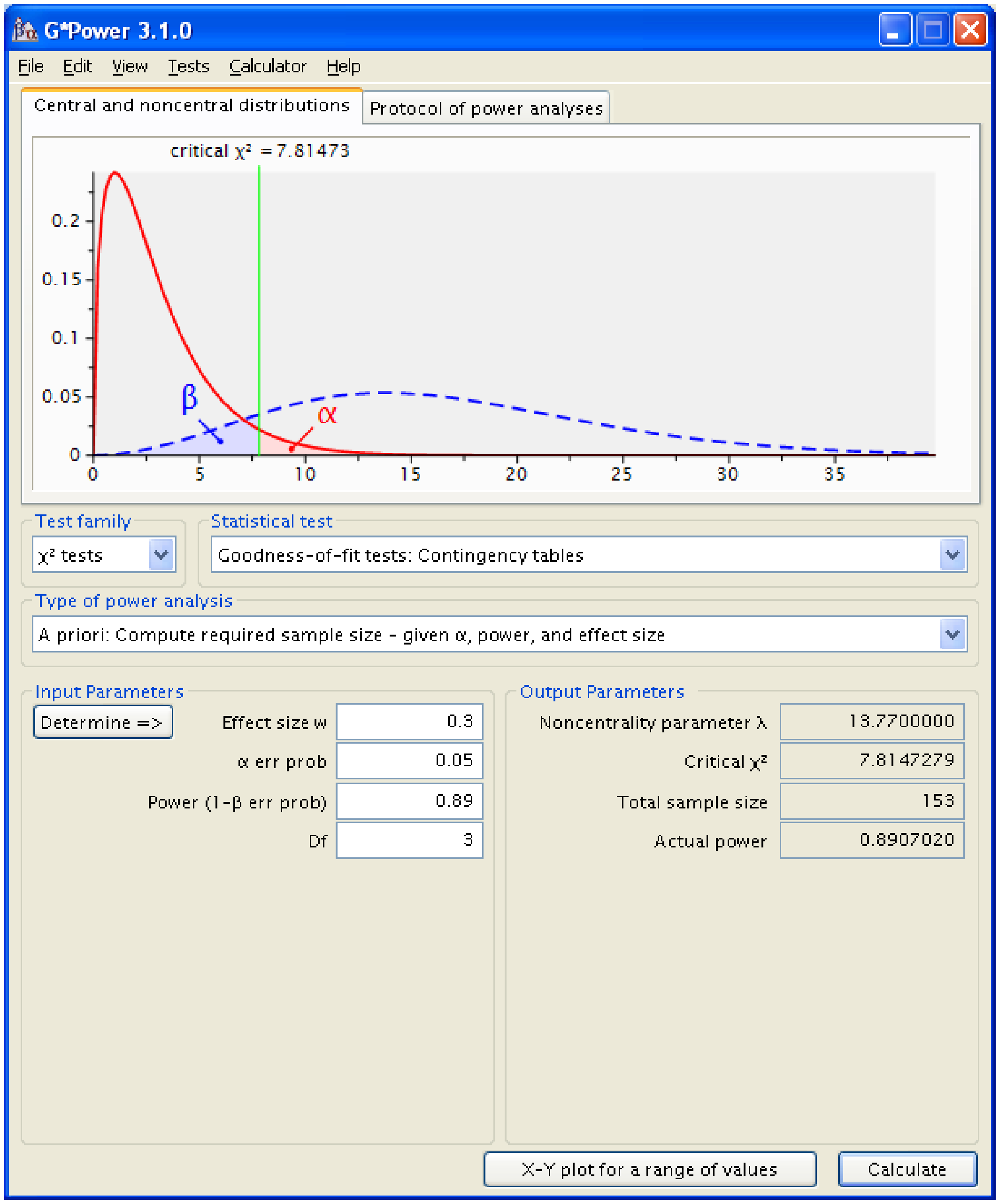

Figure 57. G*Power Calculation for Low Beta Values for Chi-squared Test for Change in ACCESS IN CLASSROOM Over Time (SQ A5)

A two-way contingency table analysis was conducted to evaluate whether access for students to computers with educational computer-based games in the classroom changed over time. There were two variables: year group and access. The year variable was segmented into year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009). The access variable was segmented into four categories which represent access to educational computer-based games in the classroom with four levels (No access; access – one computer to many students; access – more than one computer to many students; access – one computer per student). Overall, group and access were found to not be significantly related, Pearson χ^2 (6, N = 238) = 6.042, p=.418, Cramérs V = .113. The proportions of level of access per group was .395, .155, .403, and .046, respectively.

When any two groups were compared to each other, no significance was indicated. When comparing year group 1 (1996-1999) to year group 2 (2000-2004), Pearson χ^2 (3, N = 154) = .701, p=.873, Cramérs V = .067. When comparing year group 1 (1996-1999) to year group 3 (2005-2009), Pearson χ^2 (3, N = 158) = 5.337, p=.149, Cramérs V = .184 or when comparing year group 2 (2000-2004) to year group 3 (2005-2009), Pearson χ^2 (3, N = 164) = 3.914, p=.271, Cramérs V = .154. Results are presented in Table 39. For this analysis, observed counts were very close to expected counts, yielding results that were not significant.

Table 39. Contingency Table for ACCESS IN CLASSROOM

		Score				Total
		1	2	3	4	
		No access in classroom	Yes, one computer; many students	Yes, more than one computer; many students	Yes, one computer per student	
Year group 1 (1996-	Count	29	15	28	2	74
	Expected Count	29.2	11.5	29.8	3.4	74.0
	% within group	39.2%	20.3%	37.8%	2.7%	100.0%
Year group 2 (2000-	Count	29	15	32	4	80
	Expected Count	31.6	12.4	32.3	3.7	80.0
	% within group	36.3%	18.8%	40.0%	5.0%	100.0%
Year group 3 (2005-	Count	36	7	36	5	84
	Expected Count	33.2	13.1	33.9	3.9	84.0
	% within group	42.9%	8.3%	42.9%	6.0%	100.0%
Total	Count	94	37	96	11	238
	Expected Count	94.0	37.0	96.0	11.0	238.0
	% within group	39.5%	15.5%	40.3%	4.6%	100.0%

Detailed Analysis of sub-category Access in the media center

ACCESS IN MEDIA CENTER survey question 6 (SQ A6) and MEDIA CENTER WEEKLY HOURS survey question 7 (SQ A7) were analyzed to address this sub-hypothesis. β values ranged from .05-.11 for ACCESS IN MEDIA CENTER (SQ A6). Figure 58 provides the highest β values and other statistical parameters as calculated by G*Power (Faul et al., 2007) for analysis of ACCESS IN MEDIA CENTER (SQ A6).

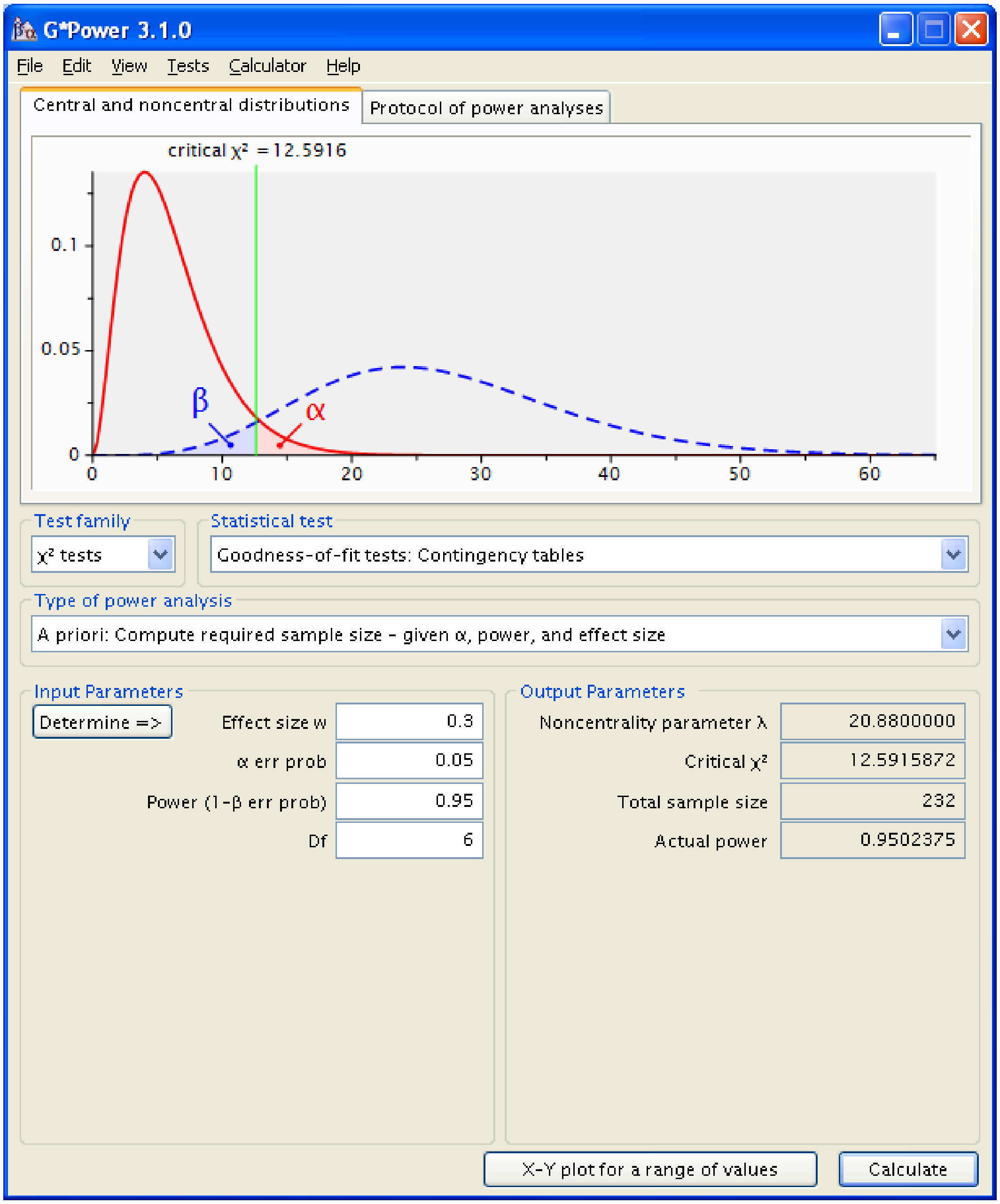

Figure 58. G*Power Calculation for High Beta Values for Chi-squared Test for Change in ACCESS IN MEDIA CENTER Over Time (SQ A6)

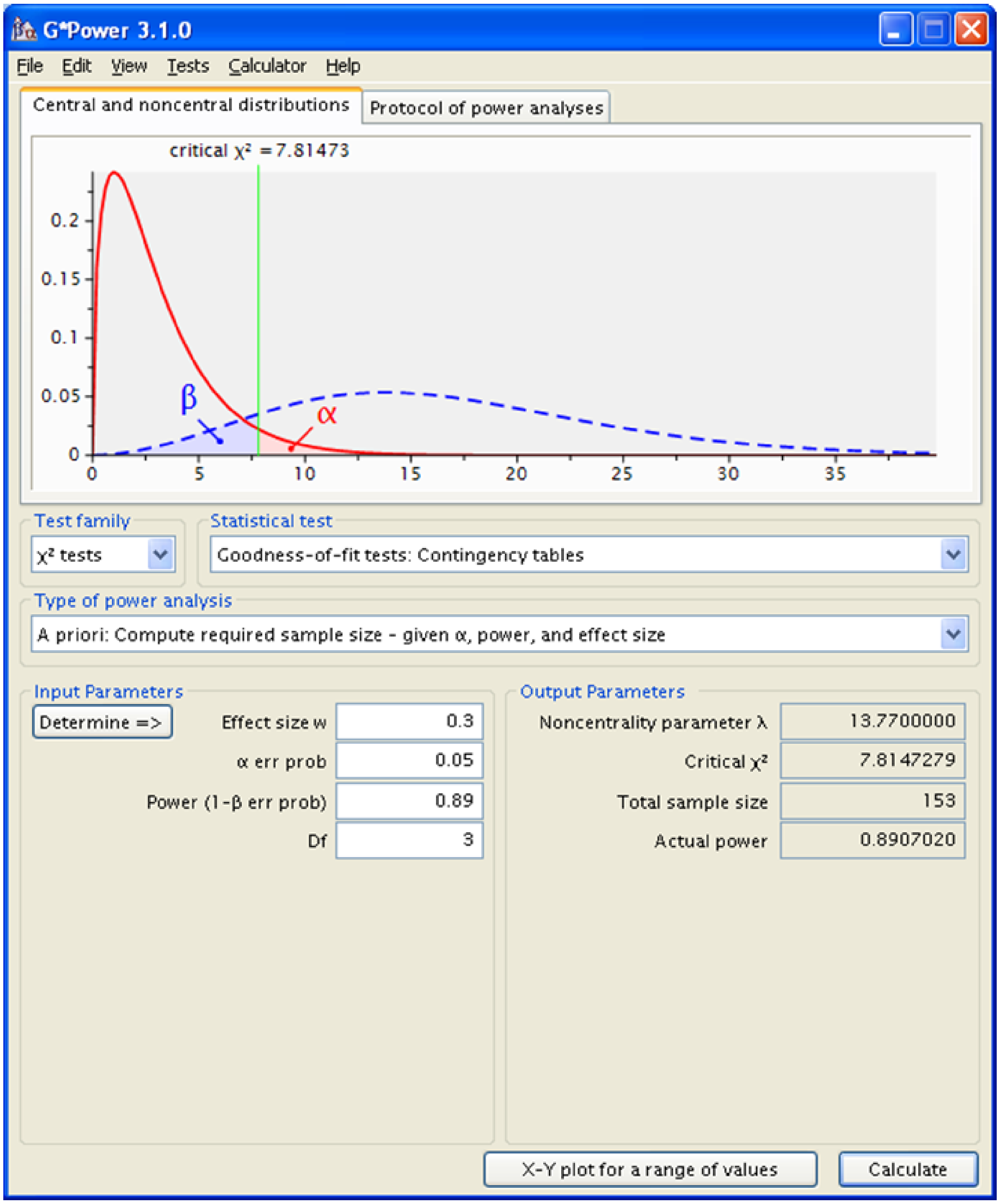

Figure 59 provides the lowest β values and other statistical parameters as calculated by G*Power (Faul et al., 2007) for analysis of ACCESS IN MEDIA CENTER (SQ A6).

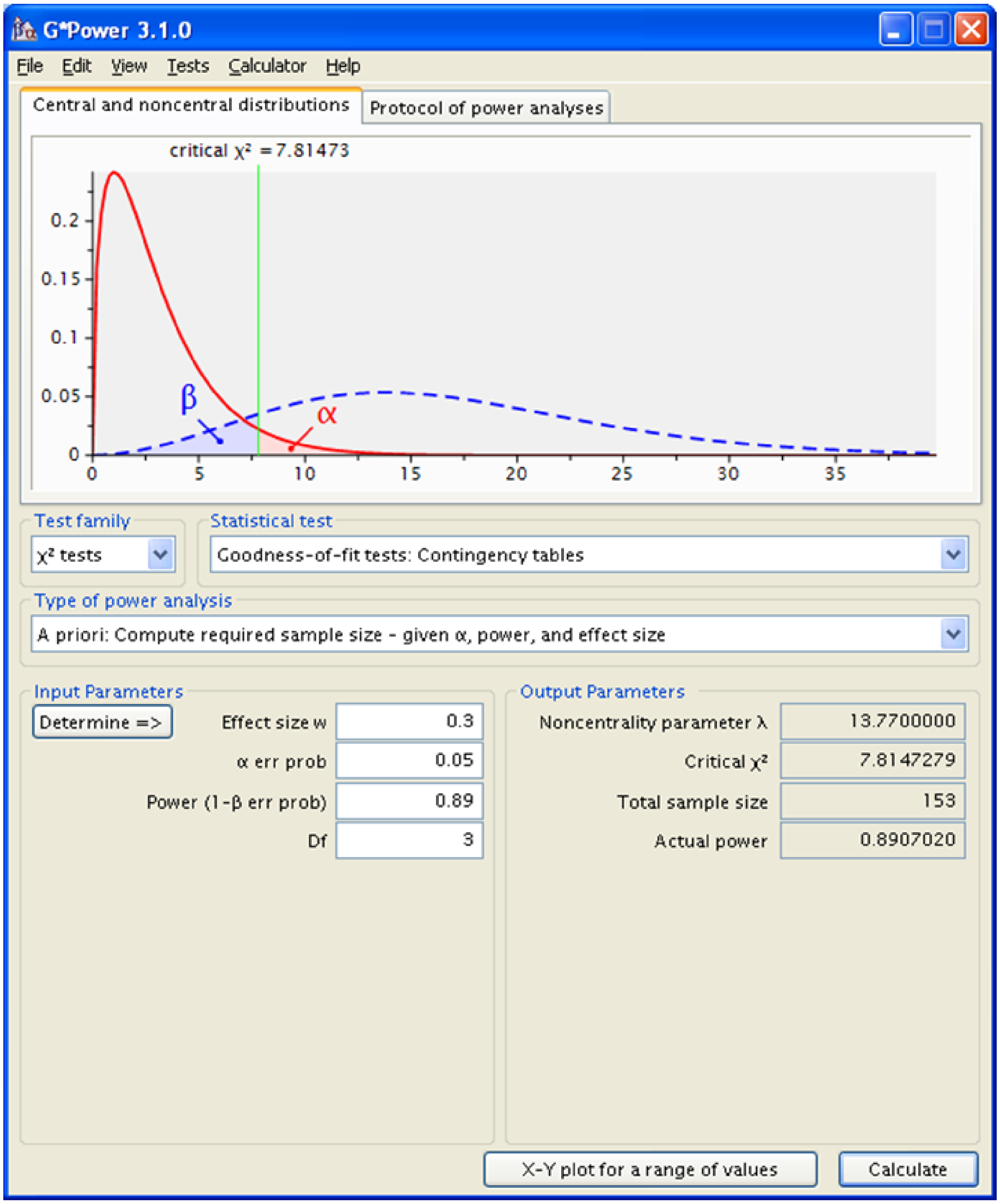

Figure 59. G*Power Calculation for Low Beta Values for Chi-squared Test for Change in ACCESS IN MEDIA CENTER Over Time (SQ A6)

β values ranged from .13-.22 for MEDIA CENTER WEEKLY HOURS survey question 7 (SQ A7).

Figure 60 Figure 61provides the highest β values and other statistical parameters as calculated by G*Power (Faul et al., 2007) for analysis of MEDIA CENTER WEEKLY HOURS (SQ A7).

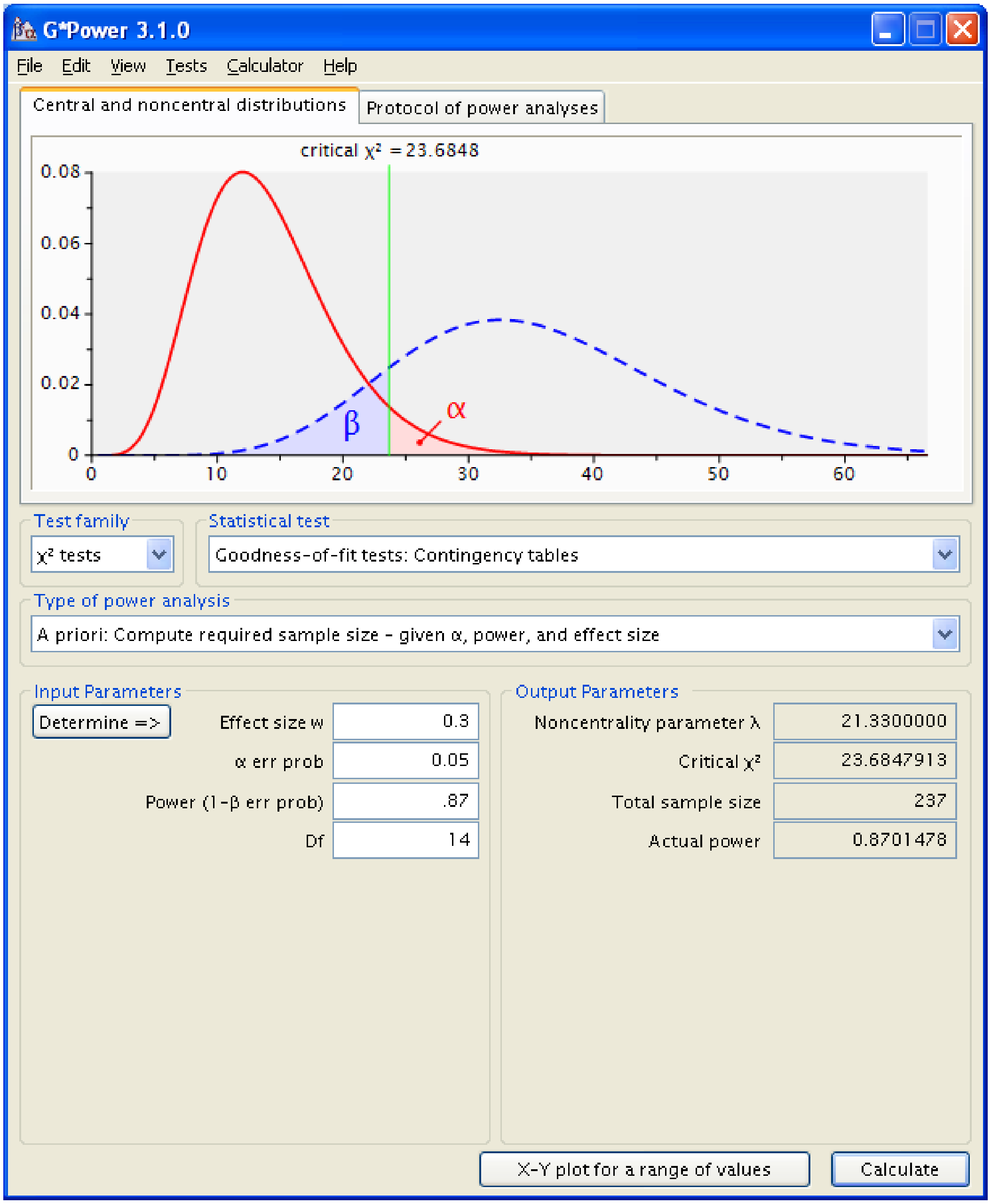

Figure 60. G*Power Calculation for High Beta Values for Chi-squared Test for Change in MEDIA CENTER WEEKLY HOURS Over Time (SQ A7)

Figure 61 provides the lowest β values and other statistical parameters as calculated by G*Power (Faul et al., 2007) for analysis of MEDIA CENTER WEEKLY HOURS (SQ A7).

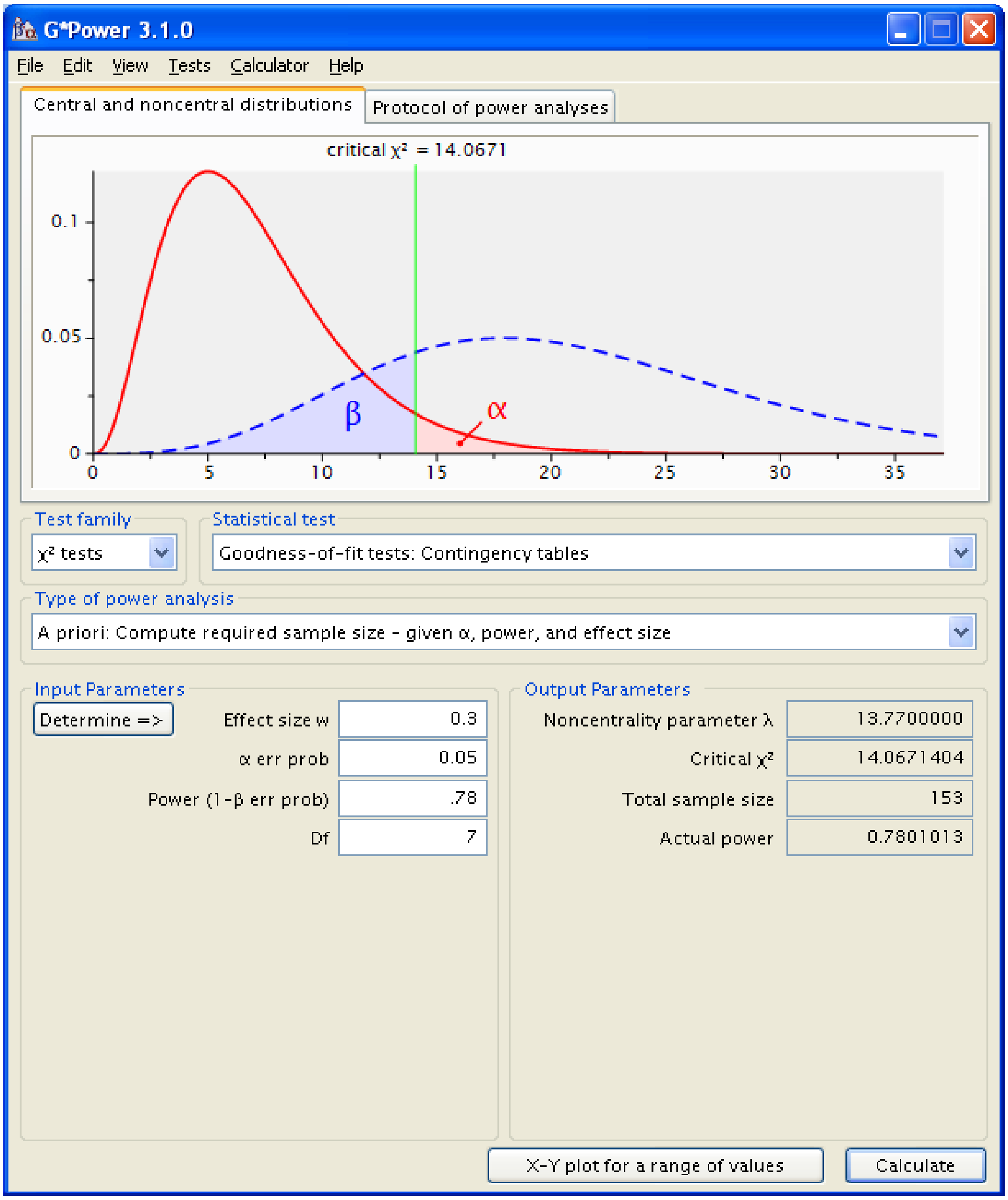

Figure 61. G*Power Calculation for Low Beta Values for Chi-squared Test for Change in MEDIA CENTER WEEKLY HOURS Over Time (SQ A7)

For ACCESS IN MEDIA CENTER (SQ A6), a two-way contingency table analysis was conducted to evaluate whether access for students to computers with educational computer-based games in the media center changed over time. The two variables were year group and access to media center. The year groups were segmented into three categories which represented three levels over time (year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009)). Media center access was segmented into four categories which represent access to educational computer-based games in a media center with four levels (No access; access – one computer to many students; access – more than one computer to many students; access – one computer per student). Overall, group and access were found to approach but not be significantly related, Pearson χ^2 (6, N = 238) = 12.203, p=.058, Cramérs V = .160. The proportions of level of access per group was .286, .046, .332, and .336, respectively.

When any two groups were compared to each other, significance was indicated only when comparing year group 1 (1996-1999) to year group 2 (2000-2004), Pearson χ^2 (3, N = 154) = 11.217, p=.011, Cramérs V = .270. No significance was indicated when comparing year group 1 (1996-1999) to year group 3 (2005-2009), Pearson χ^2 (3, N = 158) = 6.840, p=.149, Cramérs V = .208 or when comparing year group 2 (2000-2004) to year group 3 (2005-2009), Pearson χ^2 (3, N = 164) = 1.298, p=.730, Cramérs V = .089. Results are presented in Table 40.

Table 40. Contingency Table for Access in Media Center (SQ A6)

		Score 1	Score 2	Score 3	Score 4	Total
		No access in media center	Yes, one computer; many students	Yes, more than one computer; many students	Yes, one computer per student	
Year group 1 (1996-1999)	Count	24	4	32	14	74
	Expected Count	24.1	3.4	24.6	24.9	74.0
	% within group	32.4%	5.4%	43.2%	18.9%	100.0%
Year group 2 (2000-2004)	Count	19	4	22	35	80
	Expected Count	22.9	3.7	26.6	26.9	80.0
	% within group	23.8%	5.0%	27.5%	43.8%	100.0%
Year group 3 (2005-2009)	Count	25	3	25	31	84
	Expected Count	24.0	3.9	27.9	28.2	84.0
	% within group	29.8%	3.6%	29.8%	36.9%	100.0%
Total	Count	68	11	79	80	238
	Expected Count	68.0	11.0	79.0	80.0	238.0
	% within group	28.6%	4.6%	33.2%	33.6%	100.0%

For MEDIA CENTER WEEKLY HOURS (SQ A7), a two-way contingency table analysis was conducted to evaluate whether hours of access students had to computers with educational computer-based games in the media center changed over time. The two variables were group with three levels (year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009)) and hours of access to educational computer-based games in a media center with eight levels (1: less than 1 hr/wk; 2: 1-2 hrs/wk; 3: 2-3 hrs/wk; 4: 3-4 hrs/wk; 5: 4-5 hrs/wk; 6: 5-10 hrs/wk; 7: 10 or more hrs/wk; 8: does not apply). Overall, group and access were found to not be significantly related, Pearson χ2 (14, N = 238) = 8.190, *p*=.879, Cramérs *V* = .131. The proportions of level of access per group was .370, .290, .076, .046, .029, .034, .013, and .143, respectively.

When groups were compared to each other, again, there was no significance indicated. Comparing year group 1 (1996-1999) to year group 2 (2000-2004), Pearson χ^2 (7, *N* = 154) = .1.174, *p*=.992, Cramérs *V* = .087. Comparing year group 1 (1996-1999) to year group 3 (2005-2009), Pearson χ^2 (7, *N* = 158) = 6.099, *p*=.528, Cramérs *V* = .196. Comparing year group 2 (2000-2004) to year group 3 (2005-2009), Pearson χ^2 (7, *N* = 164) = 5.602, *p*=.587, Cramérs *V* = .185. Results are presented in Table 41.

Table 41. Contingency Table for Hours of Access in Media Center (SQ A7)

		Score								Total
		1	2	3	4	5	6	7	8	
		Less than 1 hr/wk	1-2 hrs/wk	2-3 hrs/wk	3-4 hrs/wk	4-5 hrs/wk	5-10 hrs/wk	10 or more hrs/wk	Does not apply	
Year group 1 (1996-1999)	Count	30	21	4	4	3	3	1	8	74
	Expected Count	27.4	21.5	5.6	3.4	2.2	2.5	.9	10.6	74.0
	% within group	40.5%	28.4%	5.4%	5.4%	4.1%	4.1%	1.4%	10.8%	100.0%
Year group 2 (2000-2004)	Count	29	23	6	4	2	4	2	10	80
	Expected Count	29.6	23.2	6.1	3.7	2.4	2.7	1.0	11.4	80.0
	% within group	36.3%	28.8%	7.5%	5.0%	2.5%	5.0%	2.5%	12.5%	100.0%
Year group 3 (2005-2009)	Count	29	25	8	3	2	1	0	16	84
	Expected Count	31.1	24.4	6.4	3.9	2.5	2.8	1.1	12.0	84.0
	% within group	34.5%	29.8%	9.5%	3.6%	2.4%	1.2%	0.0%	19.0%	100.0%
Total	Count	88	69	18	11	7	8	3	34	238
	Expected Count	88.0	69.0	18.0	11.0	7.0	8.0	3.0	34.0	238.0
	% within group	37.0%	29.0%	7.6%	4.6%	2.9%	3.4%	1.3%	14.3%	100.0%

Research Question 6 Summary

For the first sub-hypothesis, access in the classroom, all results were not significant, meaning, there was no change in access to educational computer based games in the classroom over time. For the second sub-hypothesis, access in the media center, only one of the eight analyses conducted – comparing media center access - comparing year group 1 (1996-1999) to year group 2 (2000-2004) indicated a significant difference. As a result of these analyses, we can conclude that the actual hypothesis (H_0) can be accepted for any combination of years except for media center access for year group 1 (1996-1999) but only when comparing year group 2 (2000-2004). Even this is a little sketchy, because the follow on question yielded results that were not significant for this, or any, year group comparison. For all other years, the actual hypothesis (H_0) must be accepted - there was no change in access students had to computers with educational computer-based games to meet subject objectives over time.

Research Question 7 (Instructional techniques used over time):

Which of the following instructional techniques are used most when incorporating educational computer-based games in the classroom over time?

H_0 = There is no difference among use of instructional techniques when incorporating educational computer-based games over time.

H_a = There is a difference among use of instructional techniques when incorporating educational computer-based games over time.

To investigate this hypothesis, each participant was asked to express the strength of his/her response to one question about the instructional techniques they used when incorporating educational computer based games in the classroom. Strength of instructional strategies was measured on a scale from 1 to 6 as shown in Table 42.

Table 42. Instructional Strategies Response Scale

1	2	3	4	5	6
As a class topic opener	*Summarization tool*	*One of many strategies for teaching objectives*	*Main strategy for teaching objective*	*Enabled students to interact with the computer-based game individually*	*Enabled students to interact with the computer-based game as a group*

Participants who responded to question 21 (located in Appendix B) were included in the analysis. The Chi-squared test was conducted to determine if the instructional techniques for incorporating educational computer-based games changed over time. For analysis of research question 6, desired alpha and β values were .05 and .2, respectively. Actual alpha for Chi-squared test was .05. β values ranged from .05-.12 due to sample response per survey question. In Cohen's (1977) book, effect sizes are provided for most statistical tests and vary depending on the test. Effect sizes for the non-parametric Chi-squared test were provided. A medium effect size means an effect large enough to be seen by the naked eye. For statistical analysis conducted in this research, effect size of medium was chosen. For the Chi-squared test, a medium effect size is .3. Figure 62 provides the statistical parameters as calculated by G*Power (Faul et al., 2007) for the Chi-squared test conducted on all three groups.

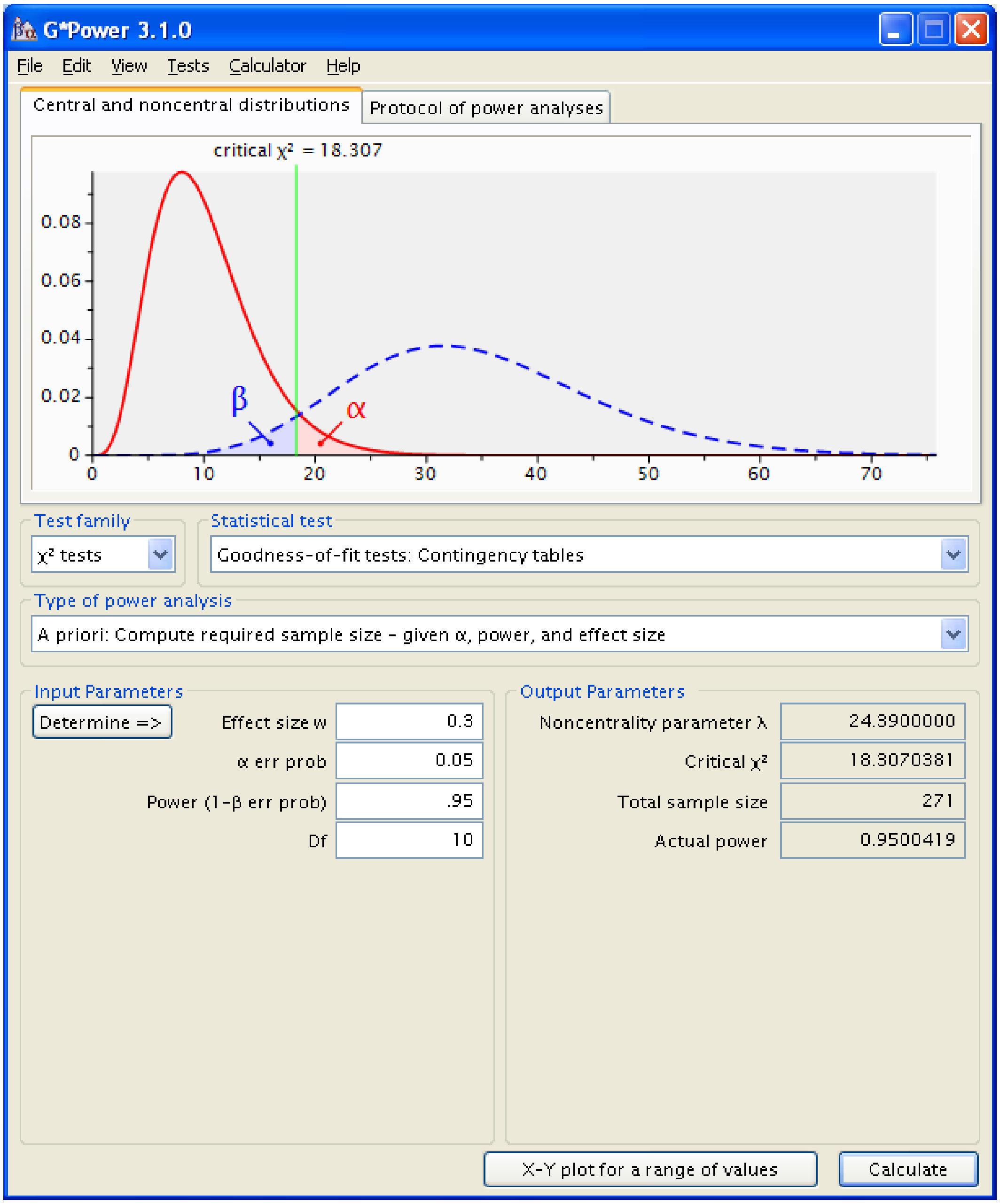

Figure 62. G*Power Calculation for Alpha and Beta Values for Chi-squared Test for year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009)

Figure 63 provides the minimal β values and statistical parameters as calculated by G*Power (Faul et al., 2007) for the Chi-squared test conducted on any two of the three groups. The full data set is provided in Appendix C.

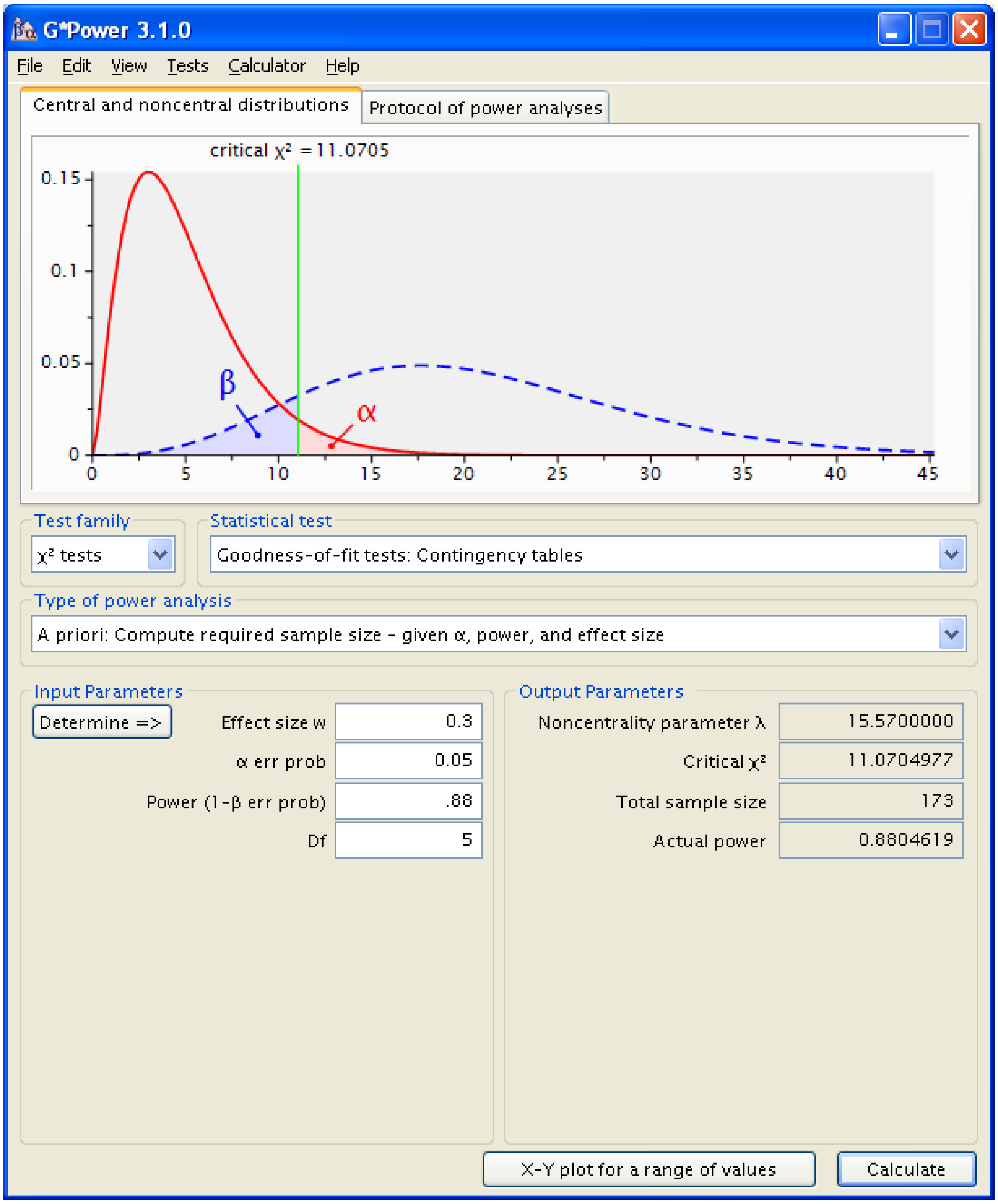

Figure 63. G*Power Calculation for Alpha and Beta Values for Chi-squared Test for Any Two of Three Year Groups

A two-way contingency table analysis was conducted to evaluate if there were differences among instructional techniques when incorporating educational computer-based games in the classroom among year group 1 (1996-1999), year group 2 (2000-

2004), and year group 3 (2005-2009). The two variables were year group and instructional technique. Year group consisted of three categories which represented three levels over time (year group 1 (1996-1999), year group 2 (2000-2004), and year group 3 (2005-2009)). Instructional techniques responses were placed into six categories which represented six different types of educational computer-based game incorporation (1: topic opener; 2: summarization; 3: one of many strategies; 4: main strategy; 5: students interact with game individually; 6: students interacted with game as a group). Group and instructional techniques were not found to be significantly related, Pearson χ^2 (10, N = 280) = 9.757, p=.462, Cramérs V = .132. The proportions of game usage per group was .1, .125, .257, .05, .264, and .204, respectively.

When any two groups were compared to each other, again, there was no significance indicated. Comparing year group 1 (1996-1999) to year group 2 (2000-2004) Pearson χ^2 (5, N = 173) = 1.058, p=.958, Cramérs V = .078. When comparing year group 1 (1996-1999) to year group 3 (2005-2009), Pearson χ^2 (5, N = 174) = 7.100, p=.213, Cramérs V = .202. When comparing year group 2 (2000-2004) to year group 3 (2005-2009), Pearson χ^2 (5, N = 213) = 8.027, p=.155, Cramérs V = .194. Results are presented in Table 43.

Table 43. Contingency Table for Instructional Techniques Used Over Time (E21)

		Instructional Strategy						Total
		1	2	3	4	5	6	
		Topic Opener	Summarization	One of many strategies	Main strategy	Enabled students to interact with game individually	Enabled students to interact with game as a group	
Year group 1 (1996-1999)	Count	7	6	19	5	16	14	67
	Expected Count	6.7	8	17	3	18	14	67
	% within group	10.4%	9.0%	28.4%	7.5%	23.9%	20.9%	100.0%
Year group 2 (2000-2004)	Count	9	11	25	8	31	22	106
	Expected Count	10.6	13	27	5	28	22	106.0
	% within group	8.5%	10.4%	23.6%	7.5%	29.2%	20.8%	100.0%
Year group 3 (2005-2009)	Count	12	18	28	1	27	21	107
	Expected Count	10.7	13	28	5	28	22	107.0
	% within group	11.2%	16.8%	26.2%	90.0%	25.2%	19.6%	100.0%
Total	Count	28	35	72	14	74	57	280
	Expected Count	28.0	35.0	72.0	14.0	74.0	57.0	280.0
	% within group	10.0%	12.5%	25.7%	5.0%	26.4%	20.4%	100.0%

Research Question 7 Summary

Due to the lack of significant results, we cannot reject the null hypothesis that there is no difference among use of instructional techniques over time. Comparisons among all year groups indicated no significant change in how educational computer based games are used.

Emergent Research Questions:

During the conduct of this research, several research questions arose from analysis of the data and feedback on presentation of the results. Three of the questions were addressed within the scope of this dissertation. The three questions were:

Is there a statistically significant difference among PEOU and PU scores for teachers based on subject taught in the year they won the Milken Educator Award?

Is there a statistically significant difference in educational computer-based game use between Elementary (K-5) and Secondary (6-12) grades?

Between instructors of Elementary and Secondary grades, is the teacher's level of acceptance of educational computer-based games different from ambivalence based on each dimension of acceptance?

Related hypotheses and analysis is provided below.

Research Question 8 (PEOU and PU scores compared per subject taught):

Is there a statistically significant difference among PEOU and PU scores for teachers based on subject taught in the year they won the Milken Educator Award?

H_0 = There is no statistical difference for PEOU and PU scores among teachers based on the subjects they taught the year they won the Milken Educator Award.

H_a = There is a statistical difference for PEOU and PU scores among teachers based on the subjects they taught the year they won the Milken Educator Award.

As the first of three additional analyses conducted, PEOU and PU individual scores were separated by subject to see if there was a significant difference among teachers depending on the subject they taught the year they won the Milken Educator Award. As mentioned in the overall Results section, teachers who taught Language Arts (LA) provided the greatest number of responses. Math teachers provided the next greatest number of responses, Science third, and finally, Social Studies. What this meant, was that subjects ended up needing to be grouped in order to obtain values close enough to conduct analyses. Table 44 presents the distribution of response rates by subject.

Table 44. Distribution of Response Rate by Subject

Subject	PEOU	PU
LA	582	485
SS	120	100
Total	702	585
M	336	280
S	288	240
Total	624	520

As a result, teachers who reported teaching Language Arts (LA) and Social Studies (SS) subjects the year they won the Milken Educator Award were grouped together, while teachers who reported teaching Math (M) and Science (S) subjects the year they won the Milken Educator Award were grouped together. Two analyses were conducted: one for PEOU scores comparing teachers of LA and SS subjects to teachers of M and S subjects, and another for PU scores comparing teachers of LA and SS subjects to teachers of M and S subjects. In this analysis, teachers were not separated by year groups as was conducted in most analyses previously; rather, all individual scores for all attributes were analyzed. Averaging was not conducted. Strength of acceptance of each question was measured on a scale from 1 to 7 as shown in Table 45 below.

Table 45. TAM Response Scale

1	2	3	4	5	6	7
Extremely Unlikely	Quite Unlikely	Slightly Unlikely	Neither Likely nor Unlikely	Slightly Likely	Quite Likely	Extremely Likely

Responses formed the basis for statistical tests of each sub-hypothesis about the sample population to that question. Questions 8-18 are found in Appendix B.

Sub-hypothesis 1 (PEOU BY SUBJECT GROUP): There is no difference for PEOU scores among teachers based on the subjects they taught the year they won the Milken Educator Award.

Sub-hypothesis 2 (PU BY SUBJECT GROUP): There is no difference for PU scores among teachers based on the subjects they taught the year they won the Milken Educator Award.

Participants who responded to all questions were included in this analysis. Because data was ordinal, the non-parametric version of the *t*-test, the Wilcoxon signed-rank test, was the test used to determine the statistical significance of inferences for group and dimension combinations. G*Power software version 3.1.0 was used. G*Power enables one to input alpha, β, and effect size while computing actual power for a given alpha and effect size. For analysis of research question 1, desired alpha and β values were .05 and .2, respectively. Actual alpha and beta values were .05 and .01, respectively. In Cohen's (1977) book effect sizes are provided for most statistical tests and vary depending on the test. While effect sizes for the non-parametric Wilcoxon signed-rank test were not provided, values for the parametric alternative, the *t*-test, were. A medium effect size means an effect large enough to be seen by the naked eye. For statistical analysis conducted in this research, effect size of medium was chosen. For the Wilcoxon signed-rank test, a medium effect size is .50. Figure 64 provides the statistical parameters as calculated by G*Power (Faul et al., 2007). The full data set is provided in Appendix C.

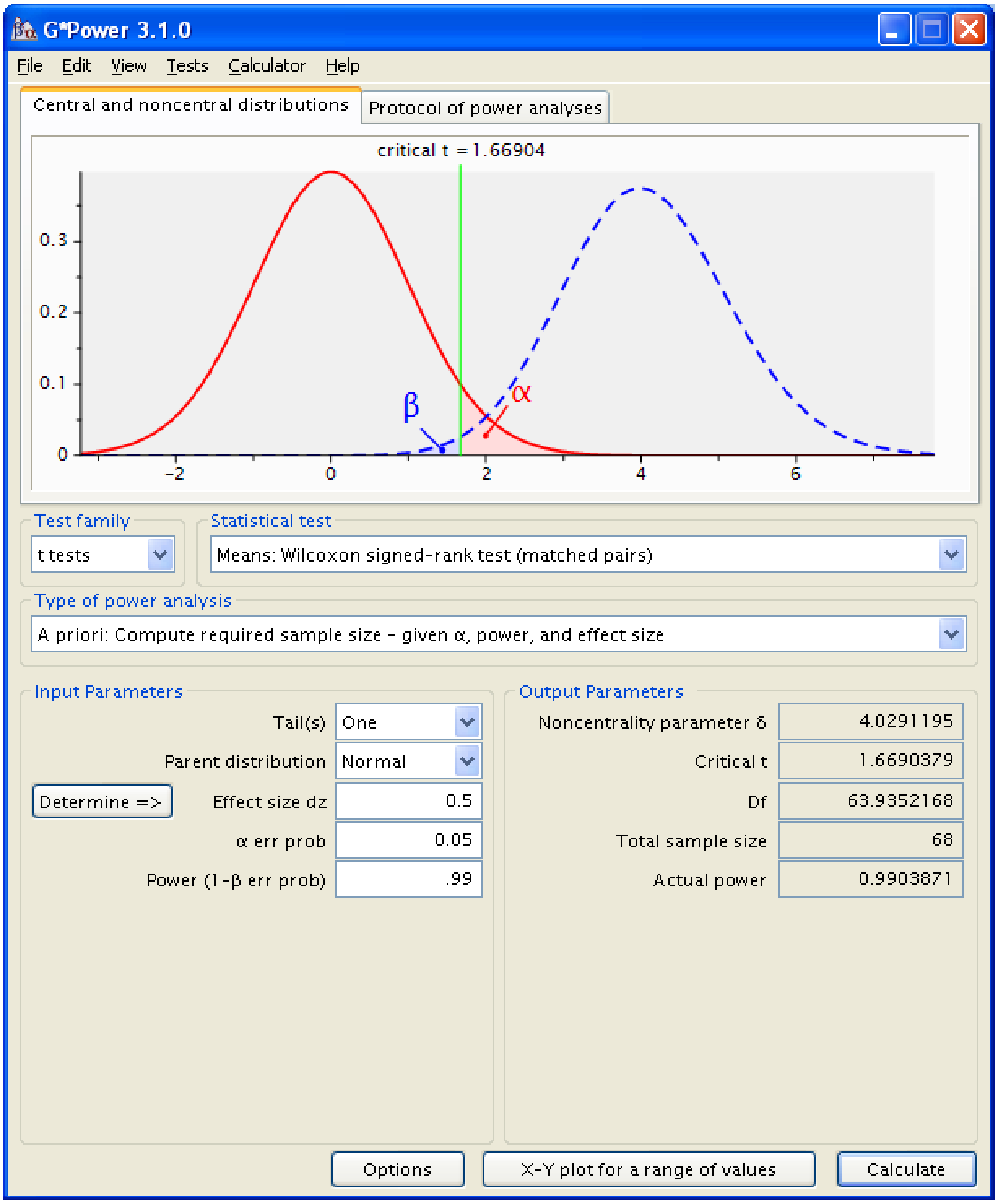

Figure 64. G*Power Calculation for Alpha and Beta Values for Wilcoxon Signed-Rank Test

Table 46 summarizes the statistical results of sub-hypothesis 1. It illustrates that for PEOU scores, teachers who taught LA and SS subjects were no different in their perception of ease of use of educational computer-based games in the classroom than teachers who taught M and S subjects.

Table 46. Results of Sub-hypothesis 1 for RQ8

PEOU Scores	α = .05 *p* values	β (beta)
LASS-MS	*p* = .747	0.01

Table 47 summarizes the statistical results of sub-hypothesis 2. It illustrates that for PU scores, teachers who taught LA and SS subjects were no different in their perception of usefulness of educational computer-based games in the classroom than teachers who taught M and S subjects.

Table 47. Results of Sub-hypothesis 2 for RQ8

PU Scores	α = .05 *p* values	β (beta)
LASS-MS	*p* = .129	0.01

Detailed Analysis of PEOU by Subject Groups

The Wilcoxon signed-rank test indicates no significant difference for PEOU scores between teachers who taught LA and SS subjects and those who taught M and S subjects, z = -.322, *p*=.747. The mean of values for teachers who taught LA and SS subjects was 5.607 (closest to “Quite Likely”), while the mode was 6 (“Quite Likely”). The mean of values for teachers who taught M and S subjects was also 5.607 (closest to “Quite Likely”), while the mode was 6 (“Quite Likely”). PEOU scores comparing teachers of LA and SS subjects to those of M and S subjects are illustrated in Figure 65.

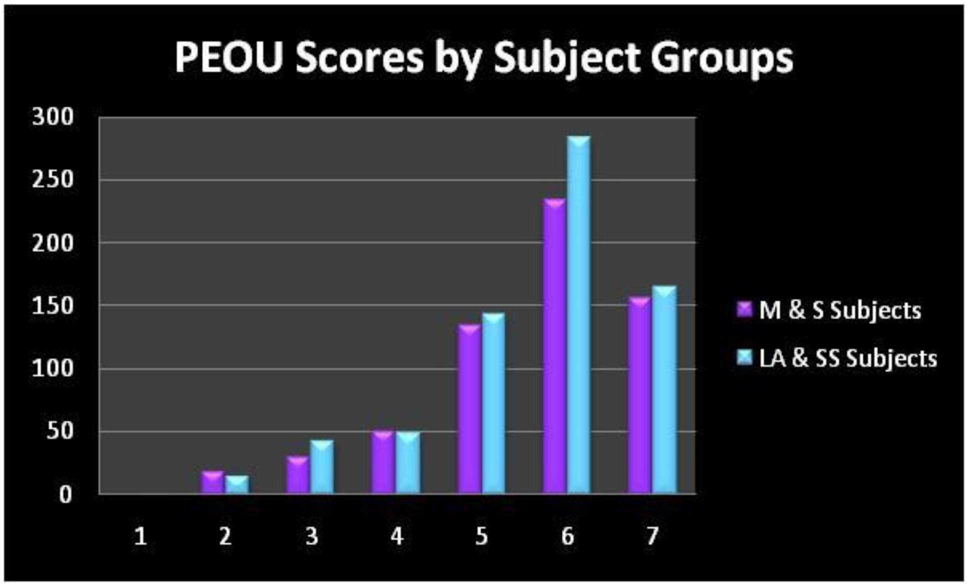

Figure 65. PEOU Scores by Subject Groups

Detailed Analysis of PU by Subject Groups

The Wilcoxon signed-rank test indicates no significant difference for PU scores between teachers who taught LA and SS subjects and those who taught M and S subjects, z = -1.519, *p*=.129. The mean of values for teachers who taught LA and SS subjects was 4.657 (closest to “Slightly Likely”), while the mode was 5 (“Slightly Likely”). The mean of values for teachers who taught M and S subjects was 4.473 (closest to “Slightly Likely”), while the mode was 5 (“Slightly Likely”). PU scores comparing teachers of LA and SS subjects to those of M and S subjects are illustrated in Figure 66.

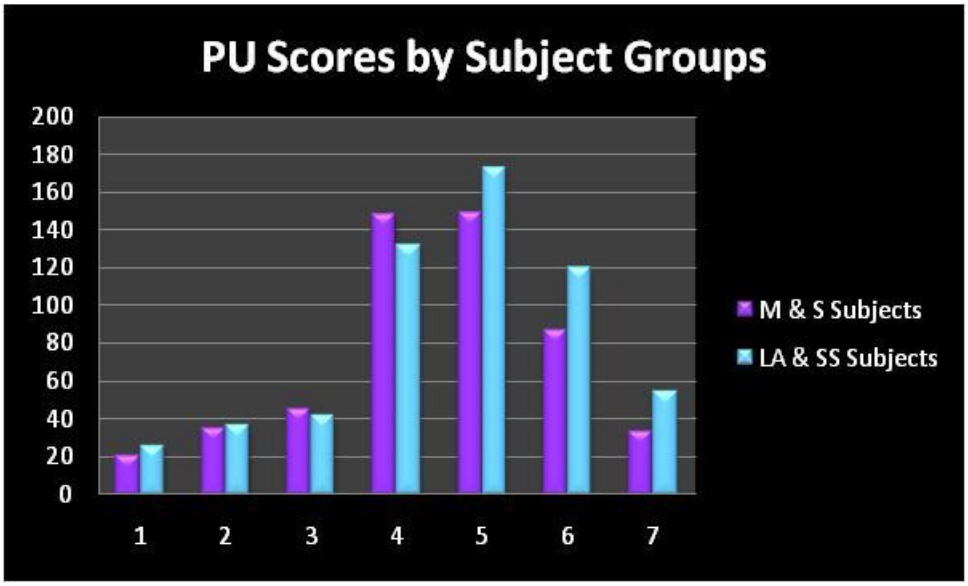

Figure 66. PU Scores by Subject Groups

Research Question 8 Summary

As with previous analyses, PEOU scores are higher than PU scores, but this analysis shows that between subjects, all teachers felt similarly about both dimensions. They feel more positively towards perceived ease of use than perceived usefulness, across the board, but by subject there was no difference. Therefore, we accept the null hypothesis that there is no difference for PEOU and PU scores among teachers based on the subjects they taught the year they won the Milken Educator Award.

Research Question 9 (Use of educational computer games between Elementary and Secondary grades):

Is there a statistically significant difference in educational computer-based game use between Elementary (K-5) and Secondary (6-12) grades?

H_0 = There is no statistical difference in educational computer-based game use between Elementary (K-5) and Secondary (6-12) grades.

H_a = There is a statistical difference in educational computer-based game use between Elementary (K-5) and Secondary (6-12) grades.

As the second of three additional analyses conducted, three responses were asked of participants: 1) whether or not educational computer games were used as an instructional strategy for the grade level the year they won the Milken Educator Award (E19 DID YOU USE GAMES), 2) to list the names of the educational computer games that were used (part one of E20 NAMES AND HOURS OF GAMES USED), and 3) to provide the approximate total number of hours allotted for student use on each game listed for the grade level the year they won the Milken Educator Award (part two of E20 NAMES AND HOURS OF GAMES USED).

Responses formed the basis for statistical tests of each sub-hypothesis about the sample population to that question. Questions 19 and 20 are found in Appendix B. The sub-hypotheses are placed in the sub-categories of Change in percentage of users and Change measured by hours of use.

Sub-category Change in percentage of users

Sub-hypothesis 1: There will be no change in the level (percentage) of instructors using educational computer-based games in the classroom between instructors of Elementary and Secondary grades.

Sub-category Change in game usage as measured by quantity of games and hours of use by instructors using games

Sub-hypothesis 2: There will be no change in the quantity of educational computer-based games used by instructors in the classroom between Elementary and Secondary grades.

Sub-hypothesis 3: There will be no change in the level of educational computer-based games usage as measured by change in amount of hours allocated per student in the classroom by an individual instructor between Elementary and Secondary grades.

All available data was included for analyzing each sub-hypothesis. This means all valid responses to E19 DID YOU USE GAMES, part one of E20 NAMES AND HOURS OF GAMES USED, and part two of E20 NAMES AND HOURS OF GAMES USED were included.

For analysis of this research question, desired alpha and beta values were .05 and .2, respectively. Actual alpha values were .05, while actual beta values were .005. The Chi-squared was conducted to determine if observed differed significantly from expected levels (Conover, 1971) of educational computer-based game usage between Elementary and Secondary grades. This test analyzed the results in survey question E19 DID YOU USE GAMES. In Cohen's (1977) book effect sizes are provided for most statistical tests and vary depending on the test. Effect sizes for the non-parametric Chi-squared test were provided. A medium effect size means an effect large enough to be seen by the naked eye. For statistical analysis conducted in this research, effect size of medium was chosen. For the Chi-squared test, a medium effect size is .3.

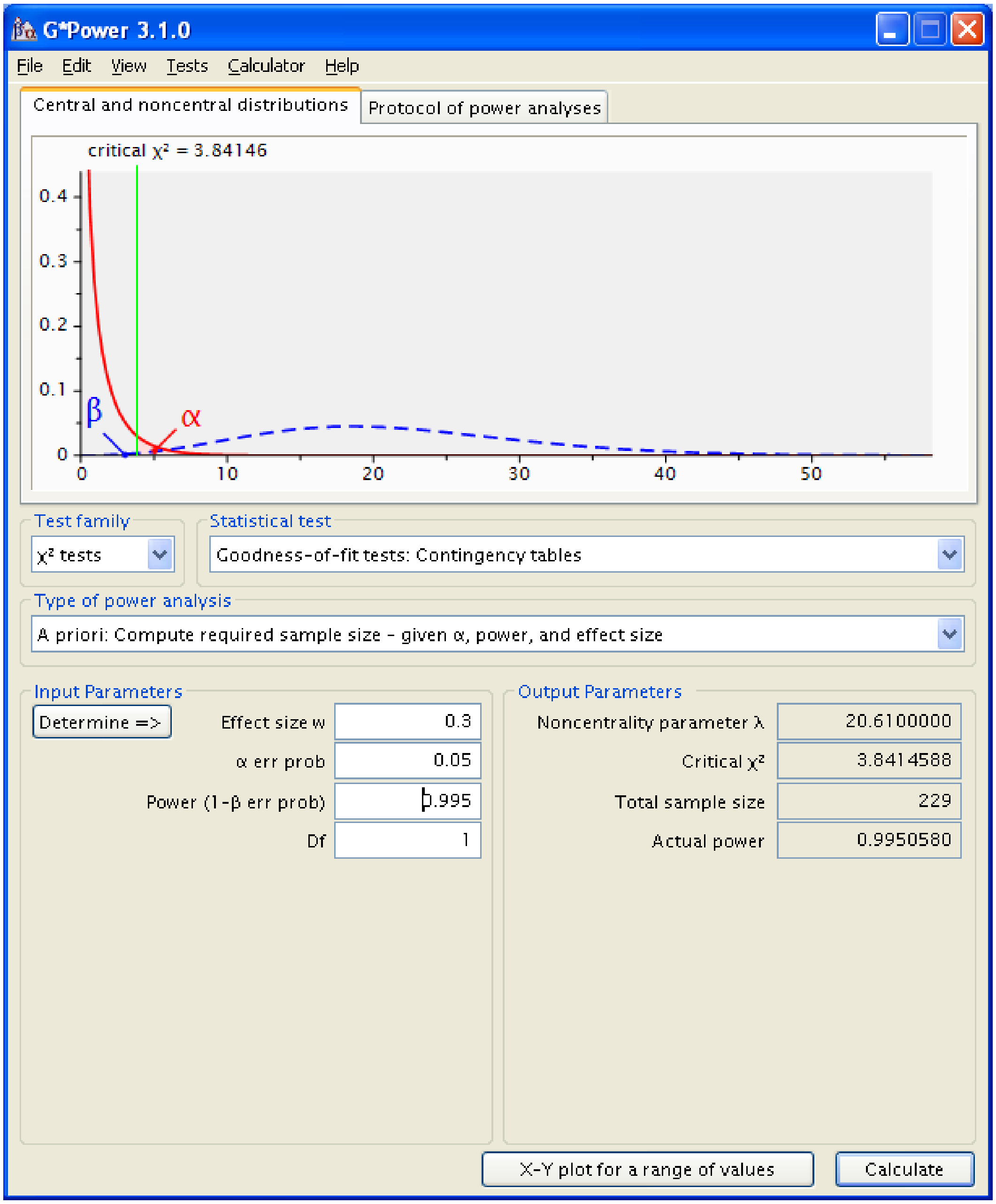

Figure 67 provides the statistical parameters as calculated by G*Power (Faul et al., 2007) for the Chi-squared test conducted on both groups.

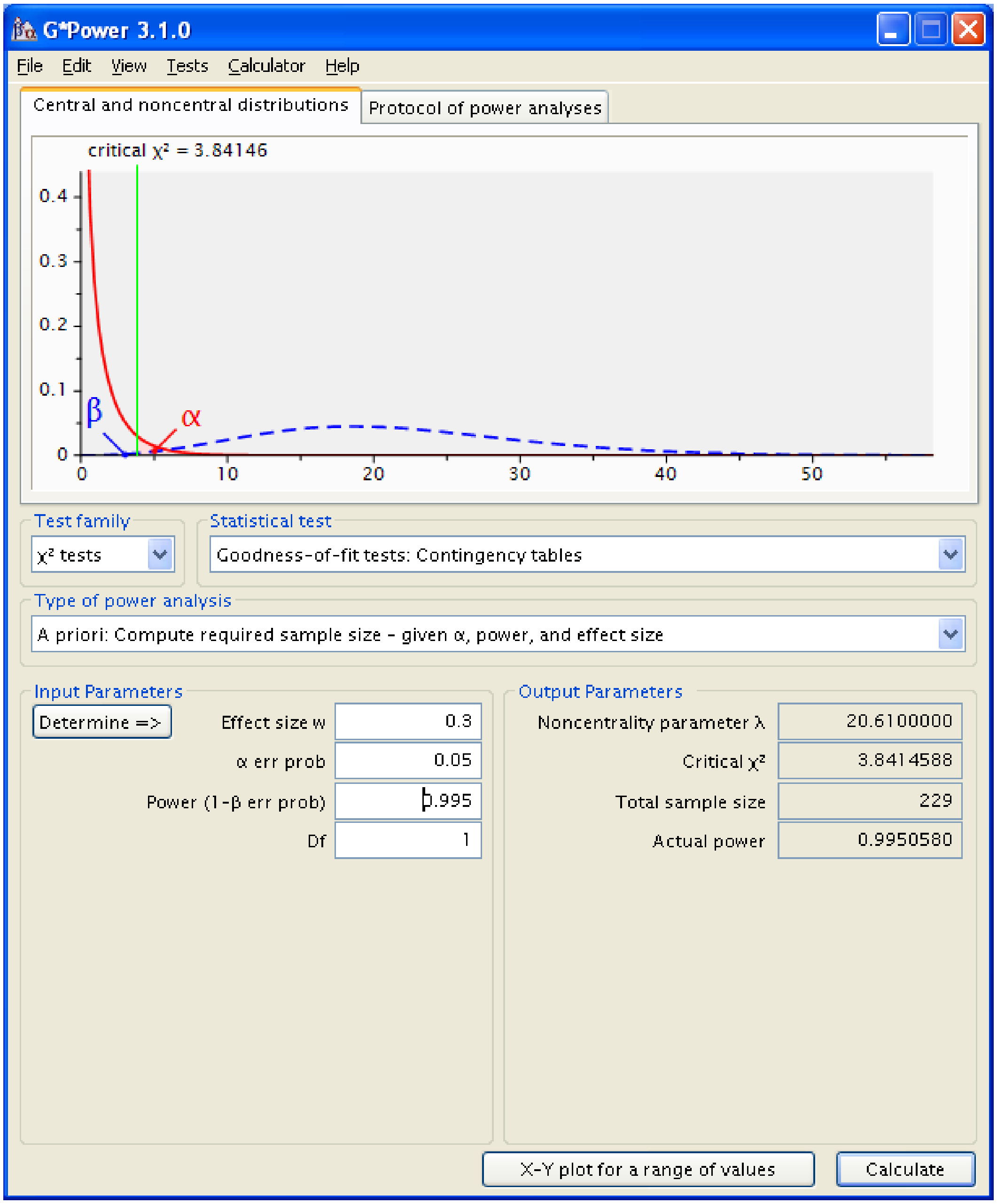

Figure 67. G*Power Calculation for Alpha and Beta Values for Chi-squared Test for Elementary and Secondary Grades

Homogeneity Test Analysis

Homogeneity tests were conducted to validate the response rate of teachers of Elementary and Secondary grades who responded to E19 DID YOU USE GAMES and those who responded to part one of E20 NAMES AND HOURS OF GAMES USED. Homogeneity tests are used to determine whether frequency counts are distributed identically across different populations (Conover, 1971). When using Elementary (grades K-5) and Secondary (grades 6-12) teachers' responses in comparing E19 DID YOU USE GAMES to part one of E20 NAMES AND HOURS OF GAMES USED, counts were not significant, meaning, they were homogeneous, Pearson $\chi 2$ (1, N = 92) = .379, p=.538, Cramérs V = .064. The proportions of level of game usage per level was .174 and .826, respectively. What this means is that the responses to part one of E20 NAMES AND HOURS OF GAMES USED are similarly representative of the two groups of those who responded to E19 DID YOU USE GAMES. Counts are illustrated in Table 48.

Table 48. Number of Games Users to Number of Users who Listed Games – Elementary to Secondary Teachers

		No of games users to No of users who listed games		Total
		No of games users	No of users who listed games	
Elementary Teachers (Grades K-5)	Count	46	11	57
	Expected Count	47.1	9.9	57.0
	% within Group	80.7%	19.3%	100.0%
Secondary Teachers (Grades 6-12)	Count	30	5	35
	Expected Count	28.9	6.1	35.0
	% within Group	85.7%	14.3%	100.0%
Total	Count	76	16	92
	Expected Count	76.0	16.0	92.0
	% within Group	82.6%	17.4%	100.0%

Follow up homogeneity tests were conducted to validate the response rate of those who responded to E19 DID YOU USE GAMES and those who responded to part two of E20 NAMES AND HOURS OF GAMES USED. When using Elementary (grades K-5) and Secondary (grades 6-12) teachers' responses in comparing E19 DID YOU USE GAMES to part two of E20 NAMES AND HOURS OF GAMES USED, again, counts were not significant, meaning, homogeneous, Pearson $\chi 2$ (1, N = 92) = 1.423, p=.233, Cramérs V = .124. The proportions of level of game usage per level was .239 and .761, respectively. What this means is that responses to part two of E20 NAMES AND HOURS OF GAMES USED are similarly representative of the two groups of those who responded to E19 DID YOU USE GAMES. Counts are presented in Table 49.

Table 49. Number of Games Users to Number of Users who Cited Hours of Game Use in Classroom - Elementary to Secondary Teachers

		No of games users to No of users who cited hours of game use in classroom		Total
		No of games users	No of users who cited hours of game use in classroom	
Elementary Teachers (Grades K-5)	Count	41	16	57
	Expected Count	43.4	13.6	57.0
	% within Group	71.9%	28.1%	100.0%
Secondary Teachers (Grades 6-12)	Count	29	6	35
	Expected Count	26.6	8.4	35.0
	% within Group	82.9%	17.1%	100.0%
Total	Count	70	22	92
	Expected Count	70.0	22.0	92.0
	% within Group	76.1%	23.9%	100.0%

Detailed Analysis of sub-category Change in percentage of users

When analyzing Change in percentage of users, responses to survey question E19 DID YOU USE GAMES and part one of E20 NAMES AND HOURS OF GAMES USED were analyzed.

DID YOU USE GAMES Group Differences

A two-way contingency table analysis was conducted to evaluate whether actual usage of educational computer-based games changed between Elementary and Secondary grade teachers. Participant responses for E19 DID YOU USE GAMES were investigated. There were two variables: grade and actual use. The grade variable was segmented into two levels: Elementary teachers (grades K-5) and Secondary teachers (grades 6-12). The actual usage of educational computer-based games variable was segmented into two levels: those who did use games and those who did not. Overall, group and actual game usage were found to not be significantly related, Pearson χ^2 (1, *N* = 233) = 29.507, *p*<.001, Cramérs *V* = .356. The proportions of level of game usage per level was .395 and .605, respectively. Counts are presented in Table 50 below.

Table 50. Level (percentage) of Instructors Using Educational Computer-Based Games in the Classroom for Elementary and Secondary Grades

		Used Games		Total
		Yes	No	
Elementary Teachers (Grades K-5)	Count	57	37	94
	Expected Count	37.1	56.9	94.0
	% within Group	60.6%	39.4%	100.0%
Secondary Teachers (Grades 6-12)	Count	35	104	139
	Expected Count	54.9	84.1	139.0
	% within Group	25.2%	74.8%	100.0%
Total	Count	92	141	233
	Expected Count	92.0	141.0	233.0
	% within Group	39.5%	60.5%	100.0%

In conclusion of sub-hypothesis 1, the distribution of game users between K-5 teachers and 6-12 teachers were statistically different (Chi-sq 29.507, df 1, *p*-value 6e-8, Yates chi-square 28.042, Yates' p-value 1.2e-7), yielding results that were significant. Between Elementary and Secondary grade teachers, there was a statistically significant difference in the level (percentage) of instructors who used educational computer-based games. We can reject sub-hypothesis one, that there is no change in the level (percentage) of instructors using educational computer-based games in the classroom between Elementary and Secondary grade teachers.

Detailed Analysis of sub-category Change in game usage as measured by quantity of games and hours of use by instructors using games

Addressing sub-hypothesis two required a Chi-squared test. Addressing sub-hypothesis three required the Mann-Whitney U analysis. These analyses are presented followed by a summarization of the sub-category.

Quantity of Games – Sub-hypothesis 2

When analyzing the quantity of games portion of the above sub-category, responses to part one of survey question E20 NAMES AND HOURS OF GAMES USED were analyzed.

Part One of E20 NAMES AND HOURS OF GAMES USED – Analysis 1

Analysis of part one of survey question E20 NAMES AND HOURS OF GAMES USED was conducted using a Chi-squared analysis on number of games used between Elementary and Secondary game teachers. Actual alpha values were .05, while actual beta values were .00002. The Chi-squared was conducted to determine if observed differed significantly from expected levels (Conover, 1971) for number of games used between Elementary and Secondary grades. This test analyzed the results in survey question part two of E20 NAMES AND HOURS OF GAMES USED. In Cohen's (1977) book effect sizes are provided for most statistical tests and vary depending on the test. Effect sizes for the non-parametric Chi-squared test were provided. A medium effect size means an effect large enough to be seen by the naked eye. For statistical analysis conducted in this research, effect size of medium was chosen. For the Chi-squared test, a medium effect size is .3. Figure 68 provides the statistical parameters as calculated by G*Power (Faul et al., 2007) for the Chi-squared test conducted on both groups.

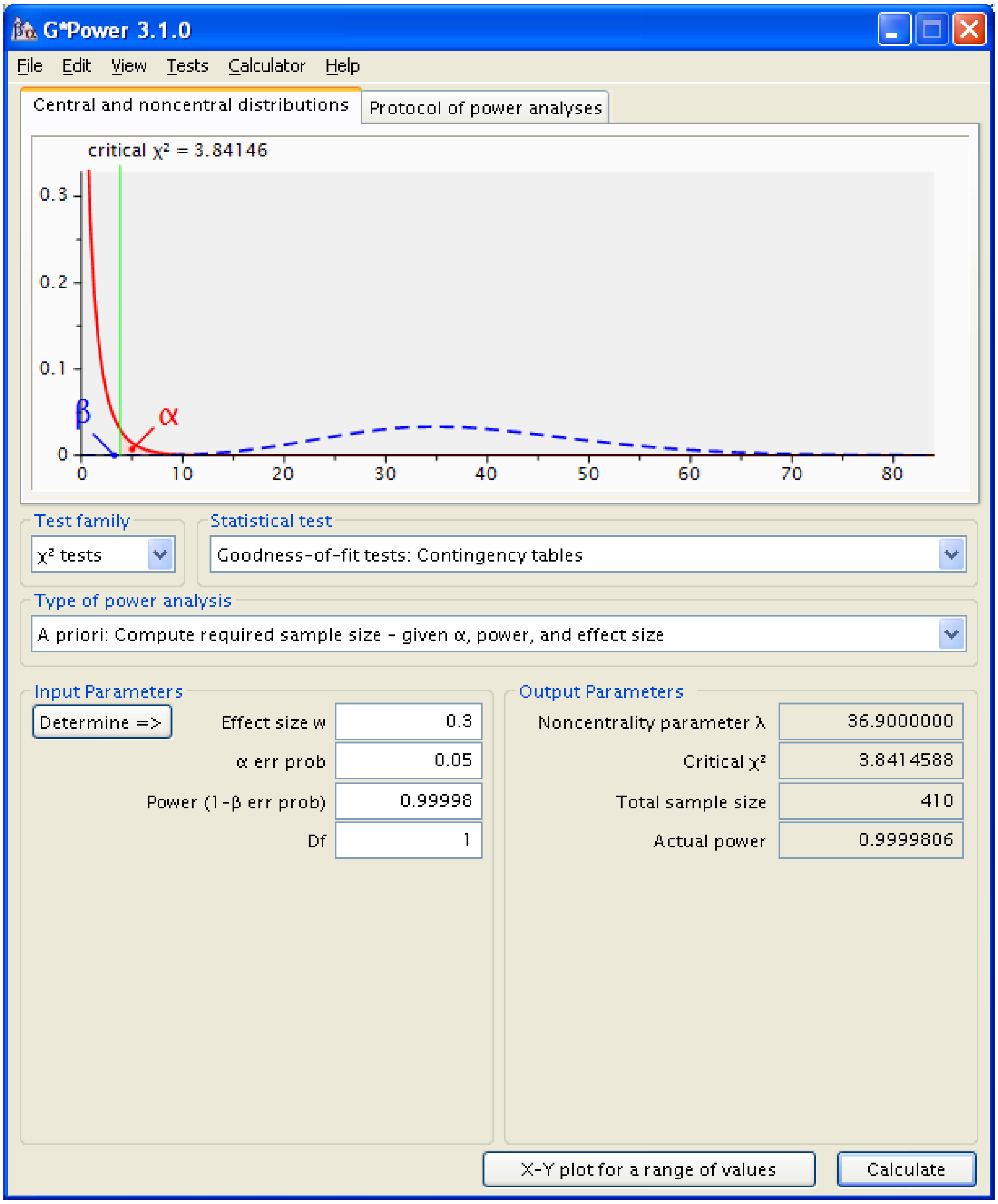

Figure 68. G*Power Calculation for Alpha and Beta Values for Chi-squared Test for Elementary and Secondary Grades

A two-way contingency table analysis was conducted to evaluate whether number of games used changed between Elementary and Secondary grade teachers. Participant responses for part one of E20 NAMES AND HOURS OF GAMES USED were investigated. There were two variables: grade and number of games used. The grade variable was segmented into two levels: Elementary teachers (grades K-5) and Secondary teachers (grades 6-12). The number of games used variable was based on expected and observed (actual) counts of games reported by these exemplar instructors. Grade and games used were found to be significantly related, Pearson χ^2 (1, N = 426) = 16.795, p<.001, Cramérs V = .199. The proportions of level of number of games used per level was .50 and .50, respectively. Counts are presented in Table 51 below.

Table 51. Games Listed for Use in Elementary and Secondary Grades

		Number of games listed		Total
		Expected	Observed	
Elementary Teachers (Grades K-5)	Count	98	140	238
	Expected Count	119.0	119.0	238.0
	% within Group	41.2%	58.8%	100.0%
Secondary Teachers (Grades 6-12)	Count	115	73	188
	Expected Count	94.0	94.0	188.0
	% within Group	61.2%	38.8%	100.0%
Total	Count	213	213	426
	Expected Count	213.0	213.0	426.0
	% within Group	50.0%	50.0%	100.0%

In conclusion of sub-hypothesis 2, the distribution of game used between K-5 teachers and 6-12 teachers were statistically different (Chi-sq 16.795, df 1, p-value 0.00004164, Yates chi-square 16.005, Yates' p-value 0.00006318) yielding significant results. Between Elementary and Secondary grade teachers, there was a statistically significant difference in the number of games used between Elementary and Secondary grade instructors. We can reject sub-hypothesis two, that there is no change in the quantity of educational computer-based games used by instructors in the classroom between Elementary and Secondary grades.

Hours of Use – Sub-hypothesis 3

When analyzing the hours of use portion of the above sub-category, responses to part two of survey question E20 NAMES AND HOURS OF GAMES USED were analyzed.

The non-parametric Mann Whitney test for two independent samples was used to determine the statistical significance of inferences for grade and hours of games used per group. As in all the above analysis, desired alpha and β values for research question 3 were .05 and .2, respectively. In Cohen's (1977) book, effect sizes are provided for most statistical tests and vary depending on the test. While effect sizes for the non-parametric Mann Whitney U test were not provided, values for comparing two independent means were. A medium effect size means an effect large enough to be seen by the naked eye. For statistical analysis conducted in this research, effect size of medium was chosen. For the Mann Whitney U test, a medium effect size is .5. Inputs into G*Power of effect size of .5, alpha values for Mann Whitney U test of .05, and beta values of .1 resulted in actual alpha of .05 and beta values of .1 with sample size of 70 in each group. Figure 69 provides the statistical parameters as calculated by G*Power (Faul et al., 2007). The full data set is provided in Appendix C.

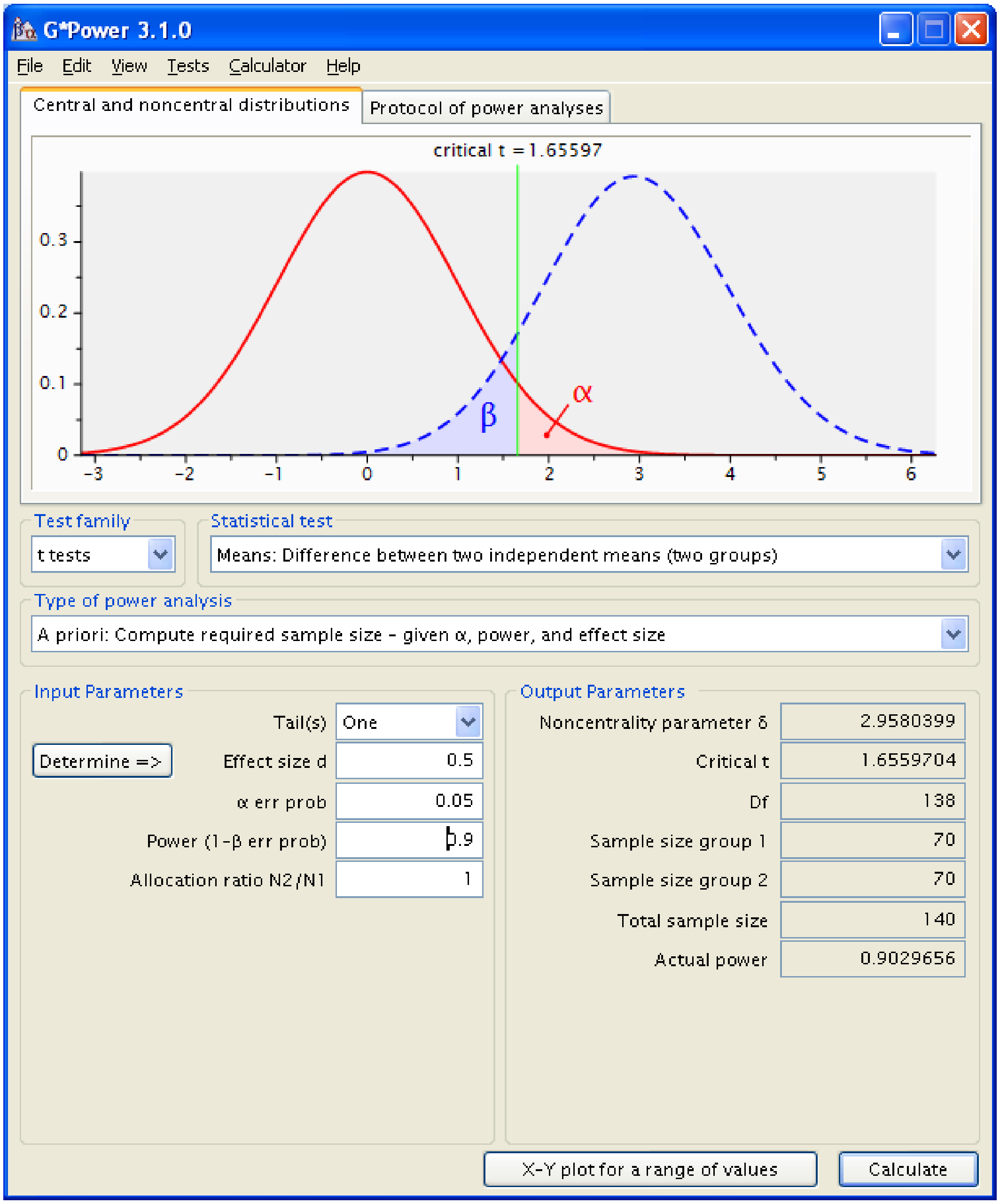

Figure 69. G*Power Calculation for Alpha and Beta Values for Mann Whitney U Test

Table 52 summarizes the statistical results of sub-hypotheses one through four for the PEOU dimension, where the two populations that are being compared for Perceived Ease of Use are differentiated from one another based on whether individuals either actually reported use of computer-based for instruction or did not. In the first column are the year groups. The second column presents the α and significance (p), followed by β values for each sub-hypothesis. The analysis shows a significant difference when comparing PEOU scores of AU populations to non-AU populations within year groups as well as over all year groups. Because results are significantly different from each other and noting the direction of the difference, computer-based game actual use instructor populations exhibit statistically higher PEOU scores than non actual use instructor populations.

Table 52. Number of Hours Games Used between Elementary and Secondary Grade Teachers

	Elementary Teachers (Grades K-5)	**Secondary Teachers (Grades K-5)**
Number of hours games used	$\alpha = .05$ *p* =.001	
	β values 0.1	

Analysis of Sub-category Perceived Ease of Use (PEOU) versus Actual Use

Total hours of use for part two of survey question E20 NAMES AND HOURS OF GAMES USED for instructors of Elementary grades (K-5) compared to those of Secondary grades (6-12) is illustrated in Figure 70. For hours of game use, the Mann Whitney U results were significant, $z = -3.231$, $p = .001$. The average amount of games hours used by Elementary grades were 99.3 hours per year, while the average amount game hours used by Secondary grades were 35.4 hours per year.

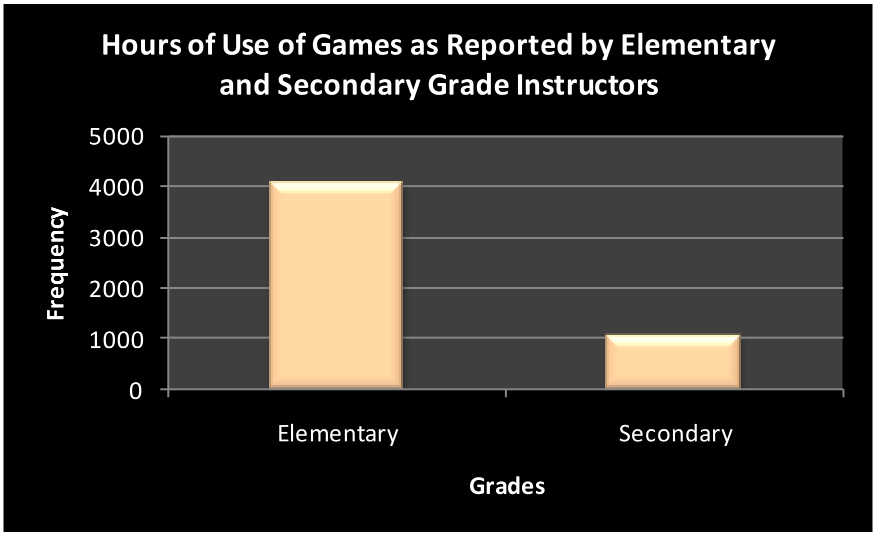

Figure 70. Number of Hours Games Used – Elementary and Secondary Grades

Research Question 9 Summary

For the first sub-hypothesis, change in level (percentage) of educational computer-based game use, results were significant; there was a change in use between instructors of Elementary and Secondary grades. For the second sub-hypothesis, change in quantity of educational computer-based games used by instructors, again, results were significant; there was a change in the quantity of games used between instructors of Elementary and Secondary grades. Finally, for the third sub-hypothesis, change in level of educational computer-based game usage as measured by hours allocated for student use, once again, results were significant; there was a change in the amount of hours allocated per student in the classroom by individual instructor between instructors of Elementary and Secondary grades. Because each sub-hypothesis yielded results that were significant, the null hypothesis can be rejected and the alternative accepted: there was an difference in the level of educational computer-based game use between instructors of elementary and secondary grades with elementary (K-5) school teachers using games at statistically significant higher: (1) percentages of the population, (2) number of games in use by each teacher, and (3) for more hours in the academic year than the 6-12 secondary school teacher .

Research Question 10 (Level of acceptance of educational computer-based games to Ambivalence):

Between instructors of Elementary and Secondary grades, is the teacher's level of acceptance of educational computer-based games different from ambivalence based on each dimension of acceptance?

H_0 = There is no difference between the level of acceptance of educational computer-based games and ambivalence for any given dimension.

H_a = There is a difference between level of acceptance of educational computer-based games and ambivalence for any given dimension.

As the third of three additional analyses conducted, each participant was asked to express the strength of his/her response to thirteen questions drawn from Davis's Technology Acceptance Model. These sub-hypotheses can be conceptually grouped into two sub categories: (1) Perceived Ease of Use of educational computer-base games, and (2) Perceived Usefulness of education computer-based games. Strength of acceptance of the question was measured on a scale from 1 to 7 as shown in Table 53 below.

Table 53. TAM Response Scale

1	2	3	4	5	6	7
Extremely Unlikely	Quite Unlikely	Slightly Unlikely	Neither Likely nor Unlikely	Slightly Likely	Quite Likely	Extremely Likely

Responses formed the basis for statistical tests of each sub-hypothesis about the ambivalence of the sample population to that question. Ambivalence is numerically represented by the response four. Questions 8-18 are found in Appendix B. The sub-hypotheses are placed in the sub-categories of Perceived Ease of Use (PEOU) and Perceived Usefulness (PU).

Sub-category Perceived Ease of Use

Sub-hypothesis 1 (LEARN TO OPERATE): Between instructors of Elementary and Secondary grades, there is no difference between Technology Acceptance Model survey question 8 (SQ T8) and ambivalence (neutral).

Sub-hypothesis 2 (DO WHAT I WANT): Between instructors of Elementary and Secondary grades, there is no difference between Technology Acceptance Model survey question 9 (SQ T9) and ambivalence (neutral).

Sub-hypothesis 3 (INTERACTION): Between instructors of Elementary and Secondary grades, there is no difference between Technology Acceptance Model survey question 10 (SQ T10) and ambivalence (neutral).

Sub-hypothesis 4 (BECOME SKILLFUL): Between instructors of Elementary and Secondary grades, there is no difference between Technology Acceptance Model survey question 11 (SQ T11) and ambivalence (neutral).

Sub-hypothesis 5 (FLEXIBLE): Between instructors of Elementary and Secondary grades, there is no difference between Technology Acceptance Model survey question 12 (SQ T12) and ambivalence (neutral).

Sub-hypothesis 6 (EASY TO USE): Between instructors of Elementary and Secondary grades, there is no difference between Technology Acceptance Model survey question 13 (SQ T13) and ambivalence (neutral).

Sub-hypothesis 7 (Overall PEOU): Between instructors of Elementary and Secondary grades, there is no difference between the PEOU dimension (T8-13) and ambivalence (neutral).

Sub-category Perceived Usefulness

Sub-hypothesis 8 (ACCOMPLISH MORE): Between instructors of Elementary and Secondary grades, there is no difference between Technology Acceptance Model survey question 14 (SQ T14) and ambivalence (neutral).

Sub-hypothesis 9 (IMPROVE PERFORMANCE): Between instructors of Elementary and Secondary grades, there is no difference between Technology Acceptance Model survey question 15 (SQ T15) and ambivalence (neutral).

Sub-hypothesis 10 (INCREASE PRODUCTIVITY): Between instructors of Elementary and Secondary grades, there is no difference between Technology Acceptance Model survey question 16 (SQ T16) and ambivalence (neutral).

Sub-hypothesis 11 (JOB EASIER): Between instructors of Elementary and Secondary grades, there is no difference between Technology Acceptance Model survey question 17 (SQ T17) and ambivalence (neutral).

Sub-hypothesis 12 (USEFUL IN JOB): Between instructors of Elementary and Secondary grades, there is no difference between Technology Acceptance Model survey question 18 (SQT18) and ambivalence (neutral).

Sub-hypothesis 13 (Overall PU): Between instructors of Elementary and Secondary grades, there is no difference between the PU dimension (T14-18) and ambivalence (neutral).

All available data was included for analyzing each sub-hypothesis. As mentioned earlier in this chapter, if a participant answered ACCOMPLISH MORE Survey Question (SQ) T8 (sub-hypothesis 1 of PEOU) but not DO WHAT I WANT SQ T9 (sub-hypothesis 2 of PEOU), the participant's data would be included to address sub-hypotheses 1 and 3-6 but not 2 and 7 (overall sub-hypothesis for PEOU). Each dimension of level of acceptance, or each TAM question, was evaluated against a hypothesized mean of ambivalence (four) where ambivalence is measured on a seven level ordinal scale used to measure subjective responses. Because data was ordinal, the non-parametric version of the *t*-test, the Wilcoxon signed-rank test, was the test used to determine the statistical significance of inferences for group and dimension combinations. In Cohen's (1977) book, effect sizes are provided for most statistical tests and vary depending on the test. While effect sizes for the non-parametric Wilcoxon signed-rank test were not provided, values for the parametric alternative, the *t*-test, were. A medium effect size means an effect large enough to be seen by the naked eye. For statistical analysis conducted in this research, effect size of medium was chosen. For the Wilcoxon signed-rank test, a medium effect size is .5. G*Power software version 3.1.0 enables one to input alpha, β, and effect size in order to compute actual sample size and power for a given alpha and effect size. For analysis of research question 1, desired sample size estimated by Cohen was based on alpha and β values of .05 and .2, respectively. G*Power 3.1.0 (Faul, et al., 2007) precisely computes minimal sample size given the alpha, power and effect size to satisfy experimental statistical requirements. Figure 71 provides the statistical parameters as calculated by G*Power (Faul et al., 2007) given actual effect size of .5, alpha of .05 and β .01. This resulted in a minimal sample size of 68 and an actual power of over .99. This sample size enabled the responses to be divided into two groups to designate Elementary instructors (grades K-5) and Secondary instructors (grades 6-12). The full data set is provided in Appendix C.

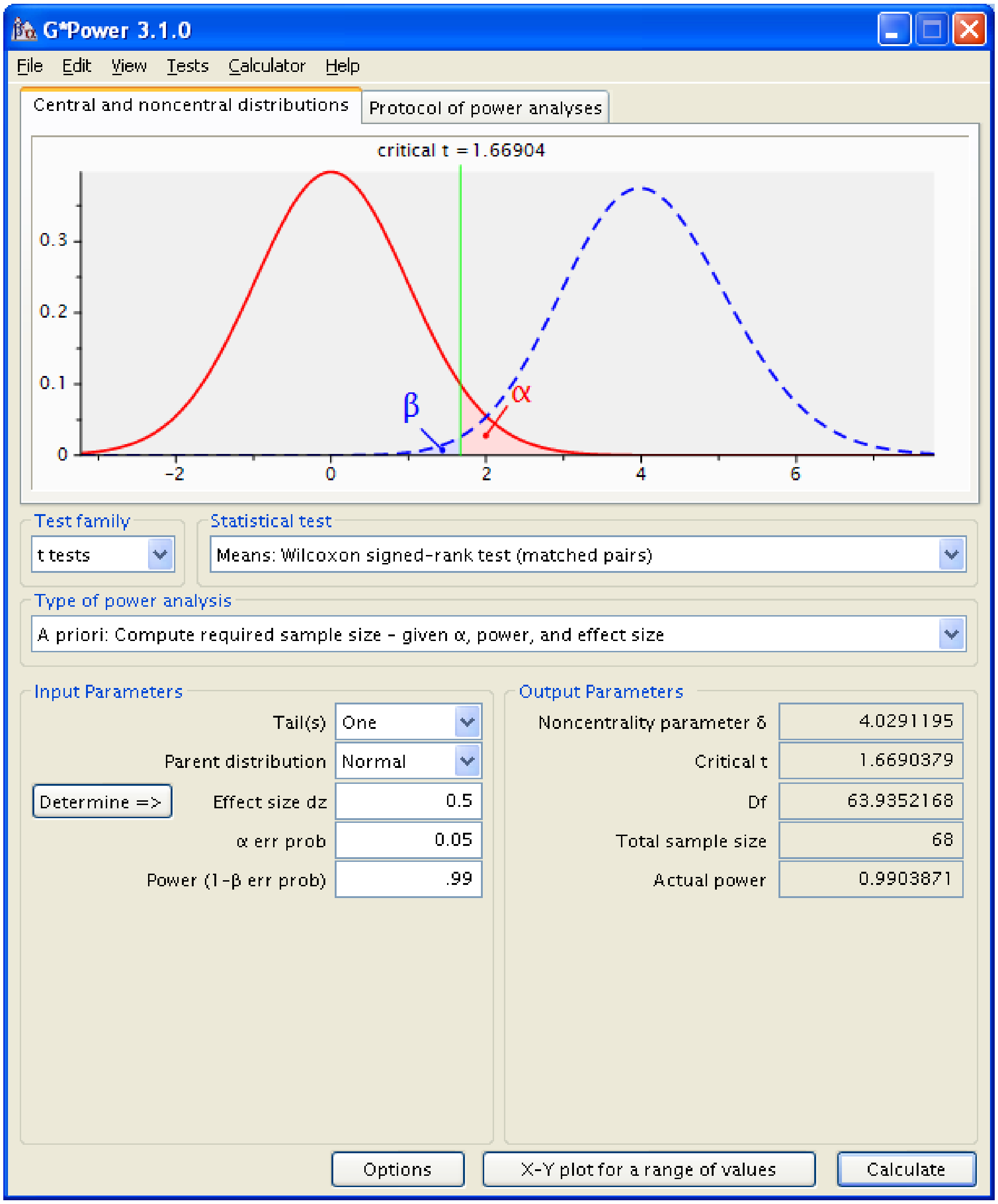

Figure 71. G*Power Calculation for Alpha and Beta Values for Wilcoxon Signed-Rank Test

Table 54 summarizes the G*Power statistical results of the 13 sub-hypotheses given the above input parameters. In the first column are the overall PEOU and PU dimensions. The second column presents the TAM question compared to Neutral, followed by α, significance (*p)*, and β values for each of the three groups. In summary, the overall dimensions of PEOU and PU were statistically different from ambivalent. The direction of the response of the subordinate dimensions was across the board positive toward PEOU. This is not true for the PU dimension. The hypotheses of neutrality about PU subordinate dimensions (1) Improve performance; (2) Increase Productivity; and (3) Job easier for Secondary (Grades 6-12) could NOT be rejected, though the overall hypothesis of there being a significant difference from ambivalence for PU could be. This is very significant as contrasting with the secondary school teachers as well as year group 2 and 3 in earlier analysis, the elementary grades K-5 did reject the hypothesized ambivalence of all the sub dimensions WITHOUT consideration of year group.

Table 54. Results of Sub-hypotheses for RQ10

TAM Dimensions	TAM Questions	Elementary (Grades K-5)		Secondary (Grades 6-12)	
		α = .05 *p* values	**β values**	**α = .05 *p* values**	**β values**
PEOU	LEARN TO OPERATE to Neutral	$p<.001$	0.01	$p<.001$	0.01
	DO WHAT I WANT to Neutral	$p<.001$	0.01	$p<.001$	0.01
	INTERACTION to Neutral	$p<.001$	0.01	$p<.001$	0.01
	BECOME SKILLFUL to Neutral	$p<.001$	0.01	$p<.001$	0.01
	FLEXIBLE to Neutral	$p<.001$	0.01	$p<.001$	0.01
	EASY TO USE to Neutral	$p<.001$	0.01	$p<.001$	0.01
	PEOU Dimension to Neutral	$\boldsymbol{p<.001}$	**0.01**	$\boldsymbol{p<.001}$	**0.01**
PU	ACCOMPLISH MORE to Neutral	$p<.001$	0.01	$p=.022$	0.01
	IMPROVE PERFORMANCE to Neutral	$p<.001$	0.01	$p=.359$	0.01
	INCREASE PRODUCTIVITY to Neutral	$p<.001$	0.01	$p=.780$	0.01
	JOB EASIER to Neutral	$p<.001$	0.01	$p=.296$	0.01
	USEFUL IN JOB to Neutral	$p<.001$	0.01	$p<.001$	0.01
	PU Dimension to Neutral	$\boldsymbol{p<.001}$	**0.01**	$\boldsymbol{p<.001}$	**0.01**

Detailed Analysis of Sub-category Perceived Ease of Use (PEOU) Difference from Ambivalence

When analyzing Perceived Ease of Use, each group of grades were isolated and tested for ambivalence toward each relevant sub-hypothesis. Analysis of each sub-hypothesis is presented individually followed by a summarization of the entire sub-category.

PEOU – LEARN TO OPERATE SQ (T8) Difference from Ambivalence

Participant responses for LEARN TO OPERATE SQ T8 compared to Neutral are illustrated in Figure 72. For instructors of Elementary grades (K-5), the Wilcoxon signed-rank test indicates a significant difference between LEARN TO OPERATE SQ T8 and ambivalence, $z = -8.459$, $p < .001$. The mean of the ranks in favor of LEARN TO OPERATE SQ T8 was 6.144 (closest to "Quite Likely"), while the mode was 7 ("Extremely Likely"). For instructors of Secondary grades (6-12), the Wilcoxon signed-rank test indicates a significant difference between LEARN TO OPERATE SQ T8 and ambivalence, $z = -9.452$, $p < .001$. The mean of the ranks in favor of LEARN TO OPERATE SQ T8 was 5.884 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely").

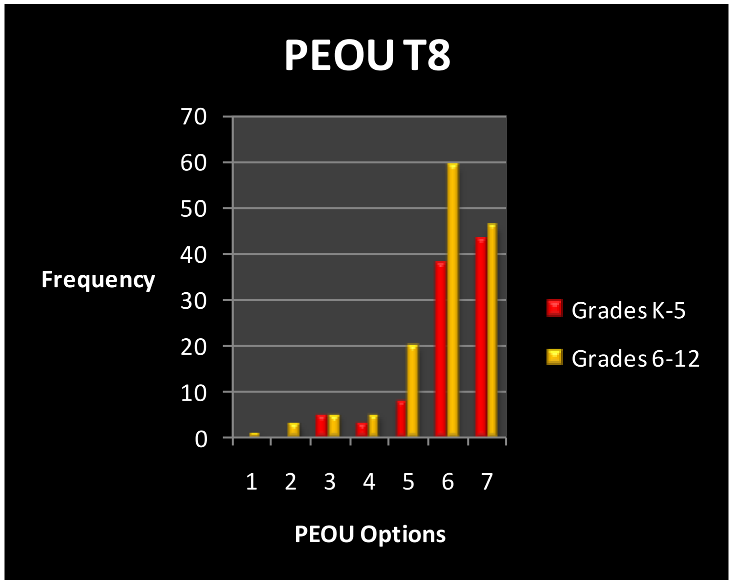

Figure 72. PEOU T8 Compared to Ambivalence

Grade groups seem to have similarly high response averages, ranging from 6.144 (closest to "Quite Likely") for Elementary grades (K-5) to 5.884 (closest to "Quite Likely") for Secondary grades (6-12). Modes differ with 7 ("Extremely Likely") for Elementary grades (K-5) and 6 ("Quite Likely") for Secondary grades (6-12). Grade group response levels were very positive on the response scale to LEARN TO OPERATE SQ T8. Overall responses to this question for both groups are not ambivalent.

PEOU – DO WHAT I WANT SQ (T9) Difference from Ambivalence

Participant responses for DO WHAT I WANT SQ T9 compared to Neutral are illustrated in Figure 73. For instructors of Elementary grades (K-5), the Wilcoxon signed-rank test indicates a significant difference between DO WHAT I WANT SQ T9 and ambivalence, z = -6.416, p <.001. The mean of the ranks in favor of DO WHAT I WANT SQ T9 was 5.319 (closest to "Slightly Likely"), while the mode was 6 ("Quite Likely"). For instructors of Secondary grades (6-12), the Wilcoxon signed-rank test indicates a significant difference between DO WHAT I WANT SQ T9 and ambivalence, $z = -6.765$, $p < .001$. The mean of the ranks in favor of DO WHAT I WANT SQ T9 was 5.028 (closest to “Slightly Likely”), while the mode was 5 (“Slightly Likely”).

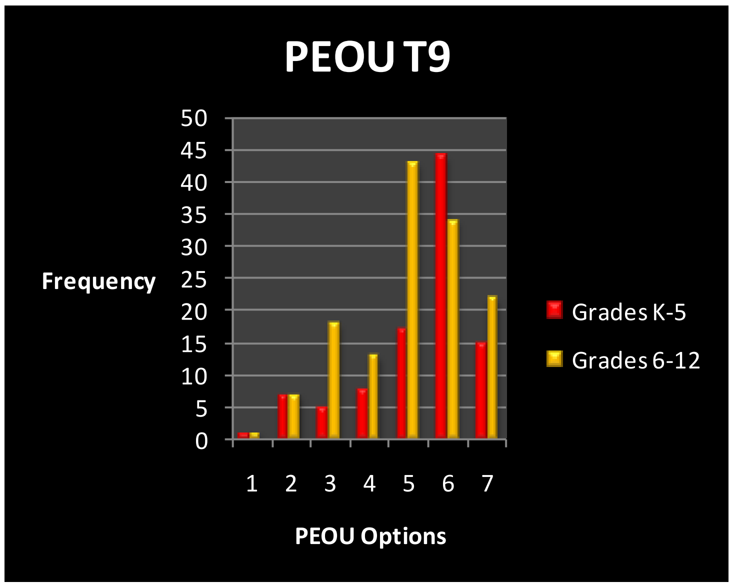

Figure 73. PEOU T9 Compared to Ambivalence

Grade groups seem to have similarly high response averages, ranging from 5.028 (closest to “Slightly Likely”) for Secondary grades (6-12) to 5.319 (closest to “Slightly Likely”) for Elementary grades (K-5). Modes differ with 5 (“Slightly Likely”) for Secondary grades (6-12) and 6 (“Quite Likely”) for Elementary grades (K-5). Grade group response levels were very positively on the response scale to DO WHAT I WANT SQ T9. Overall responses to this question for both groups are not ambivalent.

PEOU – INTERACTION SQ (T10) Difference from Ambivalence

Participant responses for INTERACTION SQ T10 compared to Neutral are illustrated in **Error! Reference source not found.**. For instructors of Elementary grades (K-5), the Wilcoxon signed-rank test indicates a significant difference between INTERACTION SQ T10 and ambivalence, z = -8.133, p <.001. The mean of the ranks in favor of INTERACTION SQ T10 was 5.814 (closest to “Quite Likely”), while the mode was 6 (“Quite Likely”). For instructors of Secondary grades (6-12), the Wilcoxon signed-rank test indicates a significant difference between INTERACTION SQ T10 and ambivalence, z = -8.090, p <.001. The mean of the ranks in favor of INTERACTION SQ T10 was 5.340 (closest to “Slightly Likely”), while the mode was 6 (“Quite Likely”).

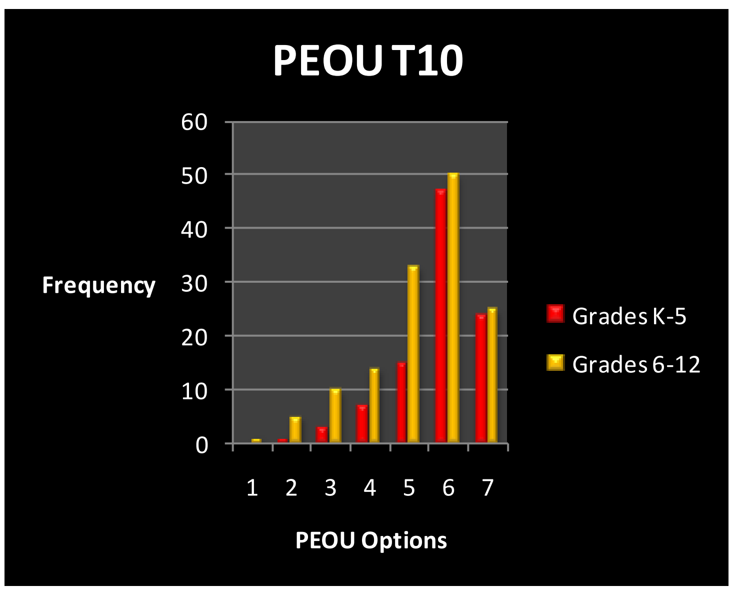

Figure 74. PEOU T10 Compared to Ambivalence

Grade groups differ though both have high response averages, with 5.340 (closest to “Slightly Likely”) for Secondary grades (6-12) to 5.814 (closest to “Quite

Likely") for Elementary grades (K-5). Modes are the same at 6 ("Quite Likely") for both grades' groups. Grade group response levels were very positively on the response scale to INTERACTION SQ T10. Overall responses to this question for both groups are not ambivalent.

PEOU – BECOME SKILLFUL SQ (T11) Difference from Ambivalence

Participant responses for BECOME SKILLFUL SQ T11 compared to Neutral are illustrated in Figure 75. For instructors of Elementary grades (K-5), the Wilcoxon signed-rank test indicates a significant difference between BECOME SKILLFUL SQ T11 and ambivalence, z = -8.434, p <.001. The mean of the ranks in favor of BECOME SKILLFUL SQ T11 was 6.041 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely"). For instructors of Secondary grades (6-12), the Wilcoxon signed-rank test indicates a significant difference between BECOME SKILLFUL SQ T11 and ambivalence, z = -9.599, p <.001. The mean of the ranks in favor of BECOME SKILLFUL SQ T11 was 5.820 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely").

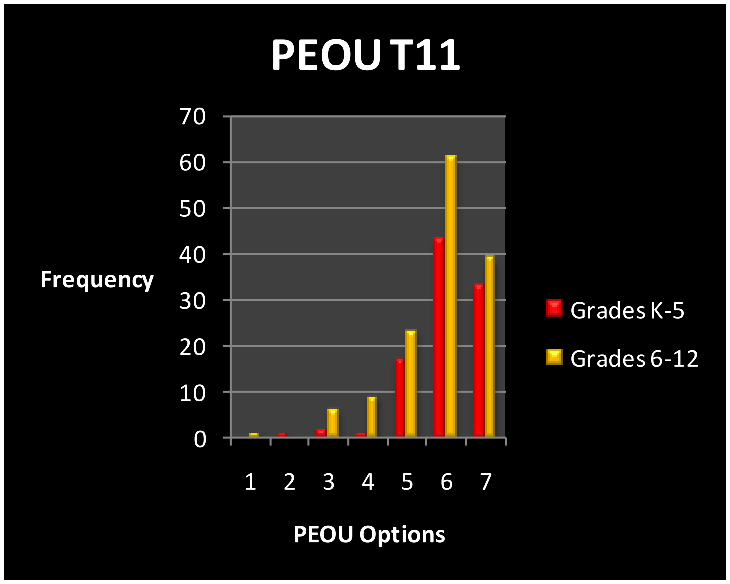

Figure 75. PEOU T11 Compared to Ambivalence

Grade groups have similarly high response averages, ranging from 5.820 (closest to "Quite Likely") for Secondary grades (6-12) to 6.041 (closest to "Quite Likely") for Elementary grades (K-5). Modes, too, stay close, at 6 ("Quite Likely") for both grades' groups. Grade group response levels were very positively on the response scale to BECOME SKILLFUL SQ T11. Overall responses to this question for both groups are not ambivalent.

PEOU – FLEXIBLE SQ (T12) Difference from Ambivalence

Participant responses for FLEXIBLE SQ T12 compared to Neutral are illustrated in Figure 76. For instructors of Elementary grades (K-5), the Wilcoxon signed-rank test indicates a significant difference between FLEXIBLE SQ T12 and ambivalence, z = -7.110, p <.001. The mean of the ranks in favor of FLEXIBLE SQ T12 was 5.402 (closest to "Slightly Likely"), while the mode was 6 ("Quite Likely"). For instructors of Secondary grades (6-12), the Wilcoxon signed-rank test indicates a significant difference between FLEXIBLE SQ T12 and ambivalence, *z* = -7.127, *p* <.001. The mean of the ranks in favor of FLEXIBLE SQ T12 was 5.093 (closest to "Slightly Likely"), while the mode was 6 ("Quite Likely").

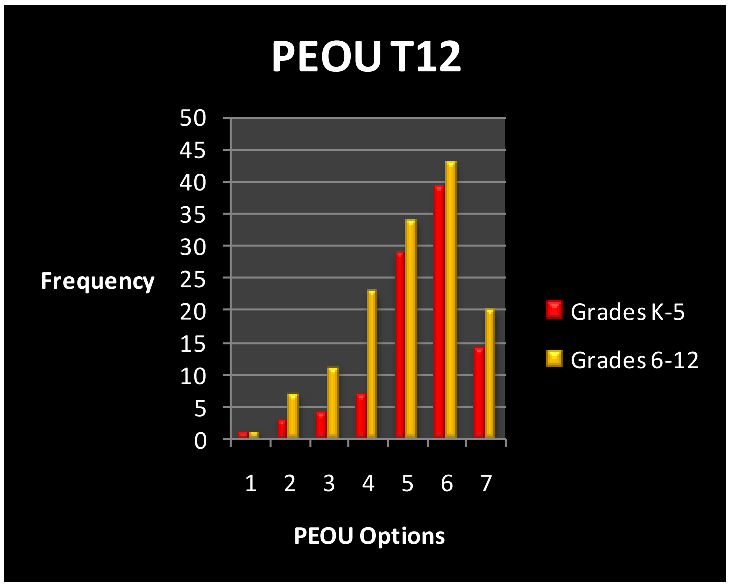

Figure 76. PEOU T12 Compared to Ambivalence

Grade groups seem to have similarly high response averages, ranging from 5.093 (closest to "Slightly Likely") for Secondary grades (6-12) to 5.402 (closest to "Slightly Likely") for Elementary grades (K-5). Modes, too, stay close, at 6 ("Quite Likely") for both grades' groups. Both grade group response levels were very positively on the response scale to FLEXIBLE SQ T12. Overall responses to this question for both groups are not ambivalent.

EASY TO USE SQ (T13) Difference from Ambivalence

Participant responses for EASY TO USE SQ T13 compared to Neutral are illustrated in Figure 77. For instructors of Elementary grades (K-5), the Wilcoxon signed-rank test indicates a significant difference between EASY TO USE SQ T13 and ambivalence, $z = -8.374$, $p < .001$. The mean of the ranks in favor of EASY TO USE SQ T13 was 5.958 (closest to "Quite Likely"), while the mode was 6 ("Quite Likely"). For instructors of Secondary grades (6-12), the Wilcoxon signed-rank test indicates a significant difference between EASY TO USE SQ T13 and ambivalence, $z = -9.337$, $p < .001$. The mean of the ranks in favor of EASY TO USE SQ T13 was 5.589 (closest to "Slightly Likely"), while the mode was 6 ("Quite Likely").

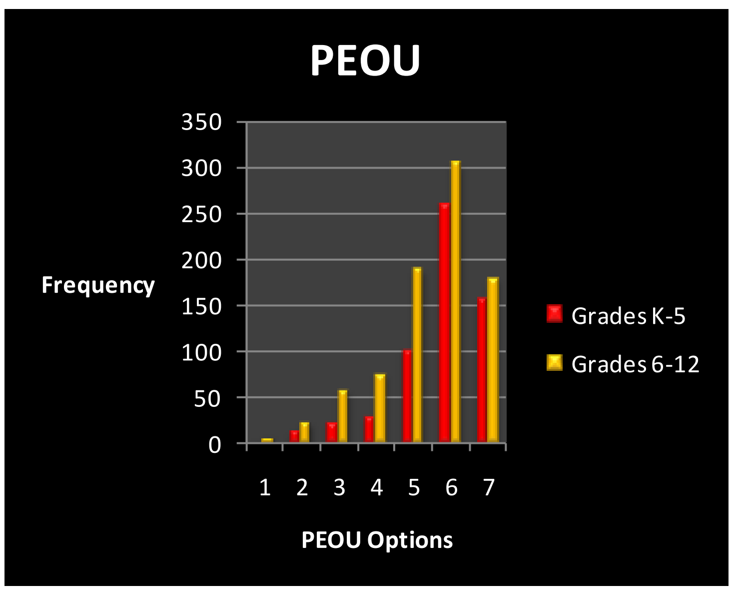

Figure 77. PEOU T13 Compared to Ambivalence

Grade groups have similarly high response averages with from 5.589 (closest to "Quite Likely") for Secondary grades (6-12) to 5.958 (closest to "Quite Likely") for

Elementary grades (K-5). Modes, too, stay close, at 6 (“Quite Likely”) for both grades’ groups. Both grade groups response levels were very positively on the response scale to EASY TO USE SQ T13. Overall responses to this question for both groups are not ambivalent.

PEOU – COMBINATION OF PEOU ATTRIBUTES Difference from Ambivalence

Participant responses for the PEOU dimension compared to Neutral are illustrated in Figure 78. To calculate the combination of PEOU attributes, all individual scores were collected and analyzed using the Wilcoxon signed-rank test; meaning, scores here were not averaged. For instructors of Elementary grades (K-5), the Wilcoxon signed-rank test indicates a significant difference between the PEOU dimension and ambivalence, $z = -19.255$, $p < .001$. The mean of the ranks in favor of the PEOU dimension was 5.780 (closest to “Quite Likely”), while the mode was 6 (“Quite Likely”). For instructors of Secondary grades (6-12), the Wilcoxon signed-rank test indicates a significant difference between the PEOU dimension and ambivalence, $z = -20.843$, $p < .001$. The mean of the ranks in favor of the PEOU dimension was 5.460 (closest to “Slightly Likely”), while the mode was 6 (“Quite Likely”).

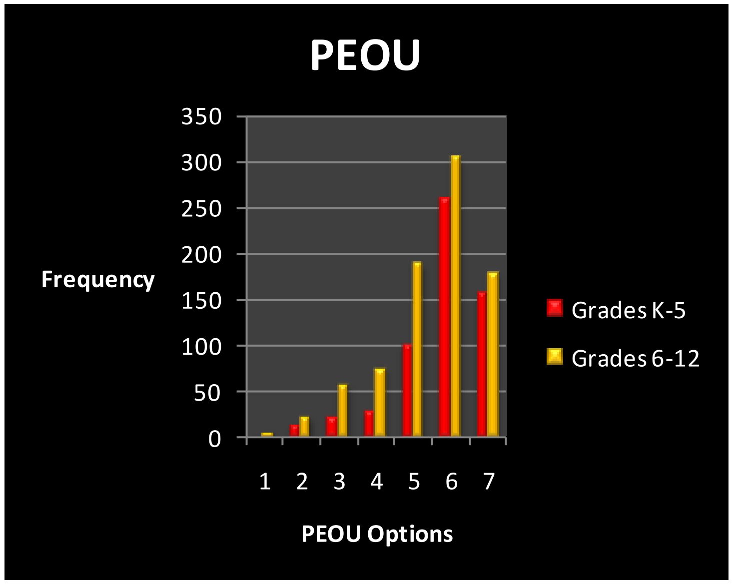

Figure 78. PEOU Compared to Ambivalence

For sub-category PEOU, all groups were significantly different from Neutral showing that they generally perceived the incorporation of educational computer games as easy to use.

Detailed Analysis of Sub-category Perceived Usefulness (PU) Difference from Ambivalence

When analyzing Perceived Usefulness, grades K-5 and 6-12 were isolated and tested for ambivalence toward each relevant sub-hypothesis. Analysis of each sub-hypothesis is presented individually followed by a summarization of the entire sub-category.

PU – ACCOMPLISH MORE SQ (T14) Difference from Ambivalence

Participant responses for ACCOMPLISH MORE SQ T14 compared to Neutral are illustrated in Figure 79. For instructors of Elementary grades (K-5), the Wilcoxon signed-rank test indicates a significant difference between ACCOMPLISH MORE SQ T14 and ambivalence, $z = -5.998$, $p < .001$. The mean of the ranks in favor of ACCOMPLISH MORE SQ T14 was 5.03 (closest to “Slightly Likely”), while the mode was also 5 (“Slightly Likely”). For instructors of Secondary grades (6-12), the Wilcoxon signed-rank test indicates a significant difference between ACCOMPLISH MORE SQ T14 and ambivalence, $z = -2.286$, $p = .022$. The mean of the ranks in favor of ACCOMPLISH MORE SQ T14 was 4.323 (closest to “Neither Likely Nor Unlikely”), while the mode was also 4 (“Neither Likely Nor Unlikely”).

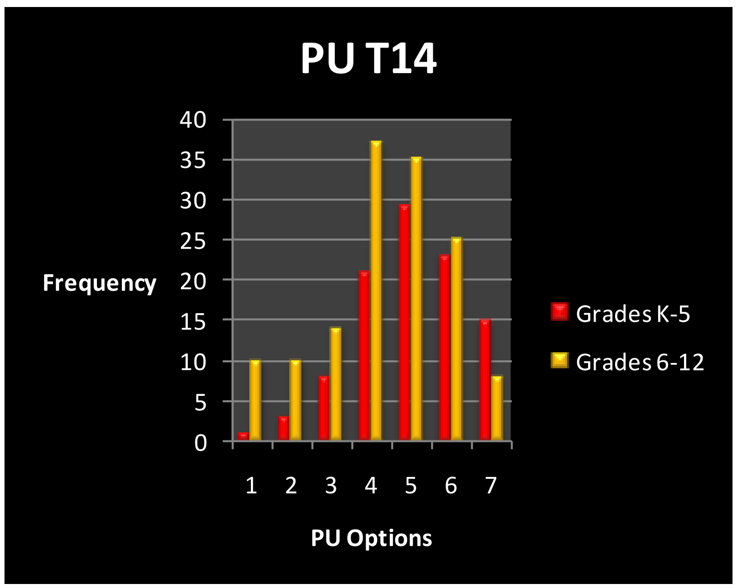

Figure 79. PU T14 Compared to Ambivalence

Grade groups differ in response averages, with 4.323 (closest to “Neither Likely Nor Unlikely”) for Secondary grades (6-12) and 5.03 (closest to “Slightly Likely”) for Elementary grades (K-5). Modes differ too with 5 (“Slightly Likely”) for Elementary grades (K-5) and 4 (“Neither Likely Nor Unlikely”) for Secondary grades (6-12). Grade groups' response levels were either Neutral or close to Neutral on the response scale to ACCOMPLISH MORE SQ T14. Grade groups' response levels to this question are mixed, with only Elementary grades (K-5) being significantly different from ambivalence.

PU – IMPROVE PERFORMANCE SQ (T15) Difference from Ambivalence

Participant responses for IMPROVE PERFORMANCE SQ T15 compared to Neutral are illustrated in Figure 80. For instructors of Elementary grades (K-5), the Wilcoxon signed-rank test indicates a significant difference between IMPROVE PERFORMANCE SQ T15 and ambivalence, $z = -4.818$, $p < .001$. The mean of the ranks in favor of IMPROVE PERFORMANCE SQ T15 was 4.72 (closest to "Slightly Likely"), while the mode was 4 ("Neither Likely nor Unlikely"). For instructors of Secondary grades (6-12), the Wilcoxon signed-rank test does not indicate a significant difference between IMPROVE PERFORMANCE SQ T15 and ambivalence, $z = -.917$, $p = .359$. The mean of the ranks in favor of IMPROVE PERFORMANCE SQ T15 was 4.143 (closest to "Neither Likely Nor Unlikely"), while the mode was also 4 ("Neither Likely Nor Unlikely").

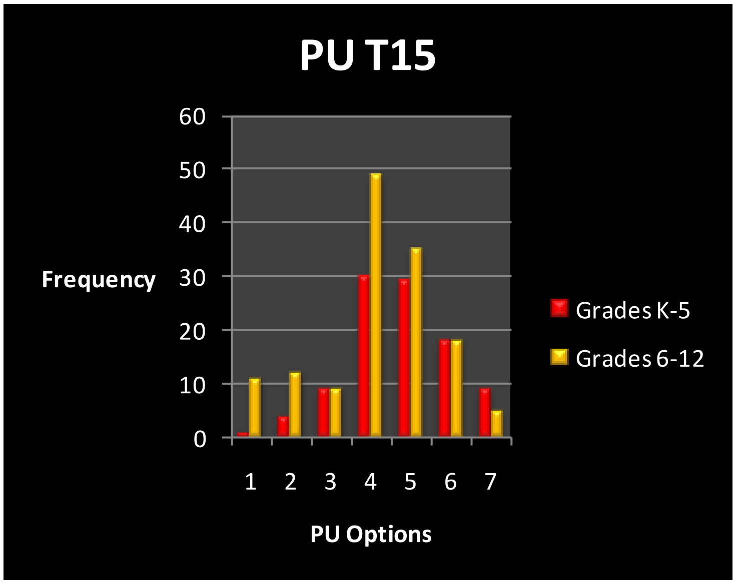

Figure 80. PU T15 Compared to Ambivalence

Grade groups differ in response averages, with 4.143 (closest to “Neither Likely Nor Unlikely”) for Secondary grades (6-12) and 4.72 (closest to “Slightly Likely ”) for Elementary grades (K-5). Modes are the same at 4 (“Neither Likely Nor Unlikely”) for both grades’ groups. Grade group response levels to IMPROVE PERFORMANCE SQ T15 are mixed with only Elementary grades (K-5) being significantly different from ambivalence.

PU – INCREASE PRODUCTIVITY SQ (T16) Difference from Ambivalence

Participant responses for INCREASE PRODUCTIVITY SQ T16 compared to Neutral are illustrated in Figure 81. For instructors of Elementary grades (K-5), the Wilcoxon signed-rank test indicates a significant difference between INCREASE PRODUCTIVITY SQ T16 and ambivalence, z = -4.318, p <.001. The mean of the ranks in favor of INCREASE PRODUCTIVITY SQ T16 was 4.686 (closest to “Slightly Likely”), while the mode was 5

("Slightly Likely"). For instructors of Secondary grades (6-12), the Wilcoxon signed-rank test does not indicate a significant difference between INCREASE PRODUCTIVITY SQ T16 and ambivalence, $z = -.280$, $p = .780$. The mean of the ranks in favor of INCREASE PRODUCTIVITY SQ T16 was 4.057 (closest to "Neither Likely Nor Unlikely"), while the mode was also 4 ("Neither Likely Nor Unlikely").

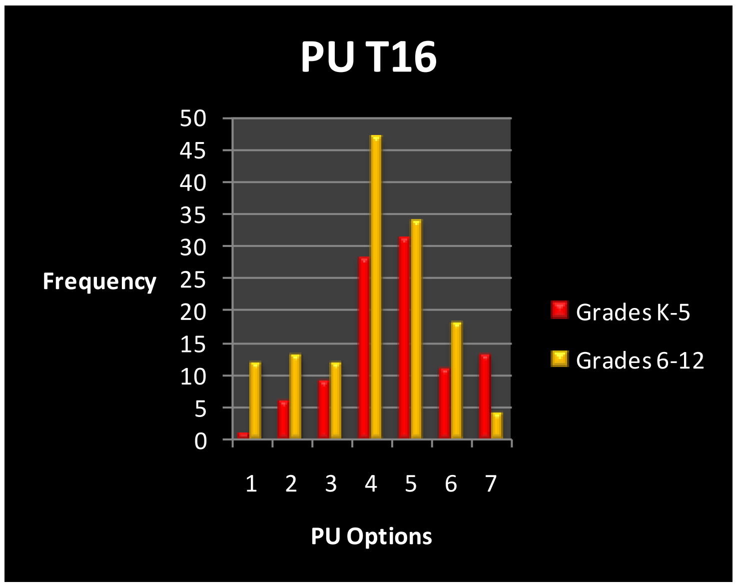

Figure 81. PU T16 Compared to Ambivalence

Grade groups differ in response averages, with 4.057 (closest to "Neither Likely Nor Unlikely") for Secondary grades (6-12) and 4.686 (closest to "Slightly Likely ") for Elementary grades (K-5). Modes differ with 4 ("Neither Likely Nor Unlikely") for Secondary grades (6-12) and 5 ("Slightly Likely") for Elementary grades (K-5). Grade groups' response levels to INCREASE PRODUCTIVITY SQ T16 are mixed with only Elementary grades (K-5) being significantly different from ambivalence.

PU – JOB EASIER SQ (T17) Difference from Ambivalence

Participant responses for JOB EASIER SQ T17 compared to Neutral are illustrated in Figure 82. For instructors of Elementary grades (K-5), the Wilcoxon signed-rank test indicates a significant difference between JOB EASIER SQ T17 and ambivalence, z = -4.189, p <.001. The mean of the ranks in favor of JOB EASIER SQ T17 was 4.66 (closest to “Slightly Likely”), while the mode was 5 (“Slightly Likely”). For instructors of Secondary grades (6-12), the Wilcoxon signed-rank test does not indicate a significant difference between JOB EASIER SQ T17 and ambivalence, z = -1.045, p = .296. The mean of the ranks in favor of JOB EASIER SQ T17 was 4.143 (closest to “Neither Likely Nor Unlikely”), while the mode was 5 (“Slightly Likely”).

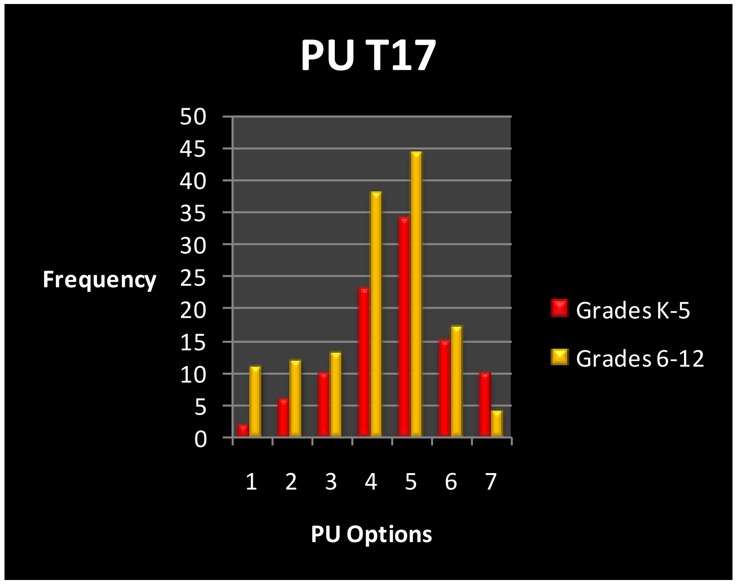

Figure 82. PU T17 Compared to Ambivalence

Grade groups differ in response averages, with 4.143 (closest to "Neither Likely Nor Unlikely") for Secondary grades (6-12) and 4.66 (closest to "Slightly Likely") for Elementary grades (K-5). Modes, too, stay close, at 5 ("Slightly Likely") for both grades' groups. Grade groups' response levels to JOB EASIER SQ T17 are mixed with only Elementary grades (K-5) being significantly different from ambivalence.

PU – USEFUL IN JOB SQ (T18) Difference from Ambivalence

Participant responses for USEFUL IN JOB SQ T18 compared to Neutral are illustrated in Figure 83. For instructors of Elementary grades (K-5), the Wilcoxon signed-rank test indicates a significant difference between USEFUL IN JOB SQ T18 and ambivalence, $z = -7.896$, $p < .001$. The mean of the ranks in favor of USEFUL IN JOB SQ T18 was 5.606 (closest to "Slightly Likely"), while the mode was 6 ("Quite Likely"). For instructors of Secondary grades (6-12), the Wilcoxon signed-rank test does indicate a significant difference between USEFUL IN JOB SQ T18 and ambivalence, z = -5.336, p < .001. The mean of the ranks in favor of USEFUL IN JOB SQ T18 was 4.807 (closest to "Slightly Likely"), while the mode was 5 ("Slightly Likely").

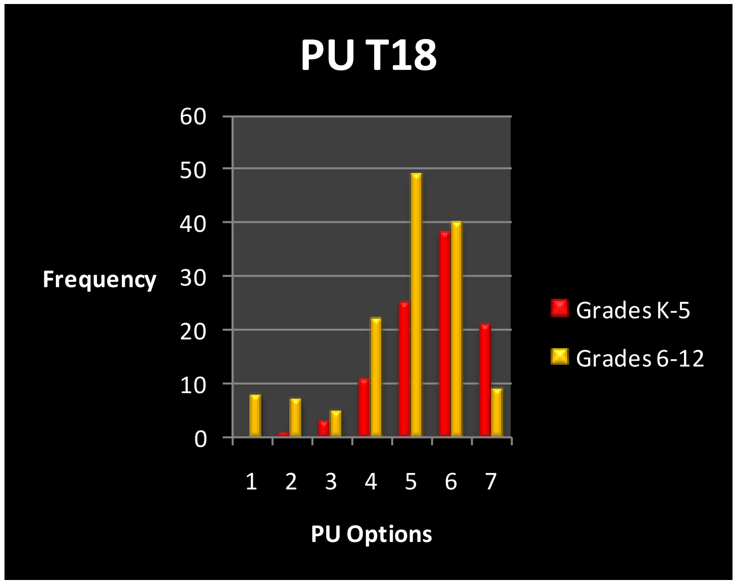

Figure 83. PU T18 Compared to Ambivalence

Grade groups differ in response averages, with 4.807 (closest to "Slightly Likely") for Secondary grades (6-12) and 5.606 (closest to "Quite Likely") for Elementary grades (K-5). Modes differ with 5 ("Slightly Likely") for Secondary grades (6-12) and 6 ("Quite Likely") for Elementary grades (K-5). Grade groups' response levels to JOB EASIER SQ T17 are similar with both grades' groups being significantly different from ambivalence.

PU – COMBINATION OF PU ATTRIBUTES Difference from Ambivalence

Participant responses for the PU dimension compared to Neutral are illustrated in Figure 84. To calculate the combination of PU attributes, all individual scores were collected and analyzed using the Wilcoxon signed-rank test; meaning, scores here were not averaged. For instructors of Elementary grades (K-5), the Wilcoxon signed-rank test indicates a significant difference between the PU dimension and ambivalence, $z = -12.483$, $p < .001$. The mean of the ranks in favor of the PU dimension was 4.939 (closest to "Slightly Likely"), while the mode was 5 ("Slightly Likely"). For instructors of Secondary grades (6-12), the Wilcoxon signed-rank test does indicate a significant difference between the PU dimension and ambivalence, $z = -4.592$, $p < .001$. The mean of the ranks in favor of the PU dimension was 4.295 (closest to "Neither Likely Nor Unlikely"), while the mode was 5 ("Slightly Likely").

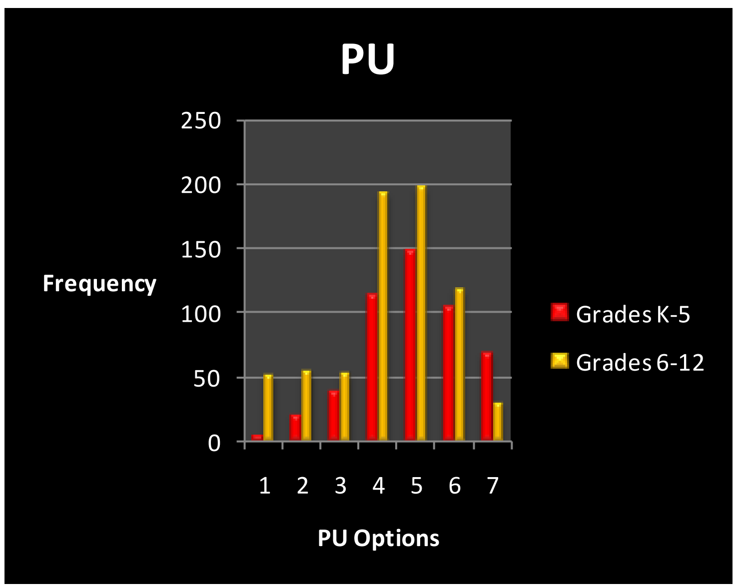

Figure 84. PU Compared to Ambivalence

For sub-category PU, Elementary grades (K-5) are statistically significantly differ than Secondary grades (6-12) with response levels typically one level higher for the PU dimension and its sub-dimensions.

Research Question 10 Summary

In general, test participants are not ambivalent about the acceptance of games for instructional purposes. It is interesting to note that for the Perceived Ease Of Use TAM dimension, participants were not ambivalent about all sub-dimensions at statistically significant levels within either the K-5 or 6-12 groups. Further, PEOU sub-dimensions for educational computer games were for the most part “Quite likely” (6) or higher. Both grades’ group expressed a statistically significant positive perception of ease of use in all sub-dimensions.

The 6-12 grade group Perceived Usefulness response levels contrasts with strong levels seen in of Perceived Ease Of Use for that grade level TAM dimension did not receive such high levels of positive perception. While PU dimension and two sub-dimensions were statistically different from ambivalence, participants in Secondary grades (6-12) did not show a significant difference from Neutral when asked if they thought educational computer games would improve job performance, increase productivity, or make their jobs easier.

Yet even with Secondary grades (6-12) showing lack of a significant difference in three of the five sub-hypotheses within the PU dimension the results suggest that we can reject the null hypothesis that there is no difference between the level of acceptance of educational computer-based games and ambivalence for either the PEOU or PU dimension for the 6-12 grade group. However, the strength of conviction about the perceived “Ease of Use” versus “Usefulness” of computer-based games for instructional purposes differ in mode and measurement with Perceived Ease Of Use being largely “Quite likely” (6) while Perceived Usefulness appear as “Slightly Likely” (5) or even “Neither Likely Nor Unlikely” (4).

The K-5 grade group response levels for both PEOU and PU were statistically significant throughout all dimensions and sub-dimensions. The mean of the ranks in favor of the overall PEOU dimension was 5.780 (closest to “Quite Likely”), while the mode was 6 (“Quite Likely”). The mean of the ranks in favor of the overall PU dimension was 4.939 (closest to “Slightly Likely”), while the mode was 5 (“Slightly Likely”).

CHAPTER FIVE: SUMMARY AND CONCLUSIONS

Summary

A review of the motivation driving this research, the research design, data collection procedures, and findings and analysis are presented in the succeeding paragraphs.

Motivation

This research was conducted to determine if a change occurred in acceptance and usage of educational computer-based games over a significant period of time. Research shows that when compared to other countries, the United States' scores in English, Mathematics, and Science are nowhere near 'leading the world', indeed, they have nearly all fallen in recent years.

At the same time, computer usage – worldwide – has been shown to increase during this same time period. Students are using computers both inside and outside of the classroom for entertainment and educational purposes. Since this is true, the motivation to do this research was largely driven by the desire to learn if and how the educational system has seized this opportunity to incorporate technology, in the form of educational computer-based games, as an instructional strategy in the classroom.

Davis's Technology Acceptance Model (1985) provided the conceptual framework for this research. His model breaks 'acceptance' into two components – perceived ease of use (PEOU) and perceived usefulness (PU) where a person's PEOU influences his or her PU. This model is known for its ability to be adaptable and was adapted to fit the purposes of this research.

The research questions addressed in this study were:

1. Did levels of acceptance towards educational computer-based games change over time?
2. Are dimensions of teacher's level of acceptance of educational computer-based games different from each other?
3. Is there a difference in level of acceptance dimensions between instructor populations that use or do not use educational computer-based games in their instruction?
4. How has the trend in each dimension of level of acceptance toward educational computer-based games in classroom instruction changed over time?
5. How has the level of use of educational computer-based games changed over time?
6. How has the level of access students have to computers with educational computer-based games to meet subject objectives changed over time?
7. Which of the following instructional techniques are used most when incorporating educational computer-based games in the classroom over time?
8. Is there a statistically significant difference among PEOU and PU scores for teachers based on subject taught in the year they won the Milken Educator Award?

9. Is there a statistically significant difference in educational computer-based game use between Elementary and Secondary grades?
10. Between instructors of Elementary and Secondary grades, is the teacher's level of acceptance of educational computer-based games different from ambivalence based on each dimension of acceptance?

Research Design

A guiding principal in the selection of the population was to target teachers who were recognized for actually increasing student performance. Hence we sought an agency that identified such teachers in their award selection criteria. We use the term "exemplar teachers" to describe the resulting target population. Of the several potential agencies considered, the Milken Foundation's Milken Educator Award was the only agency that had a definable student performance stipulation. Furthermore, winners could not apply by themselves but were nominated by others, thereby decreasing the potential for a teacher's attempt to do their best in the year they apply. Finally, as Milken Educator Awards have been distributed annually since 1987, it could meet our desired window of study, from 1996 to 2009. 1996 was picked as the starting point as Windows 95 operating system may be argued to represent the beginning of today's computer-based game interface (compared to previous Windows releases). Due to its release on August 24, 1995 (Windows '95, 1995), our target population consisted of Milken award winners in the year range from 1996 - 2009.

The targeted population was the K-12 teacher who taught any of the four basic subjects: Language Arts (e.g., Communication, Composition, Creative Writing, English, Literature, Reading, Writing), Mathematics (e.g., Algebra, Calculus, Geometry, Liberal Arts Math, Probability and Statistics), Science (e.g., Anatomy and Physiology, Biology, Chemistry, Earth Science, Environmental Science, General Science, Natural Science, Physics), and/or Social Studies (e.g., American Government, Civics, Current Events, Economics, Geography, History, Legal Studies, Psychology, World Religions).

Davis's Technology Acceptance Model (1985) provided the 'acceptance' measure in the survey. Because of its known adaptability, we substituted each instance of 'technology' with 'educational computer-based games' in the model's questions. Pilot data was used to confirm the reliability of the adapted test using Cronbach's alpha measure of internal consistency. Additionally, the survey included demographic, use of educational computer-based games, access to computers with educational computer-based games installed, and instructional strategy for the implementation of educational computer-based games questions. A pilot was conducted prior to administering the survey, resulting in minor adjustments and the ability to measure the amount of time necessary for a participant to complete the survey.

Data Collection

Communication with the Milken Foundation was established since contacting the participants was only possible through this agency's servers. The survey was available online during a ten-week period (March 15 – May 24, 2010) to accommodate teacher's schedules. Email requests were sent out on March 15, March 29, and May 4, 2010. In each of these requests, participants were provided a link to the survey. Once individuals who were deceased and provided no email address to Milken were accounted for, a remaining 1,481 participants became our target population. All possible responses were included in the analysis.

Data and Analysis

SPSS 13.0 for Windows GradPack, Excel, and online tools to perform the Fisher's Exact Test (Joosse, 2010) and regression analysis (Regression Calculator, n.d.) were used to analyze all research questions.

Two hundred fifty nine participants responded either partially or in whole, providing an overall 17.5% response rate. Response rates varied for any given year and by year groups. Of all survey participants, 2002 provided the lowest percentage of responses among any year with a 7.1% response rate while 2009 provided the highest percentage of responses among any year with a 31.5% response rate. Multiple attempts were conducted to determine if 'sent' versus 'received' emails were homogenous either by individual years or by any combination of grouped years. Homogeneity tests of individual year showed that 'sent' versus 'received' emails were significantly different from (not homogeneous with) each other. Homogeneity tests by grouping years in any combination showed that 'sent' versus 'received' emails were also significantly different from (not homogeneous with) each other. Essentially, from our target population, more recent years responded at a higher rate than earlier years.

The impact of the slightly higher trend in response rates over time as illustrated in Figure 85 is not known and is assumed for analysis purposes to be inconsequential. Research has shown that how a participant is contacted may influence their decision to respond (Börkan, 2010). Since the late 1980s the use of e-mail has greatly increased (Sheehan, 2001). Hence, the proportion of e-mail users among the 1990's target population may be assumed to be less than among the target population since 2000 (Y2K). Additionally, Anseel, Lievens, Schollaert, and Choragwicka (2010) found that there were different types of response rates based on the type of respondent (unemployed individual, consumer, employee/non-manager, manager, and executive) and each respondent responded differently to different types of survey follow up. One may argue that the more distant in time from when the participant won the award, the more likely that a Milken award winner would fall into one of the cited categories. Given the above phenomenon cited in the literature, the lower response rate of the earlier years is not unexpected. Speculative possible explanation for this phenomenon may also be attributed to other things. First, one may speculate that participants who won the Milken award in the early years may have either not used or not liked educational computer-based games, so they chose to not answer the survey. The not liking factor may have been present at the time of winning the award or may have developed over time. Another speculative possibility is that because they won the award so long ago, the earlier winners may not remember what techniques they used, and again, chose to not answer the survey. These speculative influences may exist but were not considered significant in light of the aforementioned other factors cited in the literature.

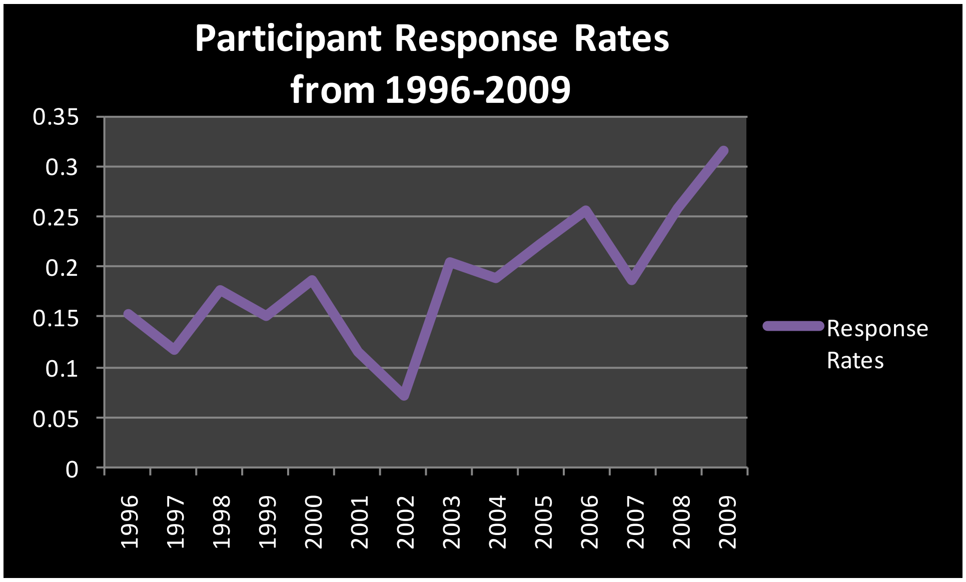

Figure 85. Response Rates from 1996-2009

The highest number of responses came from the eighth grade Language Arts teachers. Ultimately and for all grouped analyses conducted, individual years were clustered by response rates, resulting in closely numerically equivalent groups; year group 1 (1996-1999) with 83 responses, year group 2 (2000-2004) with 86 responses and year group 3 (2005-2009) with 90 responses.

The first analysis investigated levels of acceptance of educational computer-based games by year group. Response levels were compared to ambivalence. Results, summarized in Table 55, illustrate that for PEOU, assumptions of ambivalence could be rejected about any sub-dimensions at statistically significant levels for all three year groups. However, for PU, ambivalence could be rejected across all sub-dimensions for only year group 1 (G1). For year group 2 (G2) and year group 3 (G3), ambivalence was rejected for two of the sub-dimensions (ACCOMPLISH MORE and USEFUL IN JOB) at statistically significant levels within their groups. More recent year groups (G2 and G3) did not show a significant different in level of response from ambivalence (ambivalence could not be rejected) for three sub-dimensions when asked if they thought educational computer games would IMPROVE JOB PERFORMANCE, INCREASE PRODUCTIVITY, or MAKE THEIR JOBS EASIER.

Table 55. Significance of Difference Between Instructor Year Group PEOU, PU and their Sub-Dimensions Response Levels with Ambivalence

TAM Dimensions	TAM Questions	G1: 1995-1999		G2: 2000-2004		G3: 2005-2009	
		$\alpha = .05$ *p* values	β values	$\alpha = .05$ *p* values	β values	$\alpha = .05$ *p* values	β values
PEOU	LEARN TO OPERATE to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	DO WHAT I WANT to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	INTERACTION to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	BECOME SKILLFUL to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	FLEXIBLE to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	EASY TO USE to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	PEOU Dimension to Neutral	$\boldsymbol{p<.001}$	**0.01**	$\boldsymbol{p<.001}$	**0.01**	$\boldsymbol{p<.001}$	**0.01**
PU	ACCOMPLISH MORE to Neutral	$p<.001$	0.01	$p=.010$	0.01	$p=.005$	0.01
	IMPROVE PERFORMANCE to Neutral	$p=.001$	0.01	$p=.081$	0.01	$p=.081$	0.01
	INCREASE PRODUCTIVITY to Neutral	$p=.004$	0.01	$p=.333$	0.01	$p=.132$	0.01
	JOB EASIER to Neutral	$p=.001$	0.01	$p=.155$	0.01	$p=.125$	0.01
	USEFUL IN JOB to Neutral	$p<.001$	0.01	$p<.001$	0.01	$p<.001$	0.01
	PU Dimension to Neutral	$\boldsymbol{p<.001}$	**0.01**	$\boldsymbol{p<.001}$	**0.01**	$\boldsymbol{p<.001}$	**0.01**

The second analysis investigated if group 1, group 2 or group 3 teacher's level of acceptance of educational computer-based games differed from each other. As summarized in Table 56, results indicate that year group PEOU response levels were not statistically different from each other.

Table 56. Significance of Difference Between Instructor Year Group Response Levels for PEOU Sub-Dimensions

PEOU Dimension	LEARN TO OPERATE SQ T8	DO WHAT I WANT SQ T9	INTERACTION SQ T10	BECOME SKILLFUL SQ T11	FLEXIBLE SQ T12	EASY TO USE SQ T13
Year group 1 (1996-1999) Year group 2 (2000-2004) Year group 3 (2005-2009)	α = .05 β = .06 *p* = .139	α = .05 β = .06 *p* = .987	α = .05 β = .06 *p* = .896	α = .05 β = .06 *p* = .152	α = .05 β = .06 *p* = .873	α = .05 β = .06 *p* = .112

Similarly, as summarized in Table 57, results indicate that year group PU response levels were also not statistically different from each other.

Table 57. Significance of Difference Between Instructor Year Group Response Levels for PU Sub-Dimensions

PU Dimension	ACCOMPLISH MORE SQ T14	IMPROVE PERFORMANCE SQ T15	INCREASE PRODUCTIVITY SQ T16	JOB EASIER SQ T17	USEFUL IN JOB SQ T18
Year group 1 (1996-1999) Year group 2 (2000-2004) Year group 3 (2005-2009)	α = .05 β = .06 *p* = .180	α = .05 β = .06 *p* = .531	α = .05 β = .06 *p* = .305	α = .05 β = .06 *p* = .205	α = .05 β = .06 *p* = .976

However, when individual sub-dimension scores were averaged per year group, the overall combined PEOU and overall combined PU dimensions response levels were significantly different from each other for each year group, as summarized in Table 58.

Table 58. Significance of Difference Between PEOU Response Levels and PU Response Levels per Year Group

<table>
<tr><th>TAM Dimensions by Year Groups</th><th>PEOU (individual scores averaged)</th><th>PU (individual scores averaged)</th></tr>
<tr><td rowspan="2">Year group 1 (1996-1999)</td><td colspan="2">α = .05
p <.001</td></tr>
<tr><td colspan="2">β values
0.01</td></tr>
<tr><td rowspan="2">Year group 2 (2000-2004)</td><td colspan="2">α=.05
p <.001</td></tr>
<tr><td colspan="2">β values
0.01</td></tr>
<tr><td rowspan="2">Year group 3 (2005-2009)</td><td colspan="2">α=.05
p <.001</td></tr>
<tr><td colspan="2">β values
0.01</td></tr>
<tr><td rowspan="2">All year groups (1996-2009)</td><td colspan="2">α=.05
p <.001</td></tr>
<tr><td colspan="2">β values
0.01</td></tr>
</table>

The third analysis investigated if there was a difference in level of acceptance for PEOU and PU dimensions within year group populations between instructors who either did or did not use educational computer-based games in their instruction.

As summarized in Table 59, results show that there is a statistically significant difference for all year groups between acceptance levels of users and non-users of games for the PEOU dimension.

Table 59. Significance of the Difference in PEOU Response Levels Between Non-Game Users Vs. Actual Game Users

PEOU Dimension	PEOU (individual scores averaged)	Actual Use
	$\alpha = .05$ *p* values	β
Year group 1 (1996-1999)	$p = .02$	0.1
Year group 2 (2000-2004)	$p = .001$	0.1
Year group 3 (2005-2009)	$p = .001$	0.1
Year groups 1-3 (1996-2009)	$p < .001$	0.1

Similarly, as summarized in Table 60, results also show that there is a statistically significant difference between acceptance response levels of users and non-users of games for the PU dimension for all year groups.

Table 60. Significance of the Difference in PU Response Levels Between Non-Game Users Vs. Actual Game Users

PU Dimension	PU (individual scores averaged)	Actual Use
	$\alpha = .05$ *p* values	β
Year group 1 (1996-1999)	$p = .007$	0.1
Year group 2 (2000-2004)	$p < .001$	0.1
Year group 3 (2005-2009)	$p < .001$	0.1
Year groups 1-3 (1996-2009)	$p < .001$	0.1

The fourth analysis explored possible trends of level of acceptance in each dimension toward educational computer-based games in classroom instruction by year group, which infers over time. Individual and year group trend analyses were conducted using the Cox-Stuart trend test on each of the TAM dimensions. Results shown in Table 61 indicated that, based on the individual analyses, we can reject the hypothesis of NO

TREND and accept the alternative hypothesis of a trend of increasing level in acceptance of educational computer-based games in classroom instruction over time for the overall PEOU dimension and for the “LEARN TO OPERATE” sub-dimension of PEOU. The best way to understand why the overall response level for the PEOU dimension is significant while only one of its sub-dimensions is significant is cumulative effects. That is to say, all the sub dimensions had *p* values of .5 or less with several very close to .05. The Cox-Stuart test, when applied to the accumulation of so many positive values, overwhelmed the statistical likelihood of this occurring by chance; thus resulting in the statistically significant overall outcome.

Similarly, based on the individual analysis, the hypothesis of no trend for the PU dimension and two of the five PU sub-dimensions (INCREASE PRODUCTIVITY and JOB EASIER) can be rejected and the alternative hypothesis of a trend of increasing level in acceptance of educational computer-based games in classroom instruction over time for two of the five PU sub-dimensions (INCREASE PRODUCTIVITY and JOB EASIER) and the overall PU dimension accepted. Table 61 summarizes the analysis.

Table 61. Significance of Trend in PEOU Response Levels and PU Response Levels Across All Year Groups

TAM Dimensions	TAM Question	α = .05 *p* values	Total Trials	Total Positives	Total Negatives
PEOU	LEARN TO OPERATE	p = .036	79	48	31
	DO WHAT I WANT	p = .500	101	51	50
	INTERACTION	p = .417	91	47	44
	BECOME SKILLFUL	p = .075	82	48	34
	FLEXIBLE	p = .416	89	43	46
	EASY TO USE	p = .060	81	48	33
	PEOU Dimension	p = .022	523	285	238
PU	ACCOMPLISH MORE	p = .242	100	46	54
	IMPROVE PERFORMANCE	p = .111	97	55	42
	INCREASE PRODUCTIVITY	p = .041	96	57	39
	JOB EASIER	p = .022	90	55	35
	USEFUL IN JOB	p = .201	91	50	41
	PU Dimension	p = .010	474	263	211

The fifth analysis explored the response level of educational computer-based game usage change by year group, which infers over time. Results, summarized in Table 62, show that because each of the sub-hypotheses (i.e. level of the population that actually used games for educational use, level of games in use, and level of hours used) yielded results that were not significant, the null hypothesis must be accepted: there was no increase in the level of educational computer-based games over time. This may be due to many factors, to include access and educational issues discussed below. However, there is one possible but remote caveat to this conclusion. Since we know that responses per year group are not homogeneous, we know that our observations may not be representative of any one particular year and hence possibly not represent the trend over time in the span of years that we analyzed. Because this remote but possible response rate bias due to non-homogeneity, the survey sample may not reflect the population of exemplar teachers.

Table 62. Significance of the Difference of Educational Computer-Based Game Usage Across All Year Groups

RQ5 Subhypotheses	**α (alpha)**	**β (beta)**	**Data Analyzed**	***p*** **(significance value)**
Level (percentage) of instructors using games over time	0.050	0.011	Actual usage of games by instructor by year group (all three year groups)	0.639
			Do people who cited games differed from those who responded to the survey by year group (all three year groups)	0.155
			Number of people who cited games by year group (all three year groups)	0.190
			Number of people who cited games by individual year	0.470
Number of games used over time	0.050	n/a	Number of games used by year group (all three year groups)	0.290
			Number of games used by individual year	0.550
	0.050	n/a	Did number of games used within each subject area differed by year group (all three year groups)	0.301 (LA)
				0.352 (M)
				0.633 (S)
				0.111 (SS)
Number of hours games used over time	0.100	0.200	Hours of games used by year group (all three year groups)	0.165

The sixth analysis investigated the change in response level of access students have to computers with educational computer-based games by year group, which infers over time. Results, summarized in Table 63, show that because each of the sub-hypotheses yielded results that were not significant, the null hypothesis must be accepted: there was no change in access students had to computers with educational computer-based games to meet subject objectives over time. One must note that the "Change in access for students to computers with educational computer-based games in the media center" was nearly statistically significant.

Table 63. Significance of the Difference in Access to Computers with Educational Computer-Based Games Across All Year Groups

RQ6 Subhypotheses	α (alpha)	β (beta)	Data Analyzed	*p* (significance values)
Change in access to games in classroom over time	0.050	0.050	Change in access for students to computers with games in the classroom by year group (all three year groups)	0.418
Change in access to games in media center over time	0.050	0.050	Change in access for students to computers with educational computer-based games in the media center by year group (all three year groups)	0.058
	0.050	0.130	Change in hours of access students had to computers with educational computer-based games in the media center by year group (all three year groups)	0.879

The seventh analysis investigated which instructional techniques were used most when incorporating educational computer-based games in the classroom over time. Results, summarized in Table 64, indicated no significant change in how educational computer based games were used among all year groups. Hence, the null hypothesis:

there is no difference among use of instructional techniques when incorporating educational computer-based games over time, must be accepted.

Table 64. Significance of the Difference in Instructional Technique Usage Across All Year Groups

RQ7 Hypothesis	α (alpha)	β (beta)	Data Analyzed	*p* (significance values)
Difference among use of instructional techniques when incorporating games over time	0.050	0.050	Difference among instructional techniques when incorporating games in the classroom by year group (all three year groups)	0.462

The eighth analysis explored whether there was a significant difference among PEOU and PU response levels for teachers based on subject taught. Table 65 shows that for PEOU response levels, there was no difference based on the specific subject taught. Hence, for the PEOU dimension the null hypothesis: there is no difference for PEOU response levels among teachers based on the subjects they taught the year they won the Milken Educator Award, must be accepted.

Table 65. Significance of the Difference in PEOU Response Levels Based on Subject Across All Year Groups

RQ8 PEOU Differences by Subject	α (alpha)	β (beta)	Data Analyzed	*p* (significance values)
Difference for PEOU scores among teachers based on subject taught the year they won the Milken Educator Award	0.050	0.010	Difference among instructional techniques when incorporating games in the classroom by year group (all three year groups)	0.747

Table 66 shows that for PU response levels there was also no difference based on the specific subject taught. Similarly, for the PU dimension the null hypothesis:

there is no difference for PU response levels among teachers based on the subjects they taught the year they won the Milken Educator Award, must also be accepted.

Table 66. Significance of the Difference in PU Response Levels Based on Subject Across All Year Groups

RQ8 PU Differences by Subject	α (alpha)	β (beta)	Data Analyzed	*p* (significance values)
Difference for PU scores among teachers based on subject taught the year they won the Milken Educator Award	0.050	0.010	Difference among instructional techniques when incorporating games in the classroom by year group (all three year groups)	0.129

The ninth analysis explored the response level of educational computer-based game usage change between Elementary (K-5) and Secondary (6-12) grades. Results, summarized in Table 67, show that because each of the sub-hypotheses yielded results that were significant, the null hypothesis can be rejected and the alternative hypothesis accepted: there was a difference in the level of educational computer-based game usage between exemplar Elementary (K-5) and Secondary (6-12) grades with exemplar elementary teachers using educational computer-based games at significantly higher levels than exemplar secondary school teachers.

Table 67. Significance of the Difference in level of Educational Computer-Based Game Usage Between Elementary (K-5) and Secondary (6-12) Grades

RQ5 Subhypotheses	α (alpha)	β (beta)	Data Analyzed	*p* (significance value)
Level (percentage) of instructors using games over time	0.050	0.005	Actual usage of games by instructor between Elementary grades (K-5) and Secondary grades (6-12)	<.001
Number of games used over time	0.050	0.000	Number of games used between Elementary grades (K-5) and Secondary grades (6-12)	<.001
Number of hours games used over time	0.100	0.100	Hours of games used between Elementary grades (K-5) and Secondary grades (6-12)	0.001

The tenth analysis investigated levels of acceptance of educational computer-based games between Elementary (K-5) and Secondary (6-12) grades. Response levels were compared to ambivalence. Results, summarized in Table 68, illustrate that for PEOU, assumptions of ambivalence could be rejected about any sub-dimensions at statistically significant levels for both grade groups. However, for PU, ambivalence could be rejected across the PU dimension and all sub-dimensions for only Elementary grades (K-5). For Secondary grades (6-12), ambivalence was rejected for the overall PU dimension and for two of the sub-dimensions (ACCOMPLISH MORE and USEFUL IN JOB) at statistically significant levels. Secondary grades (6-12) did not show a significant different in level of response from ambivalence (ambivalence could not be rejected) for three sub-dimensions when asked if they thought educational computer games would IMPROVE JOB PERFORMANCE, INCREASE PRODUCTIVITY, or MAKE THEIR JOBS EASIER.

Table 68. Significance of Difference Between Elementary (K-5) and Secondary (6-12) Grades PEOU, PU and their Sub-Dimensions Response Levels with Ambivalence

TAM Dimensions	**TAM Questions**	**Elementary (Grades K-5)**		**Secondary (Grades 6-12)**	
		α = .05 *p* values	**β values**	**α = .05 *p* values**	**β values**
PEOU	LEARN TO OPERATE to Neutral	$p<.001$	0.01	$p<.001$	0.01
	DO WHAT I WANT to Neutral	$p<.001$	0.01	$p<.001$	0.01
	INTERACTION to Neutral	$p<.001$	0.01	$p<.001$	0.01
	BECOME SKILLFUL to Neutral	$p<.001$	0.01	$p<.001$	0.01
	FLEXIBLE to Neutral	$p<.001$	0.01	$p<.001$	0.01
	EASY TO USE to Neutral	$p<.001$	0.01	$p<.001$	0.01
	PEOU Dimension to Neutral	$\mathbf{p<.001}$	**0.01**	$\mathbf{p<.001}$	**0.01**
PU	ACCOMPLISH MORE to Neutral	$p<.001$	0.01	$p=.022$	0.01
	IMPROVE PERFORMANCE to Neutral	$p<.001$	0.01	$p=.359$	0.01
	INCREASE PRODUCTIVITY to Neutral	$p<.001$	0.01	$p=.780$	0.01
	JOB EASIER to Neutral	$p<.001$	0.01	$p=.296$	0.01
	USEFUL IN JOB to Neutral	$p<.001$	0.01	$p<.001$	0.01
	PU Dimension to Neutral	$\mathbf{p<.001}$	**0.01**	$\mathbf{p<.001}$	**0.01**

Conclusions

Major Findings

The findings for research questions addressed in this study were:

1. Did levels of acceptance towards educational computer-based games change over time? The following analysis done on this research question involved the entire sample population of 259 respondents enabling the resulting power of our analysis to exceed our target of an alpha level of .05 and beta level of .1. The data is not homogeneous in terms of respondents per year group, but this is assumed to be inconsequential as explained above.

a. In general, exemplar teachers are not ambivalent about the Perceived Ease of Use of games for instructional purposes as measured in terms of our PEOU and PU scales. The PEOU dimension and sub-dimensions for educational computer games were for the most part "Quite likely" (6) or higher. All year groups expressed a statistically significant positive perception of ease of use in terms of the following sub-dimensions: LEARN TO OPERATE, COULD MAKE THE GAME DO WHAT THEY WANT, WOULD BE FLEXIBLE TO INTERACT WITH, and WERE EASY TO USE.

b. Likewise exemplar teachers are not ambivalent about the overall Perceived Usefulness. Contrasting with strong levels of Perceived Ease Of Use, while the Perceived Usefulness sub-dimensions were for the most part statistically different from ambivalence, participants in year group 2 (2000-2004) and year group 3 (2005-2009) did not show a significant difference from Neutral when asked if they thought educational computer games would IMPROVE JOB PERFORMANCE, INCREASE PRODUCTIVITY, or MAKE JOBS EASIER. This may reflect an overall greater optimism in the 1990's about games for instructional use while exemplar teachers since 2000 have faced difficulties along those three PU sub-dimensions.

2. Are dimensions of teacher's level of acceptance of educational computer-based games different from each other over time? The following analysis done on this

research question involved the entire sample population of 259 respondents enabling the resulting power of our analysis to exceed our target of an alpha level of .05 and beta level of .1. The data is not homogeneous in terms of respondents per year group, but this is assumed to be inconsequential as explained above.

a. Within the PEOU dimension, there was no difference between year groups. All year groups' feelings towards PEOU did not differ significantly from each other. Meaning, over 14 years, exemplar teachers consistently perceived acceptance of educational computer-based games remained within the levels identified in our first set of hypotheses for our first research question. We accept the null hypothesis: there is no difference between the level of acceptance dimensions for use of educational computer-based games for classroom instruction across year groups for the PEOU dimension.

b. Similarly, within the PU dimension, there was no difference between year groups. All year groups' feelings towards PU did not differ significantly from each other. Meaning, over 14 years, exemplar teachers consistently perceived acceptance of educational computer-based games within the levels identified in our first set of hypotheses for our first research question. We accept the null hypothesis: there is no difference between the level of acceptance dimensions for use of educational computer-based games for classroom instruction across year groups for the PU dimension.

c. However, as a spin-off of the research question, when comparing PEOU response levels to PU response levels across year groups, values differed significantly from each other. Similar to Research Question 1, PEOU response levels were consistently higher (ranging from "Slightly Likely" (5) to "Quite Likely" (6)) than were those of PU (whose response levels ranged from "Neither Likely Nor Unlikely" (4) to "Slightly Likely" (5)). When comparing PEOU to PU across year groups, the null hypothesis can be rejected and the alternate hypothesis can be accepted: there is a difference between the level of acceptance dimensions for use of educational computer-based games for exemplar teachers across year groups.

3. Is there a difference in level of acceptance dimensions between exemplar instructor populations that use or do not use educational computer-based games in their instruction? The following analysis done on this research question involved the entire sample population of 259 respondents enabling the resulting power of our analysis to exceed our target of an alpha level of .05 and beta level of .1. The data is not homogeneous in terms of respondents per year group, but this is assumed to be inconsequential as explained above.

a. Overall, exemplar teachers who perceived educational computer-based games as easier (PEOU) to use or more useful (PU) were more inclined to actually use these games in the classroom. For all year groups, PEOU response levels were significantly higher for actual game users than for non-game users.

b. Similarly, for all year groups, PU response levels were significantly higher for actual game users than for non-game users. However, consistent with previous findings, PEOU response levels were higher than PU response levels among those instructors who actually used games as well as among those instructors who actually did not use games.

4. How has the trend in each dimension of level of acceptance toward educational computer-based games in exemplar teachers changed over time? The following analysis done on this research question involved the entire sample population of 259 respondents enabling the resulting power of our analysis to exceed our target of an alpha level of .05 and beta level of .1. The data is not homogeneous in terms of respondents per year group, but this is assumed to be inconsequential as explained above.

   a. The individual trend analysis showed significant outcomes for the overall PEOU dimension and LEARN TO OPERATE sub-dimension. Meaning, for these areas, a trend existed. This may reflect in the LEARN TO OPERATE sub-dimension being a strong indicator for the entire dimension. Though a trend exists, the trend does not appear strong enough to cause a significant difference in PEOU levels between the three year groups as determined in the second research question.

b. Similarly, the individual trend analysis showed significant outcomes for the overall PU dimension as well as the INCREASE PRODUCTIVITY and JOB EASIER sub-dimensions. In the same way as with the PEOU dimension, the two sub-dimensions INCREASE PRODUCTIVITY and JOB EASIER could be stronger indicators for trend within the PU dimension. Though a trend exists, the trend does not appear strong enough to cause a significant difference in PU levels between the three year groups as determined in the second research question.

5. How has the level of use of educational computer-based games changed over time? The power levels of the analysis of this section varies as explained below.

   a. Overall, there was no significant change in the levels (percentage) of exemplar instructor use of educational computer-based games when divided and analyzed between year groups or between individual years. This was determined by conducting four separate analyses: 1) determining if actual usage of educational computer-based games changed over time, which it did not; this analysis was done using the entire sample population of 259 respondents enabling the resulting power of our analysis to exceed our target of an alpha level of .05 and beta level of .1. The data is not homogeneous in terms of respondents per year group, but this is assumed to be inconsequential as explained above. 2) determining if there was a significant change over time for whether people who cited games differed from those who responded to the survey, again there was not; this analysis was done using the entire sample population of 259 respondents enabling the resulting power of our analysis to exceed our target of an alpha level of .05 and beta level of .1. The data is not homogeneous in terms of respondents per year group, but this is assumed to be inconsequential as explained above. 3) determining if there was a significant relationship between year groups and number of people who cited games within each year group, and again there was not; this analysis was done using the 80 respondents who cited games enabling us to reach an alpha level of .05. Beta levels were not provided using the regression statistical analysis. The data is not homogeneous in terms of respondents per year group, but this is assumed to be inconsequential as explained above. Finally, 4) determining if there was a significant relationship between year groups and number of people who cited games by individual year, and again there was not; this analysis was done using the 86 respondents who cited games enabling us to reach an alpha level of .05. Beta levels were not provided using the regression statistical analysis. The data is not homogeneous in terms of respondents per year group, but this is assumed to be inconsequential as explained above.

b. It was also discovered that there was no change in the quantity of educational computer-based games used by exemplar instructors in the classroom over time. This was determined by conducting three separate analyses: 1) determining if there was a significant relationship between year groups and number of games used within each year group, which there was not; this analysis was done using the 231 games provided by respondents enabling us to reach an alpha level of .05. Beta levels were not provided using the regression statistical analysis. The data is not homogeneous in terms of respondents per year group, but this is assumed to be inconsequential as explained above. 2) determining if there was a significant relationship between individual year and number of games used by year, which there was not; this analysis was done using the 231 games provided by respondents enabling us to reach an alpha level of .05. Beta levels were not provided using the regression statistical analysis. Finally, 3) determining whether number of educational computer-based games used within each subject area differed between year groups, which they did not; this analysis was done analyzing participant responses for each subject area. For Language Arts teachers, 113 participants provided data enabling us to reach an alpha level of .05.

Beta values ranged from .08-.3 for between group analysis and were not available for overall group analyses. For Math teachers, 47 participants provided data enabling us to reach an alpha level of .05. Beta values ranged from .06-.3 for between group analysis and were not available for overall group analyses. For Science teachers, 50 participants provided data enabling us to reach an alpha level of .05. Beta values ranged from .03-.13 for between group analysis and were not available for overall group analyses. For Social Studies teachers, 12 participants provided data enabling us to reach an alpha level of .05. Beta values ranged from .06-.45 for between group analysis and were not available for overall group analyses. However, it is important to note that for the Social Studies subject, when year group 1 was compared to year group 2, the difference did approach significance at .058.

c. Finally, no significant difference was found between year groups and hours of game used; this analysis was done using the 73 participants who provided hours of games use enabling the resulting power of our analysis to exceed our target of an alpha level of .05 and beta level of .2. The data is not homogeneous in terms of respondents per year group, but this is assumed to be inconsequential as explained above.. Because each of these areas yielded results that were not significant, the null hypothesis must be accepted – that there was no increase of educational computer-based games over time.

6. How has the level of access students have to computers with educational computer-based games to meet subject objectives changed over time? The following analysis done on this research question involved up to 238 respondents enabling the resulting power of our analysis to reach an alpha level of .05 and beta level of .05-.22 due to sample responses per survey question. The data is not homogeneous in terms of respondents per year group, but this is assumed to be inconsequential as explained above.
    a. Access students had to educational computer-based games used by instructors in the classroom did not significantly change over time. This held true whether comparing all three year groups to each other or when comparing any two of the three groups to each other.
    b. Access students had to educational computer-based games used by instructors in the media center also did not significantly change over time, however, it must be noted the value approached significance at .058. However, when comparing any two years to each other year group 1 (1996-1999) compared to year group 2 (2000-2004) showed a significant value at p=.011.
    c. When further analyzing whether hours of access students had to computers with educational computer-based games in the media center

changed over time, results were not significantly different from each other.

7. Which of the following instructional techniques are used most when incorporating educational computer-based games in the classroom over time? The following analysis done on this research question involved up to 280 responses enabling the resulting power of our analysis to exceed our target of an alpha level of .05 and beta level of .2. The data is not homogeneous in terms of respondents per year group, but this is assumed to be inconsequential as explained above.
    a. Instructional techniques used when incorporating educational computer-based games in the classroom did not significantly change over time. This held true whether comparing all three year groups to each other or when comparing any two of the three groups to each other.
8. Is there a statistically significant difference among PEOU and PU scores for teachers based on subject taught in the year they won the Milken Educator Award? The following analysis done on this research question involved using the entire sample population of 259 respondents enabling the resulting power of our analysis to exceed our target of an alpha level of .05 and beta level of .01. The data is not homogeneous in terms of respondents per year group, but this is assumed to be inconsequential as explained above.

a. PEOU response levels did not vary significantly between teachers who taught Language Arts and Social Studies and those who taught Math and Science.

b. Similarly, PU response levels did not vary significantly between teachers who taught Language Arts and Social Studies and those who taught Math and Science.

9. Is there a statistically significant difference in educational computer-based game use between Elementary and Secondary grades? The power levels of the analysis of this section varies as explained below.

    a. Overall, there was a significant change in the levels (percentage) of instructor use of educational computer-based games when divided between Elementary (K-5) and Secondary (6-12) grades. This was determined by determining if actual usage of educational computer-based games changed between Elementary (K-5) and Secondary (6-12) grades, which it did. This analysis was done using the sample population of 233 respondents enabling the resulting power of our analysis to exceed our target of an alpha level of .05 and beta level of .005. The data is homogeneous in terms of respondents per grade group.

    b. It was also discovered that there was a change in the quantity of educational computer-based games used by instructors in the classroom between Elementary (K-5) and Secondary (6-12) grades. This was determined by determining if there was a significant relationship between Elementary (K-5) and Secondary (6-12) grades and number of games used within each year group, which there was. This analysis was done using the sample population of 213 respondents enabling the resulting power of our analysis to exceed our target of an alpha level of .05 and beta level of .00002. The data is homogeneous in terms of respondents per grade group.

c. Finally, a significant difference was found between Elementary (K-5) and Secondary (6-12) grades and hours of game used. Because each of these areas yielded results that were significant, the null hypothesis can be rejected and the alternate hypothesis accepted – that there was a increase of educational computer-based games between Elementary (K-5) and Secondary (6-12) grades. This analysis was done using the sample population of 140 respondents enabling the resulting power of our analysis to exceed our target of an alpha level of .05 and beta level of .1. The data is homogeneous in terms of respondents per grade group.

10. Between instructors of Elementary and Secondary grades, is the teacher's level of acceptance of educational computer-based games different from ambivalence based on each dimension of acceptance? This analysis was done using the entire sample population of 259 respondents enabling the resulting power of our analysis to

exceed our target of an alpha level of .05 and beta level of .01. The data is homogeneous in terms of respondents per grade group.

a. In general, exemplar teachers are not ambivalent about the Perceived Ease Of Use of games for instructional purposes. The PEOU sub-dimensions for educational computer games were for the most part "Quite likely" (6) or higher. Both grades' groups expressed a statistically significant positive perception of ease of use in all PEOU sub-dimensions.
b. Likewise exemplar teachers are not ambivalent about the overall Perceived Usefulness. Contrasting with strong levels of Perceived Ease Of Use, while the Perceived Usefulness sub-dimensions were for the most part statistically different from ambivalence, participants in the Secondary grades (6-12) did not show a significant difference from Neutral when asked if they thought educational computer games would IMPROVE JOB PERFORMANCE, INCREASE PRODUCTIVITY, or MAKE JOBS EASIER. This may reflect an overall greater optimism in the Elementary grades (K-5) about games for instructional use while exemplar teachers in Secondary grades (6-12) have faced difficulties along those three PU sub-dimensions.

The results of this research suggest, overall, that PEOU, PU, actual use, and diversity of educational computer-based games by exemplar teachers for K-12 classroom instruction has not changed over the time period from 1996 to 2009. This makes a lot of sense since access to computers with educational computer-based games installed also did not change during the time period examined. However, the lack of change in use and game diversity is not due to teachers' acceptance (operationally defined as perceived ease of use and perceived usefulness). Now we can see that, over 14 years, teachers' feelings have remained constant – they *do* tend to perceive educational computer-based games as both easy to use (referencing the PEOU dimension) and useful (referencing the PU dimension). As discussed earlier, previous research (Rice, 2007b) shows that it is other issues (e.g., administrative support or funding) that play a role in why educational computer-based games are not incorporated in the curriculum. A final outcome from the results shows that instructional techniques used most frequently in the early years maintained in popularity over time as well.

Lessons Learned

In this experiment, we encountered several unexpected obstacles that provided potentially unknown limitations. For example, the server crashes that occurred during each data collection session proved to be a concern. Though correspondence with the Milken Foundation liaison was reassuring and it was confirmed that each and every email was sent, there is no way to verify that all 1,481 emails actually were pushed through. Additionally, assuming all emails went through, a confirmation email was sent notifying the administrator of each approved email. So, nearly 3,000 emails were generated by the server in order to access half that number in survey participants.

Another limitation included the method of contacting these voluntary participants. There was only one way to do so and it was through the Milken Foundation page. There is no way to verify that the email Milken sent to was the email address most used by the participants, so some may not have even received the survey request. Due to the limitation of using only one mode of communication, we do not know how many additional responses could have been received had another approach been allowed. This limitation may very well have influenced the homogeneous issue stated in the beginning of the Results section and again when analyzing Research Question 5. There is a remote possibility that responses, due to non-homogeneity, may not be representative of the given year or year group. Because of this remotely possible response rate bias, the nature of the survey itself may have a remote possibility of reflecting a bias due to response level differences caused by issues cited in the literature and/or from previously speculated bias in those participating in the survey.

Suggested Future Research

With any retrospective study, all findings are subject to recall bias. This can only be overcome by undertaking a prospective study and asking the survey population (in this case Milken Educator Award winners) at the time they won the award about how and if they feel the incorporation of educational computer-based games influence their winning the award. To better examine the effect educational computer-based games have on future Milken Educator Award winners, or any research population, a survey provided to the winners at the same incremental time after winning the award would provide a better opportunity for recall of what techniques were used and how and what access was available to students.

Another idea for future research includes sampling a different type of population. In this study, our sample included not only exemplar teachers, but a specific agency's winners. How do levels of game acceptance and use by teachers who were not winners differ from award winners? Would results have varied?

Each of our research questions could have a variety of follow on questions. Future research would include the opportunity to follow up with the participants to ask additional questions about their responses: in their environment, why does each teacher have stronger feelings about the perception of ease of use of educational computer-based games, but not their usefulness? A closer look at subject-specific educational computer-based games would help in understanding why a teacher chose one game over another when and if a game was incorporated in the curriculum. Asking teachers to document their usage of educational computer-based games on a weekly or monthly basis would provide more realistic data towards their incorporation of these games. Asking follow on questions regarding students' access to subject-specific educational computer-based games would help us understand better if this is a choice made by the teacher or administration, if funding and other resources are simply not available (Rice, 2007b), or, as McFarlane, Sparrowhawk, and Heald (2002) opine that content of games used in schools are ill-matched to the curriculum content.

This research started out illustrating where the United States stood in comparison with other countries. Another possible extension of this research could be to find a common inclusion criterion on which to gather a group of domestic and international teachers, present this survey (or one modified) and see what the results would show. Do K-12 students in other countries have more or less access than United States students? How do international teachers' PEOU and PU scores differ from US teachers' scores? How do instructional techniques differ?

A final suggestion for future research would be to, based on the same grade, subject and curriculum, compare performance results of students who do use educational computer-based games to those who do not per subject over the course of a semester or year.

APPENDIX A – IRB APPROVAL

University of Central Florida

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Yaela Dahan-Marks**

Date: **February 16, 2010**

Dear Researcher:

On 2/16/2010, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review:	Exempt Determination
Project Title:	ANALYSIS OF THE RELATIONSHIP BETWEEN THE LEVEL OF COMPUTER GAME USE AND MILKEN EXEMPLAR TEACHER INSTRUCTIONAL STRATEGIES
Investigator:	Yaela Dahan-Marks
IRB Number:	SBE-10-06722
Funding Agency:	
Grant Title:	
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 02/16/2010 04:17:56 PM EST

Joanne Muratori

IRB Coordinator

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APPENDIX B – SURVEY

Final Survey Questions

www.yaelasresearch.com

I. Demographic (Part One)

1. Gender:

   Male

   Female

2. What year did you win the Milken Educator Award?

   Code 96 = 1996

   Code 97 = 1997

   Code 98 = 1998

   Code 99 = 1999

   Code 20 = 2000

   Code 1 = 2001

   Code 2 = 2002

   Code 3 = 2003

   Code 4 = 2004

   Code 5 = 2005

   Code 6 = 2006

   Code 7 = 2007

   Code 8 = 2008

   Code 9 = 2009

3. What was your age at the time you won the Milken Educator Award?

   Enter a numeric value

4. Based on the year you won the Milken Educator Award, please choose ONE grade and subject on which you will base your responses for the remainder of this survey. If you feel you taught more than one grade and subject an equal amount of time, please choose one grade and subject to base all your responses for the remainder of the survey. For example, choose 5th grade Mathematics OR 10th grade Social Studies OR 9th grade Language Arts, etc.

    Part one of answer:

    Code 0 = Kindergarten

    Code 1 = 1st grade

    Code 2 = 2nd grade

    Code 3 = 3rd grade

    Code 4 = 4th grade

    Code 5 = 5th grade

    Code 6 = 6th grade

    Code 7 = 7th grade

    Code 8 = 8th grade

    Code 9 = 9th grade

    Code 10 = 10th grade

    Code 11 = 11th grade

    Code 12 = 12th grade

Part two of answer:

Code LA = Language Arts

(e.g., Communication, Composition, Creative Writing, English, Literature, Reading, Writing)

Code M = Mathematics

(e.g., Algebra, Calculus, Geometry, Liberal Arts Math, Probability and Statistics)

Code S = Science

(e.g., Anatomy and Physiology, Biology, Chemistry, Earth Science, Environmental Science, General Science, Natural Science, Physics)

Code SS = Social Studies

(e.g., American Government, Civics, Current Events, Economics, Geography, History, Legal Studies, Psychology, World Religions)

II. Access

5. For the subject and grade you chose in the previous question, did your students have access to educational computer-based games in the classroom?

   Code 1 = No, students ***did not*** *have access to computers with educational computer-based games in the classroom.*

   Code 2 = Yes, students did have access in my classroom: There was ***one computer*** *with educational computer-based games in the classroom for* ***all students*** *in my class.*

   Code 3 = Yes, students did have access in my classroom: There was ***more than one computer*** *with educational computer-based games in the classroom that was* ***shared by all students*** *in my class.*

   Code 4 = Yes, students did have access in my classroom: There was ***one computer*** *with educational computer-based games in the classroom for* ***each student*** *in my class.*

6. For the subject and grade you chose in the previous question, did your students have access to educational computer-based games in the media center/open computer laboratory/library?

   Code 1 = No, students ***did not*** *have access to computers with educational computer-based games in the media center/open computer laboratory/library.*

   Code 2 = Yes, students did have access at the media center/open computer laboratory/library: There was ***one computer*** *with educational computer-based games in the media center/open computer laboratory/library for* ***all students*** *in my class.*

   Code 3 = Yes, students did have access at the media center/open computer laboratory/library: There was ***more than one computer*** *with educational computer-based games in the media center/open computer laboratory/library that was* ***shared by students*** *in my class.*

   Code 4 = Yes, students did have access at the media center/open computer laboratory/library: There was ***one computer*** *with educational computer-based games in the media center/computer laboratory/library for* ***each student*** *in my class.*

7. At the time of winning the Milken Educator Award and for the grade and subject you previously chose, which statement most closely matches approximately how many hours a week your students had access on their own to JUST the media center/open computer laboratory/library to use educational computer-based games?

   Code 1 = Less than 1 hour per week

   Code 2 = 1 to 2 hours per week

   Code 3 = 2 to 3 hours per week

   Code 4 = 3 to 4 hours per week

   Code 5 = 4 to 5 hours per week

   Code 6 = 5 to 10 hours per week

   Code 7 = 10 or more hours per week

   Code 8 = Does not apply

III. TAM

8. Learning to operate educational computer-based games would be easy for me.
   Code 1 = Extremely Unlikely

   Code 2 = Quite Unlikely

   Code 3 = Slightly Unlikely

   Code 4 = Neither Likely nor Unlikely

   Code 5 = Slightly Likely

   Code 6 = Quite Likely

   Code 7 = Extremely Likely

9. I would find it easy to make educational computer-based games do what I want them to do.
   Code 1 = Extremely Unlikely

   Code 2 = Quite Unlikely

   Code 3 = Slightly Unlikely

   Code 4 = Neither Likely nor Unlikely

   Code 5 = Slightly Likely

   Code 6 = Quite Likely

   Code 7 = Extremely Likely

10. Overall, my interaction with educational computer-based games would be clear and understandable.
    Code 1 = Extremely Unlikely

    Code 2 = Quite Unlikely

    Code 3 = Slightly Unlikely

    Code 4 = Neither Likely nor Unlikely

    Code 5 = Slightly Likely

    Code 6 = Quite Likely

    Code 7 = Extremely Likely

11. It would be easy for me to become skillful at using educational computer-based games.
    Code 1 = Extremely Unlikely

    Code 2 = Quite Unlikely

    Code 3 = Slightly Unlikely

    Code 4 = Neither Likely nor Unlikely

    Code 5 = Slightly Likely

    Code 6 = Quite Likely

    Code 7 = Extremely Likely

12. I would find educational computer-based games flexible when interacting with them.
    Code 1 = Extremely Unlikely

    Code 2 = Quite Unlikely

    Code 3 = Slightly Unlikely

    Code 4 = Neither Likely nor Unlikely

    Code 5 = Slightly Likely

    Code 6 = Quite Likely

    Code 7 = Extremely Likely

13. I would find educational computer-based games easy to use.
    Code 1 = Extremely Unlikely

    Code 2 = Quite Unlikely

    Code 3 = Slightly Unlikely

    Code 4 = Neither Likely nor Unlikely

    Code 5 = Slightly Likely

    Code 6 = Quite Likely

    Code 7 = Extremely Likely

14. Using educational computer-based games in my job would enable me to accomplish tasks more quickly.
    Code 1 = Extremely Unlikely

    Code 2 = Quite Unlikely

    Code 3 = Slightly Unlikely

    Code 4 = Neither Likely nor Unlikely

    Code 5 = Slightly Likely

    Code 6 = Quite Likely

    Code 7 = Extremely Likely

15. Using educational computer-based games would improve my job performance.
    Code 1 = Extremely Unlikely

    Code 2 = Quite Unlikely

    Code 3 = Slightly Unlikely

    Code 4 = Neither Likely nor Unlikely

    Code 5 = Slightly Likely

    Code 6 = Quite Likely

    Code 7 = Extremely Likely

16. Using educational computer-based games would increase my productivity.
    Code 1 = Extremely Unlikely

    Code 2 = Quite Unlikely

    Code 3 = Slightly Unlikely

    Code 4 = Neither Likely nor Unlikely

    Code 5 = Slightly Likely

    Code 6 = Quite Likely

    Code 7 = Extremely Likely

17. Using educational computer-based games would make it easier to do my job.
    Code 1 = Extremely Unlikely

    Code 2 = Quite Unlikely

    Code 3 = Slightly Unlikely

    Code 4 = Neither Likely nor Unlikely

    Code 5 = Slightly Likely

    Code 6 = Quite Likely

    Code 7 = Extremely Likely

18. I would find educational computer-based games useful in my job.
    Code 1 = Extremely Unlikely

    Code 2 = Quite Unlikely

    Code 3 = Slightly Unlikely

    Code 4 = Neither Likely nor Unlikely

    Code 5 = Slightly Likely

    Code 6 = Quite Likely

    Code 7 = Extremely Likely

IV. Educational Computer-Based Games

19. At the time of winning the Milken Educator Award and for the subject and grade you previously chose, did you actually use educational computer-based games as an instructional strategy?

    Code 1 = Yes

    Code 2 = No

20. Please list the names of up to 10 educational computer-based games used as an instructional strategy for the subject and grade focused on in this survey. Next, write the approximate total number of hours allotted for student use on each of these games for the year you won the Milken Educator Award.

    Code 1 = Name of Computer-Based Game

    Code 2 = Total hours allotted for this game for the year

21. Which of the following instructional strategies did you employ when using computer-based games?

    Code 1 = As a class topic opener

    Code 2 = Summarization tool

    Code 3 = One of many strategies for teaching objectives

    Code 4 = Main strategy for teaching objective

    Code 5 = Enabled students to interact with the computer-based game

    Individually

    Code 6 = Enabled students to interact with the computer-based game as a group

V. Demographics (Part Two)

22. Years of teaching experience (after receiving teaching certification) at the time of winning the Milken Educator Award.
    Enter a numeric value

23. Highest level of education completed at the time of winning the Milken Educator Award.
    Code 1 = Bachelor's

    Code 2 = Master's

    Code 3 = Doctorate

    Code 4 = Other

24. At the time you won the award, were you teaching out of field?
    Code 1 = Yes

    Code 2 = No

25. Your race/ethnicity:
    Code 1 = American Indian or Alaskan Native

    Code 2 = Asian or Asian-American

    Code 3 = Black or African-American

    Code 4 = Hispanic or Latino/a

    Code 5 = Native Hawaiian or other Pacific Islander

    Code 6 = White/Caucasian

    Code 7 = Some Other Race

APPENDIX C – DATA

Survey Question 1

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	M	54	F	107	F	161	M	213	M
2	M	55	F	108	F	162	F	214	F
3	F	56	F	109	F	163	M	215	M
5	F	57	F	110	F	164	F	216	F
6	M	58	M	111	M	165	F	217	F
7	F	59	M	112	M	166	F	218	M
8	F	60	M	113	F	167	F	219	F
9	M	61	M	114	M	168	M	220	F
10	F	62	M	115	F	169	M	221	
11	F	63	F	116	F	170	F	222	M
12	M	64	M	117	F	171	F	223	F
13	M	66	F	118	F	172	F	224	M
14	M	67	M	119	F	173	M	225	F
15	F	68	F	120	F	174	F	226	F
16	F	69	F	121	M	175	M	227	F
17	M	70	F	122	M	176	M	228	M
18	F	71	M	123		177	F	229	M
19	M	72	F	124	M	178	F	230	F
20	F	73	F	125	F	179	F	231	F
21	M	74	F	126	M	180	F	232	F
22	F	75	F	127	F	181	F	233	M
23	F	76	F	128	M	182	F	234	M
24	F	77	F	129	F	183	M	235	M
25	F	78	F	130	F	184	F	236	M
26	M	79	F	131	F	185	F	237	M
27	M	80	M	132	F	186	F	238	F
28	F	81	F	133	F	187	F	239	F
29	M	82	F	134	F	188	F	240	F
30	M	83	F	135	M	189	F	241	F
31	F	84	F	136	F	190	F	242	F
32	M	85	F	137	M	191	F	243	F
33	M	86	M	138	F	192	F	244	M
34	M	87	M	139	F	193	F	245	F
35	F	88	F	140	F	194	F	246	F
36	F	89	F	141	F	195	F	247	F
37	M	90	F	143	F	196	F	248	F
38	M	91	M	144	F	197	F	249	F
39	F	92	F	145	F	198	F	250	F
40	F	93	F	146	M	199	M	251	F
41	F	94	F	147	F	200	M	252	F
42	F	95	F	148	M	201	F	253	M
43	F	96	M	149	F	202	F	254	M
44	M	97	F	150	F	203	F	255	F
45	F	98	F	151	M	204	F	256	M
46	M	99	M	152	M	205	F	257	F
47	F	100	F	153	F	206	M	258	F
48	F	101	M	154	F	207	F	259	M
49	M	102	F	155	F	208	F	260	M
50	F	103	F	156	F	209	F	261	M
51	F	104	F	157	F	210	M	262	M
52	F	105	M	159	M	211	M	263	F
53	M	106	F	160	M	212	F		

Survey Question 2

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	2004	54	2009	107	2007	161	2005	213	2009
2	2005	55	2009	108	1998	162	1999	214	2000
3	2003	56	2006	109	1996	163	2001	215	2007
5	1999	57	2009	110	1996	164	2009	216	1996
6	1997	58	2006	111	2003	165	2001	217	2004
7	1999	59	2005	112	2006	166	2001	218	1997
8	1999	60	2004	113	2008	167	2005	219	2004
9	2005	61	2009	114	1999	168	2003	220	2006
10	2006	62	2007	115	2006	169	2000	221	2008
11	2004	63	2005	116	2008	170	1998	222	1998
12	2003	64	2003	117	1999	171	2006	223	2008
13	2004	66	2005	118	2008	172	1998	224	2003
14	1996	67	2003	119	2004	173	1998	225	2007
15	2000	68	2005	120	2000	174	2004	226	2006
16	1998	69	2005	121	1997	175	2005	227	2000
17	1997	70	2009	122	2007	176	2005	228	1998
18	2006	71	2009	123	1997	177	2000	229	1999
19	1997	72	1999	124	2009	178	2004	230	2003
20	2006	73	2003	125	1998	179	2001	231	1998
21	1996	74	2006	126	1998	180	1996	232	2005
22	1996	75	2000	127	2003	181	1998	233	2000
23	2009	76	1999	128	2003	182	1998	234	2003
24	1996	77	2008	129	2006	183	2008	235	2007
25	2005	78	2000	130	1998	184	2004	236	2009
26	1996	79	1998	131	1997	185	2005	237	1997
27	1997	80	2003	132	2008	186	2006	238	2007
28	2004	81	2002	133	1998	187	2000	239	2009
29	1999	82	2008	134	2000	188	2000	240	2004
30	2004	83	2001	135	2008	189	2009	241	1998
31	1999	84	2001	136	2000	190	1997	242	1998
32	2005	85	1999	137	2008	191	2001	243	1999
33	1999	86	1999	138	2001	192	2001	244	2000
34	1999	87	2003	139	1998	193	2009	245	2004
35	1999	88	1998	140	2007	194	2002	246	2008
36	2003	89	2000	141	1997	195	2000	247	2008
37	2005	90	1997	143	2007	196	2008	248	2003
38	2000	91	1999	144	2006	197	2000	249	2006
39	2006	92	2000	145	1998	198	2009	250	2003
40	2003	93	2008	146	2005	199	1998	251	1996
41	2006	94	1996	147	2008	200	2009	252	1999
42	2001	95	1998	148	2000	201	2002	253	2007
43	1999	96	2000	149	2004	202	2004	254	2008
44	2000	97	2000	150	2005	203	2001	255	2002
45	2006	98	2000	151	2005	204	1998	256	1999
46	1996	99	2008	152	1997	205	2000	257	2001
47	1996	100	2003	153	2001	206	2007	258	2006
48	1996	101	1999	154	2006	207	2000	259	2000
49	1996	102	1999	155	1998	208	1996	260	2002
50	2004	103	2000	156	1996	209	2006	261	2007
51	1996	104	2002	157	2005	210	2009	262	2007
52	2002	105	1997	159	2007	211	1997	263	2003
53	1997	106	1998	160	1999	212	2004		

Survey Question 3

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	35	54	27	107	47	161	32	213	34
2	37	55	38	108	35	162	32	214	44
3	34	56	36	109	43	163	43	215	36
5	40	57	28	110	29	164	46	216	50
6	39	58	40	111	36	165	56	217	33
7	46	59	40	112	35	166	27	218	43
8	44	60	32	113	35	167	42	219	39
9	33	61	49	114	49	168	50	220	41
10	33	62	31	115	30	169	44	221	35
11	41	63	50	116	37	170	41	222	37
12	37	64	48	117	39	171	29	223	29
13	28	66	37	118	35	172	51	224	34
14	40	67	27	119	35	173	44	225	45
15	32	68	40	120	30	174	49	226	38
16	49	69	42	121	39	175	39	227	38
17	32	70	38	122	42	176	31	228	55
18	46	71	42	123	44	177	51	229	45
19	48	72	42	124	38	178	35	230	53
20	33	73	44	125	39	179	49	231	45
21	56	74	31	126	30	180	43	232	37
22	50	75	39	127	46	181	59	233	42
23	32	76	44	128	42	182	39	234	37
24	46	77	32	129	32	183	28	235	35
25	41	78	47	130	50	184	34	236	39
26	57	79	40	131	49	185	33	237	32
27	37	80	30	132	35	186	29	238	36
28	44	81	39	133	40	187	34	239	31
29	47	82	44	134	27	188	50	240	38
30	28	83	34	135	37	189	37	241	48
31	33	84	45	136	50	190	32	242	43
32	39	85	49	137	37	191	47	243	36
33	50	86	39	138	32	192	31	244	42
34	41	87	35	139	28	193	32	245	35
35	31	88	44	140	41	194	30	246	33
36	33	89	40	141	33	195	30	247	31
37		90	43	143	28	196	31	248	40
38	33	91	42	144	30	197	40	249	
39	36	92	42	145	32	198	49	250	42
40	45	93	35	146	38	199	34	251	
41	31	94	48	147	37	200	38	252	38
42	49	95	43	148	41	201	39	253	37
43	36	96	49	149	32	202	47	254	30
44	50	97	35	150	42	203	45	255	30
45	46	98	53	151	42	204	47	256	42
46	39	99	35	152	40	205	30	257	40
47	41	100	34	153	41	206	34	258	49
48	43	101	47	154	36	207	33	259	39
49	42	102	50	155	48	208	52	260	33
50	47	103	48	156	50	209	31	261	40
51	36	104	54	157	37	210	33	262	37
52	48	105	35	159	53	211	34	263	44
53	45	106	41	160	29	212	29		

Survey Question 4

Part One

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	K	54	11	107	7	161	9	213	10
2		55	11	108	2	162	10	214	5
3	11	56	6	109	5	163	8	215	8
5	6	57	7	110	4	164	10	216	10
6	10	58	3	111	9	165	12	217	1
7	8	59	12	112	11	166	10	218	12
8	8	60	1	113	1	167	10	219	3
9	11	61	8	114	11	168	11	220	
10	3	62	8	115	4	169	5	221	4
11	4	63	8	116	2	170	6	222	
12	10	64	8	117	7	171	6	223	1
13	5	66	7	118	1	172	4	224	9
14	3	67	12	119	5	173	6	225	8
15	4	68	9	120	3	174	5	226	5
16	4	69	9	121	3	175	10	227	5
17	8	70	2	122	8	176	10	228	8
18	10	71	10	123	7	177	5	229	8
19	4	72	8	124	11	178	9	230	11
20	5	73	8	125	K	179	11	231	5
21	4	74	3	126	1	180	8	232	4
22	10	75	4	127	6	181	7	233	4
23	10	76	12	128	8	182	2	234	12
24	1	77	5	129	2	183	11	235	5
25	9	78	4	130	5	184	K	236	11
26	3	79	4	131	11	185	10	237	12
27	8	80	12	132	1	186	4	238	9
28	8	81	3	133	6	187	5	239	9
29	11	82	8	134	K	188	5	240	2
30	2	83	1	135	5	189	8	241	4
31		84	10	136	5	190	5	242	5
32	12	85	4	137	5	191	7	243	11
33	11	86	10	138	9	192	10	244	11
34	9	87	11	139	5	193	11	245	7
35	10	88	4	140	8	194	3	246	2
36	8	89	3	141	8	195	12	247	4
37	7	90	9	143	11	196	3	248	6
38	5	91	9	144	5	197	10	249	
39	6	92	4	145	10	198	6	250	11
40		93	4	146	8	199	11	251	
41	3	94	5	147	3	200	9	252	8
42	12	95	8	148	4	201	1	253	10
43	12	96	11	149	4	202	3	254	4
44	10	97	1	150	9	203	6	255	2
45	8	98	4	151	12	204	1	256	12
46	3	99	6	152	11	205	8	257	8
47	2	100	11	153	10	206	8	258	K
48	5	101	9	154	3	207	1	259	11
49	12	102	12	155	5	208	9	260	10
50	3	103	K	156	6	209	4	261	9
51	4	104	5	157	9	210	11	262	7
52	1	105	9	159	6	211	12	263	6
53	12	106	2	160	8	212	3		

Part Two

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	LA	54	M	107	LA	161	SS	213	M
2		55	LA	108	LA	162	S	214	M
3	LA	56	LA	109	S	163	LA	215	M
5	S	57	LA	110	LA	164	S	216	
6		58	LA	111	LA	165	M	217	LA
7	M	59	LA	112	M	166	LA	218	S
8	LA	60	LA	113	M	167	S	219	LA
9	S	61	S	114	SS	168	LA	220	
10		62	LA	115	LA	169	SS	221	M
11	M	63	S	116	LA	170	S	222	
12	SS	64	S	117	M	171	M	223	M
13	LA	66	M	118	LA	172	LA	224	M
14	LA	67	M	119	LA	173	LA	225	LA
15	LA	68	LA	120	LA	174	LA	226	LA
16	M	69	M	121	S	175	LA	227	M
17	SS	70		122	LA	176	LA	228	M
18	S	71	S	123	S	177	M	229	S
19	LA	72	SS	124	LA	178	LA	230	SS
20	LA	73	M	125	LA	179	S	231	M
21	S	74	LA	126	LA	180	LA	232	M
22	S	75	LA	127	LA	181	M	233	LA
23	SS	76	LA	128	LA	182		234	LA
24	SS	77	S	129	LA	183	LA	235	M
25	LA	78	SS	130	M	184	LA	236	LA
26	LA	79	M	131	LA	185	S	237	M
27	SS	80	M	132	LA	186	LA	238	LA
28	LA	81	M	133	LA	187		239	LA
29	SS	82	LA	134		188	LA	240	LA
30	LA	83	LA	135	LA	189	M	241	M
31		84	LA	136	M	190	M	242	M
32	S	85	M	137	M	191	LA	243	LA
33	S	86	S	138	S	192	M	244	S
34	SS	87	SS	139	M	193	S	245	M
35	S	88	LA	140	S	194	LA	246	LA
36	M	89	LA	141		195	SS	247	LA
37	LA	90	SS	143	M	196	LA	248	S
38	LA	91	S	144	S	197	S	249	LA
39	LA	92	M	145	S	198	LA	250	S
40		93	M	146	M	199	S	251	
41	LA	94	SS	147	LA	200	S	252	M
42	S	95	SS	148	LA	201	LA	253	M
43	LA	96	M	149	S	202	LA	254	LA
44	S	97	LA	150	M	203	S	255	LA
45	S	98	S	151	S	204	LA	256	
46	LA	99	M	152	SS	205	SS	257	
47	LA	100	LA	153	S	206	M	258	
48	LA	101	S	154	LA	207	LA	259	S
49	SS	102	LA	155	M	208	S	260	SS
50	LA	103	LA	156	LA	209	LA	261	S
51	LA	104	LA	157	SS	210	M	262	LA
52	LA	105	S	159	LA	211	M	263	M
53	S	106	M	160	M	212	LA		

Survey Question 5

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	3	54	1	107	1	161	4	213	1
2		55	2	108	2	162	3	214	3
3	1	56	3	109	3	163	1	215	1
5	1	57	1	110	3	164	2	216	1
6	3	58	1	111	1	165	1	217	3
7	1	59	1	112		166	1	218	1
8	1	60	2	113	3	167	1	219	2
9	1	61	1	114	1	168	3	220	2
10	3	62	1	115	3	169	3	221	3
11	3	63	3	116	3	170	2	222	
12	1	64	3	117	2	171	1	223	2
13		66	1	118	3	172	2	224	1
14	3	67	1	119	1	173		225	1
15	2	68	1	120	1	174		226	1
16	2	69	1	121	3	175	3	227	3
17	2	70	3	122	3	176	3	228	1
18	3	71	1	123	1	177	2	229	1
19	1	72	3	124	3	178	1	230	2
20	3	73	1	125	3	179	3	231	2
21	3	74	3	126	3	180	3	232	3
22	1	75	3	127	2	181	2	233	3
23	1	76	1	128	3	182	3	234	4
24	1	77	3	129	3	183	1	235	4
25	1	78	3	130	3	184	3	236	1
26	1	79		131	2	185	1	237	1
27	3	80	1	132	1	186	3	238	1
28	3	81	3	133	3	187	1	239	1
29	2	82	1	134	1	188	4	240	2
30	2	83	3	135	3	189	3	241	3
31		84	1	136	3	190	4	242	3
32	4	85	3	137	3	191	1	243	1
33	3	86	2	138	2	192	1	244	1
34	2	87	1	139	1	193	2	245	1
35	3	88	1	140	1	194	2	246	3
36	2	89	3	141	2	195	1	247	3
37	1	90		143	1	196	3	248	1
38	3	91	3	144	4	197	4	249	3
39	2	92		145	3	198	1	250	1
40	3	93	3	146	4	199	1	251	
41	3	94	1	147	3	200	3	252	3
42	4	95	2	148		201	2	253	1
43	1	96	1	149	1	202	3	254	3
44	3	97	3	150	1	203	2	255	2
45	1	98	3	151	1	204	2	256	3
46		99	2	152	1	205	3	257	1
47	3	100		153	3	206	1	258	3
48	3	101	3	154	3	207	3	259	2
49	1	102	1	155	3	208	1	260	1
50	1	103	3	156	3	209	3	261	3
51	1	104	3	157	1	210	1	262	1
52	3	105	1	159	3	211	1	263	1
53	1	106	4	160	1	212	3		

Survey Question 6

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	1	54	4	107	4	161	4	213	1
2		55	3	108	3	162	3	214	4
3	4	56	3	109	3	163	3	215	4
5	3	57	4	110	1	164	3	216	1
6	1	58	3	111	4	165	1	217	4
7	3	59	1	112		166	1	218	4
8	3	60	4	113	1	167	3	219	4
9	4	61	1	114	4	168	1	220	1
10	3	62	1	115	4	169	3	221	3
11	3	63		116	1	170	3	222	
12	2	64	1	117	3	171	4	223	4
13		66	1	118	1	172	3	224	4
14	3	67	1	119	1	173		225	4
15	4	68	1	120	4	174		226	2
16	3	69	3	121	3	175	3	227	4
17	2	70	1	122	4	176	3	228	1
18	3	71	4	123	1	177	2	229	1
19	1	72	3	124	3	178	3	230	1
20	4	73	3	125	4	179	4	231	4
21	3	74	3	126	3	180	3	232	4
22	3	75	4	127	4	181	1	233	4
23	4	76	1	128	3	182	3	234	3
24	1	77	3	129	1	183	3	235	1
25	3	78	4	130	4	184	4	236	1
26	4	79		131	1	185	1	237	3
27	3	80	1	132	1	186	4	238	1
28	3	81	3	133	4	187	4	239	1
29	1	82	1	134	3	188	4	240	4
30	2	83	4	135	4	189	4	241	3
31		84	1	136	4	190	3	242	4
32	4	85	1	137	4	191	3	243	1
33	4	86	1	138	4	192	1	244	3
34	4	87	1	139	1	193	1	245	3
35	3	88	1	140	1	194	2	246	4
36	3	89	4	141	2	195	3	247	4
37	3	90		143	3	196	4	248	4
38	3	91	3	144	2	197	4	249	3
39	3	92	4	145	4	198	3	250	1
40	4	93	3	146	1	199	3	251	
41	4	94	1	147	4	200	2	252	4
42	3	95	3	148		201	4	253	4
43	4	96	1	149	4	202	3	254	4
44	4	97	1	150	1	203	1	255	3
45	3	98	1	151	1	204	3	256	
46		99	4	152	1	205	4	257	1
47	3	100		153	3	206		258	4
48	1	101	3	154	3	207	3	259	1
49	1	102	3	155	2	208	4	260	4
50	4	103	1	156	3	209	3	261	1
51	3	104	3	157	4	210	1	262	1
52	4	105	1	159	4	211	1	263	4
53	1	106	1	160	2	212	4		

Survey Question 7

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	8	54	1	107	1	161	2	213	8
2		55	6	108	2	162	5	214	8
3	6	56	2	109	2	163	1	215	1
5	2	57	1	110	4	164	3	216	1
6	1	58	2	111	2	165	1	217	1
7	3	59	8	112		166	8	218	2
8	1	60	2	113	8	167	2	219	1
9	3	61	8	114	1	168	2	220	8
10	2	62	8	115	2	169	2	221	2
11	1	63		116	8	170	1	222	
12	3	64	3	117	3	171	1	223	2
13		66	8	118	1	172	1	224	7
14	6	67	8	119	8	173		225	1
15	1	68	8	120	2	174		226	8
16	1	69	4	121	2	175	2	227	4
17	2	70	8	122	2	176	2	228	8
18	5	71	2	123		177	1	229	1
19	8	72	3	124	1	178	1	230	1
20	1	73	2	125	1	179	3	231	2
21	2	74	1	126	1	180	4	232	2
22	1	75	2	127	1	181	1	233	1
23	3	76	7	128	3	182	2	234	2
24	1	77	3	129	1	183	1	235	2
25	1	78	1	130	1	184	1	236	8
26	2	79		131	1	185		237	1
27	2	80	1	132	8	186	3	238	1
28	3	81	2	133	2	187	1	239	8
29	2	82	8	134	2	188	4	240	1
30	5	83	2	135	2	189	2	241	6
31		84		136	2	190	4	242	1
32	1	85	8	137	2	191	2	243	8
33	5	86	1	138	6	192	1	244	7
34	3	87	2	139	1	193	1	245	3
35	2	88	8	140	2	194	1	246	3
36	2	89	4	141	1	195	1	247	1
37	2	90		143	4	196	1	248	2
38	4	91	1	144	2	197	1	249	4
39	3	92	1	145	6	198	2	250	1
40	6	93	2	146	1	199	1	251	
41	3	94	8	147	2	200	1	252	1
42	8	95	2	148		201	1	253	1
43	2	96	8	149	1	202	1	254	1
44	6	97	8	150	8	203	8	255	2
45	1	98	1	151	1	204	1	256	
46		99	1	152	8	205	5	257	8
47	2	100		153	2	206	4	258	1
48	2	101	2	154	5	207	2	259	1
49	8	102	1	155	5	208	1	260	1
50	2	103	1	156	2	209	2	261	1
51	1	104	2	157	1	210	1	262	
52	1	105	1	159	2	211	1	263	2
53	1	106	4	160	2	212	2		

Survey Question 8

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	6	54	7	107	6	161	7	213	7
2		55	6	108	5	162	6	214	7
3	6	56	6	109	6	163	4	215	6
5	2	57	7	110	6	164	7	216	3
6	4	58		111	5	165	7	217	6
7	6	59	6	112		166	5	218	6
8	6	60	7	113	7	167	6	219	4
9	6	61	5	114	5	168	6	220	6
10	7	62	7	115	7	169	7	221	7
11	7	63		116	6	170	5	222	
12	6	64	7	117	5	171	6	223	6
13		66	6	118	6	172	3	224	7
14	6	67	7	119		173		225	5
15	3	68	6	120	7	174		226	6
16	3	69	6	121	6	175	6	227	7
17	5	70	6	122	6	176	7	228	7
18	6	71	7	123	7	177	7	229	7
19	7	72	7	124	7	178	3	230	7
20	7	73	5	125	7	179	6	231	4
21	6	74	7	126	6	180	7	232	6
22	6	75	5	127	6	181	2	233	6
23	7	76	7	128	5	182	6	234	4
24	7	77	7	129	7	183	3	235	6
25	6	78	6	130	7	184	7	236	6
26		79		131	6	185	6	237	5
27	6	80	5	132	6	186	7	238	4
28	6	81	5	133	5	187	6	239	5
29	7	82	7	134	6	188	7	240	6
30	6	83	7	135	7	189	6	241	5
31		84	7	136	6	190	7	242	5
32	3	85	7	137	7	191	7	243	6
33	7	86	7	138	6	192	6	244	6
34	7	87	7	139	6	193	7	245	6
35	7	88	7	140	6	194	7	246	7
36	7	89	6	141	5	195	6	247	7
37	5	90		143	6	196	7	248	6
38	7	91	7	144	6	197	6	249	7
39	6	92	5	145	7	198	6	250	6
40	7	93	7	146	7	199	5	251	
41	6	94	6	147	6	200	7	252	5
42	6	95	4	148		201	7	253	6
43	6	96	6	149	7	202	6	254	6
44	6	97	7	150	4	203	6	255	7
45	6	98	7	151	6	204	5	256	
46		99	6	152	6	205	3	257	2
47	7	100		153	7	206	6	258	6
48	6	101	7	154	6	207	6	259	7
49	1	102	6	155	7	208	6	260	7
50	6	103	5	156	5	209	7	261	6
51	6	104	3	157	6	210	6	262	7
52	7	105	6	159	6	211	5	263	7
53	7	106	7	160	3	212	7		

Survey Question 9

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	6	54	7	107	5	161	7	213	4
2		55	5	108	2	162	3	214	4
3	3	56	5	109	6	163	3	215	2
5	2	57	7	110	6	164	7	216	3
6	5	58		111	5	165	6	217	6
7	6	59		112		166	5	218	4
8		60	7	113	4	167	5	219	4
9	5	61	5	114	5	168	5	220	6
10	6	62	2	115	6	169	6	221	7
11	6	63		116	5	170	5	222	
12	4	64	7	117	2	171	4	223	5
13		66	5	118	6	172	2	224	7
14	4	67	4	119		173		225	3
15	3	68	6	120	6	174		226	6
16	3	69	6	121	6	175	6	227	7
17	5	70	6	122	6	176	6	228	5
18	6	71	5	123	6	177	6	229	6
19	7	72	7	124	3	178	2	230	5
20	6	73	5	125	6	179	3	231	5
21	6	74	7	126	6	180	5	232	6
22	6	75	4	127	5	181	2	233	2
23	6	76	7	128	5	182	6	234	3
24	7	77	7	129	6	183	3	235	3
25	6	78	6	130	6	184	5	236	4
26		79		131	5	185	6	237	5
27	6	80	4	132	6	186	5	238	3
28	5	81	5	133	4	187	6	239	3
29	5	82	1	134	6	188	6	240	6
30	2	83	2	135	6	189	5	241	4
31		84	6	136	6	190	7	242	2
32	3	85	6	137	6	191	7	243	6
33	7	86	6	138	2	192	3	244	6
34	7	87	7	139	5	193	5	245	2
35	6	88	7	140	5	194	7	246	6
36	7	89	6	141	5	195	6	247	5
37	4	90		143	5	196	6	248	6
38	7	91	7	144	5	197	6	249	6
39	6	92	5	145	7	198	3	250	5
40	7	93	7	146	7	199	5	251	
41	5	94	5	147	6	200	7	252	3
42	6	95	3	148		201	5	253	5
43	6	96	4	149	7	202	6	254	6
44	6	97	7	150	4	203	5	255	6
45	5	98	7	151	5	204	5	256	
46		99	6	152	6	205	3	257	4
47	6	100		153	7	206	6	258	5
48	5	101	6	154	5	207	6	259	5
49	1	102	5	155	7	208	5	260	5
50	6	103	5	156	5	209	6	261	5
51	4	104	3	157	4	210	6	262	5
52	6	105	3	159	6	211	5	263	7
53	7	106	7	160	3	212	4		

Survey Question 10

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	6	54	7	107	6	161	7	213	4
2		55	6	108	5	162	5	214	6
3	4	56	5	109	7	163	4	215	3
5	2	57	7	110	6	164	7	216	3
6	5	58		111	3	165	6	217	6
7	6	59		112		166	5	218	5
8		60	7	113	5	167	6	219	4
9	6	61	5	114	5	168	5	220	5
10	6	62	5	115	7	169	7	221	7
11	6	63		116	6	170	5	222	
12	6	64	7	117	3	171	5	223	6
13		66	5	118	6	172	4	224	7
14	6	67	5	119		173		225	4
15	3	68	6	120	6	174		226	6
16	3	69	6	121	6	175	6	227	7
17	5	70	6	122	6	176	6	228	6
18	6	71	7	123	6	177	6	229	6
19	6	72	7	124	4	178	2	230	6
20	7	73	5	125	6	179	6	231	5
21	6	74	7	126	6	180	6	232	6
22	6	75	6	127	5	181	2	233	6
23	7	76	7	128	5	182	6	234	3
24	7	77	7	129	6	183	2	235	5
25	6	78	6	130	7	184	6	236	4
26		79		131	6	185	6	237	5
27	6	80	4	132	6	186	7	238	3
28	6	81	5	133	5	187	5	239	4
29	7	82	5	134	6	188	7	240	6
30	4	83	7	135	6	189	6	241	4
31		84	6	136	6	190	6	242	4
32	2	85	6	137	7	191	7	243	6
33	7	86	6	138	6	192	3	244	6
34	7	87	7	139	6	193	6	245	4
35	6	88	7	140	5	194	7	246	6
36	6	89	6	141	6	195	6	247	6
37	4	90		143	6	196	6	248	6
38	7	91	7	144	5	197	6	249	6
39	6	92	5	145	7	198	5	250	5
40	7	93	7	146	7	199	5	251	
41	5	94	5	147	6	200	7	252	5
42	6	95	3	148		201	4	253	6
43	6	96	5	149	7	202	6	254	6
44	6	97	7	150	4	203	5	255	6
45	5	98	7	151	4	204	5	256	
46		99	6	152	6	205	3	257	3
47	7	100		153	7	206	6	258	5
48	6	101	6	154	6	207	5	259	6
49	1	102	5	155	7	208	5	260	5
50	6	103	5	156	5	209	7	261	6
51	6	104	4	157	4	210	5	262	5
52	6	105	4	159	6	211	3	263	7
53	7	106	7	160	2	212	7		

Survey Question 11

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	5	54	7	107	6	161	7	213	7
2		55	6	108	3	162	5	214	6
3	6	56	6	109	6	163	3	215	6
5	5	57	7	110	6	164	7	216	3
6	6	58		111	5	165	6	217	6
7	6	59		112		166	5	218	6
8	6	60	7	113	6	167	4	219	5
9	6	61	5	114	6	168	5	220	6
10	7	62	6	115	7	169	7	221	7
11	7	63		116	6	170	5	222	
12	6	64	7	117	5	171	5	223	7
13		66	6	118	6	172	5	224	7
14	6	67	6	119		173		225	5
15	3	68	6	120	7	174		226	6
16	5	69	6	121	6	175	6	227	7
17	5	70	7	122	6	176	7	228	7
18	6	71	7	123	6	177	6	229	7
19	6	72	7	124	7	178	3	230	6
20	7	73	6	125	6	179	6	231	5
21	5	74	7	126	7	180	6	232	6
22	6	75	5	127	6	181	5	233	6
23	6	76	7	128	5	182	7	234	6
24	7	77	7	129	6	183	2	235	4
25	6	78	6	130	7	184	7	236	5
26		79		131	6	185	5	237	5
27	6	80	4	132	6	186	7	238	5
28	6	81	5	133	5	187	6	239	4
29	7	82	6	134	6	188	7	240	6
30	5	83	7	135	7	189	6	241	5
31		84	6	136	7	190	6	242	5
32	4	85	6	137	7	191	7	243	6
33	7	86	6	138	6	192	6	244	6
34	7	87	7	139	6	193	7	245	5
35	6	88	7	140	6	194	7	246	6
36	7	89	6	141	5	195	6	247	6
37	3	90		143	6	196	7	248	6
38	7	91	7	144	6	197	7	249	6
39	6	92	5	145	7	198	6	250	6
40	7	93	7	146	7	199	4	251	
41	6	94	5	147	6	200	7	252	3
42	6	95	3	148		201	7	253	6
43	6	96	7	149	7	202	6	254	6
44	6	97	7	150	4	203	6	255	7
45	6	98	7	151	5	204	5	256	
46		99	6	152	6	205	4	257	6
47	7	100		153	7	206	7	258	6
48	6	101	7	154	6	207	6	259	7
49	1	102	5	155	7	208	6	260	6
50	6	103	5	156	5	209	7	261	6
51	6	104	4	157	6	210	6	262	6
52	6	105	6	159	5	211	5	263	7
53	7	106	7	160	4	212	7		

Survey Question 12

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	5	54	6	107	6	161	7	213	4
2		55	6	108	5	162	3	214	6
3	5	56	6	109	6	163	5	215	2
5	2	57	7	110	5	164	6	216	3
6	4	58		111	4	165	6	217	6
7	6	59		112		166	5	218	5
8	5	60	7	113	3	167	5	219	4
9	3	61	4	114	6	168	5	220	6
10	6	62	4	115	7	169	5	221	7
11	6	63		116	5	170	5	222	
12	5	64	6	117	4	171	5	223	6
13		66	5	118	6	172	1	224	7
14	6	67	5	119		173		225	3
15	2	68	4	120	4	174		226	6
16	3	69	4	121	6	175	6	227	7
17	5	70	6	122	6	176	6	228	6
18	6	71	7	123	6	177	5	229	6
19	6	72	7	124	7	178	3	230	5
20	5	73	4	125	5	179	6	231	5
21	6	74	7	126	6	180	6	232	6
22	5	75	3	127	5	181	5	233	3
23	6	76	7	128	5	182	7	234	5
24	4	77	7	129	5	183	2	235	4
25	6	78	5	130	6	184	6	236	2
26		79		131	5	185	5	237	4
27	6	80	3	132	6	186	6	238	5
28	6	81	6	133	3	187	5	239	4
29	7	82	6	134	6	188	7	240	2
30	5	83	6	135	6	189	6	241	4
31		84	5	136	6	190	4	242	5
32	2	85	6	137	6	191	7	243	6
33	7	86	6	138	2	192	3	244	5
34	6	87	7	139	5	193	6	245	2
35	6	88	6	140	2	194	7	246	6
36	7	89	5	141	6	195	6	247	5
37	4	90		143	6	196	6	248	6
38	7	91	7	144	5	197	6	249	6
39	6	92	5	145	7	198	4	250	5
40	6	93	7	146	7	199	3	251	
41	6	94	5	147	5	200	4	252	4
42	6	95	4	148		201	4	253	3
43	6	96	4	149	7	202	6	254	6
44	5	97	7	150	4	203	5	255	6
45	6	98	7	151	3	204	6	256	
46		99	5	152	5	205	5	257	5
47	5	100		153	7	206	7	258	6
48	6	101	5	154	6	207	6	259	6
49		102	4	155	7	208	5	260	6
50	5	103	5	156	4	209	7	261	4
51	5	104	3	157	4	210	6	262	5
52	5	105	6	159	5	211	5	263	6
53	7	106	6	160	4	212	5		

Survey Question 13

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	6	54	7	107	6	161	7	213	5
2		55	6	108	5	162	5	214	6
3	5	56	6	109	6	163	5	215	5
5	5	57	7	110	6	164	7	216	3
6	6	58		111	5	165	6	217	6
7	6	59		112		166	5	218	5
8	6	60	7	113	5	167	6	219	4
9	6	61	5	114	5	168	5	220	6
10	6	62	6	115	7	169	6	221	7
11	7	63		116	6	170	3	222	
12	6	64	7	117	5	171	5	223	6
13		66	6	118	6	172	3	224	7
14	6	67	6	119		173		225	4
15	3	68	5	120	6	174		226	6
16	5	69	5	121	6	175	5	227	7
17	5	70	6	122	6	176	6	228	5
18	7	71	7	123	6	177	6	229	6
19	6	72	7	124	7	178	3	230	6
20	7	73	4	125	7	179	6	231	5
21	5	74	7	126	7	180	6	232	6
22	6	75	5	127	6	181	4	233	7
23	6	76	7	128	5	182	7	234	5
24	7	77	7	129	5	183	2	235	5
25	6	78	6	130	6	184	7	236	3
26		79		131	6	185	5	237	5
27	6	80	5	132	6	186	7	238	5
28	6	81	5	133	3	187	6	239	5
29	7	82	6	134	6	188	7	240	6
30	6	83	7	135	7	189	6	241	4
31		84	6	136	6	190	6	242	5
32	3	85	6	137	6	191	7	243	6
33	6	86	6	138	6	192	4	244	6
34	7	87	6	139	5	193	6	245	4
35	6	88	6	140	6	194	7	246	6
36	7	89	6	141	6	195	6	247	6
37	5	90		143	6	196	7	248	6
38	7	91	7	144	5	197	6	249	6
39	6	92	5	145	7	198	4	250	5
40	7	93	7	146	7	199	4	251	
41	6	94	6	147	6	200	7	252	3
42	6	95	4	148		201	7	253	6
43	6	96	6	149	7	202	6	254	6
44	6	97	7	150	4	203	5	255	6
45	6	98	7	151	5	204	5	256	
46		99	6	152	5	205	5	257	6
47	7	100		153	7	206	7	258	6
48	6	101	6	154	6	207	6	259	7
49	1	102	4	155	7	208	5	260	6
50	6	103	5	156	5	209	7	261	6
51	6	104	3	157	6	210	6	262	6
52	7	105	6	159	5	211	5	263	6
53	7	106	7	160	4	212	7		

Survey Question 14

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	4	54	4	107	6	161	7	213	2
2		55	6	108	5	162	5	214	6
3	5	56	5	109	5	163	5	215	1
5	4	57	5	110	4	164	4	216	3
6	5	58		111	1	165	4	217	4
7	5	59		112		166	4	218	3
8	6	60	5	113	4	167	4	219	2
9	6	61	4	114	6	168	4	220	4
10	6	62	5	115	7	169	6	221	5
11	5	63		116	5	170	5	222	
12		64	6	117	3	171	5	223	6
13		66	3	118	4	172	4	224	4
14	6	67	2	119		173		225	1
15	3	68	5	120	4	174		226	3
16	2	69	4	121	5	175	5	227	7
17	5	70	4	122	4	176	3	228	5
18	5	71	6	123	6	177	5	229	6
19	5	72	3	124	3	178	4	230	4
20	5	73	2	125	4	179	6	231	5
21	6	74	7	126	7	180	6	232	5
22	7	75	2	127	5	181	4	233	6
23	4	76	7	128	5	182	7	234	2
24	6	77	7	129	5	183	1	235	4
25	5	78	5	130	4	184	7	236	2
26		79		131	6	185	4	237	4
27	6	80	2	132	6	186	7	238	4
28	6	81	6	133	4	187	4	239	4
29	7	82	1	134	6	188	7	240	6
30	6	83	5	135	5	189	6	241	3
31		84	2	136	6	190	4	242	5
32	1	85	5	137	5	191	4	243	4
33	6	86	6	138	2	192	4	244	5
34	6	87	3	139	1	193	5	245	1
35	6	88	6	140	3	194	7	246	4
36	5	89	5	141	5	195	2	247	5
37	5	90		143	6	196	4	248	5
38	7	91	7	144	3	197	6	249	5
39	6	92	3	145	7	198	4	250	5
40	4	93	4	146	4	199	3	251	
41	5	94	6	147	5	200	1	252	4
42	6	95	3	148		201	4	253	4
43	5	96	4	149	7	202	5	254	6
44	4	97	7	150	2	203	4	255	5
45	5	98	6	151	4	204	5	256	
46		99	6	152	3	205	5	257	1
47	4	100		153	7	206	7	258	7
48	6	101	5	154	4	207	6	259	3
49	1	102	4	155	7	208	5	260	4
50	6	103	3	156	6	209	6	261	4
51	6	104	3	157	3	210	5	262	5
52	5	105	4	159	5	211	4	263	5
53	5	106	5	160	4	212	3		

Survey Question 15

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	5	54	6	107	5	161	7	213	4
2		55	5	108	4	162	5	214	4
3	4	56	5	109	5	163	5	215	1
5	4	57	5	110	4	164	5	216	3
6	4	58		111	2	165	5	217	4
7	5	59		112		166	5	218	6
8	6	60	4	113	3	167	4	219	2
9	4	61	4	114	5	168	4	220	4
10	5	62	4	115	6	169	6	221	5
11	5	63		116	5	170	3	222	
12	4	64	5	117	3	171	4	223	6
13		66	2	118	4	172	4	224	4
14	6	67	2	119		173		225	1
15	5	68	5	120	3	174		226	4
16	2	69	4	121	5	175	6	227	7
17	4	70	4	122	5	176	5	228	5
18	4	71	6	123	4	177	3	229	2
19	5	72	2	124	3	178	2	230	4
20	5	73	4	125	4	179	5	231	4
21	5	74	7	126	6	180	4	232	5
22	7	75	2	127	5	181	4	233	6
23	4	76	7	128	5	182	7	234	1
24	6	77	4	129	3	183	1	235	4
25	5	78	5	130	3	184	7	236	2
26		79		131	6	185	4	237	4
27	6	80	2	132	6	186	7	238	4
28	6	81	5	133	4	187	4	239	4
29	7	82	1	134	4	188	7	240	4
30	4	83	6	135	5	189	6	241	3
31		84	1	136	6	190	4	242	3
32	1	85	5	137	5	191	4	243	4
33	5	86	4	138	2	192	4	244	4
34	6	87	3	139	1	193	5	245	1
35	5	88	5	140	2	194	7	246	6
36	5	89	5	141	6	195	5	247	5
37	3	90		143	6	196	4	248	4
38	4	91	4	144	4	197	4	249	4
39	4	92	3	145	6	198	2	250	5
40	5	93	4	146	4	199	4	251	
41	5	94	6	147	4	200	1	252	4
42	6	95	4	148		201	4	253	4
43	5	96	4	149	7	202	4	254	6
44	4	97	7	150	2	203	4	255	2
45	6	98	6	151	4	204	5	256	
46		99	5	152	3	205	5	257	1
47	5	100		153	7	206	4	258	5
48	5	101		154	4	207	6	259	4
49	1	102	4	155	6	208	3	260	5
50	6	103	5	156	6	209	5	261	5
51	6	104	3	157	3	210	6	262	4
52	4	105	4	159	6	211	5	263	5
53	5	106	5	160	5	212	4		

Survey Question 16

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	5	54	3	107	6	161	7	213	2
2		55	5	108	3	162	5	214	6
3	4	56	5	109	5	163	5	215	5
5	4	57	5	110	5	164	5	216	3
6	4	58		111	1	165	5	217	4
7	5	59		112		166	4	218	5
8	5	60	4	113	3	167	4	219	2
9	5	61	4	114	5	168	4	220	4
10	5	62	3	115	5	169	5	221	5
11	5	63		116	4	170	3	222	
12	4	64	5	117	4	171	4	223	6
13		66	2	118	4	172	4	224	4
14	7	67	2	119		173		225	2
15	5	68	5	120	2	174		226	3
16	2	69	4	121	5	175	6	227	7
17	4	70		122	4	176	4	228	5
18	4	71	6	123	4	177	3	229	4
19	5	72	1	124	4	178	2	230	4
20	4	73	3	125	4	179	5	231	4
21	5	74	7	126	5	180	4	232	5
22	7	75	2	127	4	181	4	233	7
23	4	76	7	128	5	182	7	234	1
24	7	77	5	129	4	183	1	235	4
25	5	78	5	130	3	184	7	236	2
26		79		131	6	185	4	237	4
27	6	80	2	132	6	186	7	238	4
28	6	81	5	133	5	187	4	239	4
29	7	82	1	134	5	188	7	240	5
30	5	83	5	135	5	189	6	241	2
31		84	1	136	6	190	4	242	3
32	1	85	5	137	5	191	4	243	4
33	6	86	4	138	2	192	4	244	3
34	6	87	3	139	1	193	5	245	1
35	1	88	6	140	2	194	7	246	4
36	5	89	5	141	5	195	2	247	3
37	5	90		143	6	196	4	248	4
38	4	91	5	144	4	197	4	249	4
39	4	92	3	145	6	198	4	250	3
40	4	93	4	146	4	199	4	251	
41	5	94	4	147	4	200	1	252	4
42	6	95	4	148		201	4	253	5
43	5	96	3	149	7	202	4	254	6
44	4	97	7	150	2	203	4	255	2
45	6	98	5	151	4	204	6	256	
46		99	5	152	3	205	5	257	1
47	4	100		153	6	206	6	258	5
48	5	101	5	154	4	207	6	259	4
49	1	102	2	155	7	208	3	260	4
50	6	103	5	156	6	209	4	261	2
51	6	104	3	157	3	210	5	262	4
52	4	105	4	159	6	211	5	263	5
53	5	106	6	160	6	212	5		

Survey Question 17

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	5	54	5	107	6	161	7	213	3
2		55	5	108	3	162	5	214	6
3	4	56	5	109	5	163	5	215	4
5	4	57	5	110	6	164	6	216	2
6	5	58		111	2	165	5	217	4
7	5	59		112		166	5	218	5
8	5	60	5	113	3	167	2	219	2
9	5	61	4	114	5	168	4	220	3
10	5	62	4	115	5	169	6	221	4
11	4	63		116	5	170	3	222	
12	4	64	5	117	5	171	5	223	4
13		66	2	118	5	172	2	224	5
14	6	67	2	119		173		225	2
15	2	68	5	120	2	174		226	2
16	2	69	4	121	5	175	6	227	7
17	5	70	4	122	5	176	3	228	5
18	4	71	6	123	5	177	5	229	4
19	5	72	1	124	2	178	4	230	4
20	5	73	4	125	4	179	5	231	5
21	5	74	7	126	5	180	4	232	4
22	7	75	3	127	5	181	4	233	6
23	4	76	7	128	5	182	7	234	1
24	7	77	3	129	4	183	1	235	4
25	5	78	5	130	3	184	7	236	2
26		79		131	6	185	4	237	4
27	6	80	1	132	6	186	7	238	4
28	6	81	5	133	3	187	4	239	4
29	6	82	1	134	5	188	7	240	5
30	5	83	6	135	5	189	5	241	3
31		84	1	136	6	190	4	242	4
32	1	85	5	137	5	191	4	243	4
33	5	86	4	138	2	192	4	244	3
34	6	87	3	139	1	193	4	245	1
35	5	88	6	140	2	194	7	246	5
36	4	89	5	141	5	195	2	247	3
37	5	90		143	6	196	4	248	5
38	4	91	4	144	4	197	5	249	4
39	6	92	3	145	7	198	4	250	3
40	4	93	4	146	4	199	3	251	
41	5	94	5	147	4	200	1	252	4
42	6	95	5	148		201	4	253	3
43	5	96	4	149	7	202	5	254	6
44	3	97	7	150	6	203	5	255	1
45	6	98	5	151	4	204	6	256	
46		99	5	152	3	205	5	257	1
47	5	100		153		206	4	258	5
48	5	101	5	154	4	207	6	259	4
49	1	102	2	155	6	208	3	260	4
50	6	103	5	156	6	209	4	261	4
51	6	104	3	157	3	210	5	262	5
52	5	105	4	159	6	211	5	263	4
53	5	106	5	160	6	212	4		

Survey Question 18

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	6	54	6	107	6	161	7	213	4
2		55	6	108	5	162	5	214	7
3	5	56	5	109	5	163	5	215	3
5	4	57	5	110	7	164	6	216	2
6	5	58		111	4	165	5	217	4
7	5	59		112		166	5	218	6
8	6	60	5	113	5	167	5	219	3
9	5	61	5	114	5	168	5	220	4
10	7	62	5	115	6	169	6	221	5
11	7	63		116	6	170	6	222	
12	4	64	5	117	4	171	5	223	6
13		66	4	118	5	172	4	224	7
14	6	67	2	119		173		225	2
15	5	68	5	120	4	174		226	4
16	3	69	5	121	6	175	6	227	7
17	4	70	5	122	5	176	6	228	4
18	5	71	6	123	5	177	6	229	5
19	5	72	1	124	1	178	3	230	5
20	7	73	4	125	6	179	6	231	5
21	6	74	7	126	6	180	5	232	6
22	7	75	5	127	5	181	4	233	7
23	5	76	7	128	5	182	7	234	1
24	7	77	7	129	5	183	1	235	4
25	5	78	6	130	4	184	7	236	2
26		79		131	6	185	5	237	4
27	6	80	3	132	6	186	7	238	4
28	6	81	6	133	5	187	5	239	3
29	7	82	1	134	6	188	7	240	6
30	6	83	6	135	6	189	7	241	4
31		84	2	136	6	190	6	242	5
32	2	85	5	137	7	191	5	243	5
33	6	86	6	138	6	192	4	244	5
34	6	87	5	139	2	193	6	245	1
35	5	88	6	140	2	194	7	246	6
36	5	89	5	141	6	195	5	247	6
37	5	90		143	6	196	5	248	6
38	6	91	7	144	4	197	7	249	4
39	6	92	5	145	7	198	4	250	5
40	4	93	7	146	5	199	4	251	
41	6	94	6	147	6	200	5	252	6
42	6	95	4	148		201	5	253	6
43	5	96	4	149	7	202	5	254	
44	4	97	7	150	5	203	4	255	5
45	6	98	6	151	5	204	6	256	
46		99	6	152	3	205	6	257	1
47	6	100		153	6	206	6	258	6
48	5	101	6	154	5	207	6	259	4
49	1	102	4	155	7	208	5	260	6
50	6	103	5	156	6	209	6	261	6
51	6	104	3	157	6	210	5	262	5
52	6	105	4	159	6	211	6	263	6
53	5	106	7	160	6	212	5		

Survey Question 19

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	1	54	1	107	1	161	1	213	2
2		55	2	108	2	162	1	214	1
3	2	56	2	109	2	163	2	215	2
5	2	57	2	110	1	164	2	216	2
6	1	58		111	2	165	2	217	2
7	2	59	2	112		166	2	218	1
8	2	60	1	113	1	167	2	219	2
9	2	61	2	114	2	168	1	220	2
10	1	62	2	115	1	169	1	221	1
11	1	63		116	1	170	2	222	
12	2	64	2	117	2	171	2	223	1
13		66	2	118	2	172	2	224	2
14	1	67	2	119		173		225	2
15	2	68	2	120	2	174		226	2
16	2	69	2	121	1	175	1	227	1
17	2	70	2	122	2	176	1	228	2
18	2	71	1	123	2	177	1	229	2
19	2	72	2	124	2	178	2	230	2
20	2	73	2	125	2	179	1	231	1
21	2	74	1	126	1	180	1	232	1
22	2	75	1	127	2	181	2	233	2
23	2	76	2	128	2	182	1	234	2
24	2	77	1	129	1	183	2	235	2
25	2	78	1	130	1	184	1	236	2
26		79		131	2	185	2	237	2
27	1	80	2	132	2	186	1	238	2
28	1	81	1	133	1	187	2	239	2
29	1	82	2	134	1	188		240	1
30	2	83	1	135		189	1	241	2
31		84	2	136	1	190	1	242	1
32	1	85	2	137	1	191	2	243	2
33	1	86	2	138	1	192	2	244	2
34	2	87	2	139	2	193	1	245	2
35	2	88	2	140	2	194	2	246	1
36	2	89	1	141	2	195	1	247	1
37	2	90		143	2	196	2	248	2
38	1	91	1	144	2	197	2	249	1
39	1	92	2	145	1	198	2	250	2
40	1	93		146	2	199		251	
41	2	94	2	147	1	200	2	252	2
42	1	95	2	148		201	2	253	1
43	1	96	2	149	1	202	1	254	1
44		97	1	150	2	203	2	255	1
45	1	98	1	151	2	204	1	256	
46		99	1	152	2	205	2	257	2
47	2	100		153	1	206	2	258	2
48	1	101	1	154	1	207	1	259	2
49	2	102	2	155	1	208	2	260	2
50	2	103	1	156	2	209	1	261	1
51	2	104	2	157	2	210	2	262	2
52	1	105	2	159	1	211	2	263	2
53	1	106	1	160	2	212	1		

Survey Question 20

Part One

Participant ID:	Name (20_1a)	Name (20_2a)	Name (20_3a)	Name (20_4a)	Name (20_5a)
1	Muppets Capital and Small Letters	Jump Start Kindergarten	Winnie the Pooh Kindergarten	Reader Rabbit Personalized K	Get Ready for School, Charlie Brown!
2					
3					
5					
6	sim city	auto builder	robotic		
7					
8					
9					
10	Math Blaster				
11	Math Shop	Multiplication.com	Jump Start		
12					
13					
14	geochallenge	internet for NASA	MAC games	Apple IIGS	sticky bear times
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28	Accelarated Reader	Fact Monster	Math facts		
29	President Elect	Powerpoint Jeopardy			
30					
31					
32	Interactive Physics 2000				
33	Interactive Physics	Physics			
34					
35					
36					
37					
38	Egg-spert				
39	jeopardy	leapfrog			
40	Food Pyramid	Meal Planning			
41					
42	Eye simulator	CIPE materials	Physiology		
43	Vocabulary renegades	Grammar renegades			
44					
45	algeblaster	sim city	genetics	build a roller coaster	
46					
47					
48	Orchard				
49					
50					

Participant ID:	Name (20_1a)	Name (20_2a)	Name (20_3a)	Name (20_4a)	Name (20_5a)
51					
52	Kid Pix	MECC games			
53	IBM courseware	Interactive Physics			
54	Thr Ruler Game	Guess the graph	FreeRice.com		
55					
56					
57					
58					
59					
60	Reader Rabbit 1, 2, 3	Kidspiration	neighborhood Map Machine	Everyday Mathematics Games	
61					
62					
63					
64					
66					
67					
68					
69					
70					
71	Arizona Biology Online Onion	WGBH DNA and Protein Synthesis			
72					
73					
74	Quia.com	Compass Learning Odyssey			
75	Oregon Trail	Lemonade Stand	Number/Word Munchers		
76					
77	Textbook series games				
78	Oregon Trail	Where in the World is Carmen SanDiego	Inspiration		
79					
80					
81	Number Maze	Number Munchers	NFL Math	Battleship	Math Blasters
82					
83	Compass System	Reader Rabbit	Math Blaster	Various Internet	
84					
85					
86					
87					
88					
89	LeapPad Reading Program	LeapPad Content-Reading Program			
90					
91	Sim City				
92					
93					
94					
95					
96					
97					
98	Science Court (12 titles)	Earth Explorers	Rainforest Adventure	Adam (Human Body)	Decisions Decisions The Environment
99					
100					

Participant ID:	Name (20_1a)	Name (20_2a)	Name (20_3a)	Name (20_4a)	Name (20_5a)	Name (20_6a)
101	West Point Bridge Builder	SimCity	DamBuilder	Flight Simulator	The Incredible Machine	
102						
103	Reader Rabbit					
104						
105						
106						
107	quia.com					
108						
109						
110	Kidspiration		spelling game	typing game	word for writing	oregon trail
111						
112						
113	Investigations software					
114						
115	Study Island					
116	Study Island					
117						
118						
119						
120						
121						
122						
123						
124						
125						

Participant ID:	Name (20_1a)	Name (20_2a)	Name (20_3a)	Name (20_4a)	Name (20_5a)	Name (20_6a)
126	Mighty					
127						
128						
129	Word Processing	i know that.com	aaamath.com	spelling city.com		
130	Zoombini	Oregon Trail	Where in the World - Carmen Sandiegoo	TimeLiner	SchoolHouse Rock	HyperStudio
131						
132						
133	Reader Rabbit	Math Blaster				
134	math blaster					
135						
136	Study Island	NCTM on-line (various)				
137	Math Arena	Geo Logo				
138						
139						
140						
141						
143						
144						
145						
146						
147	BrainPop	Gamequarium				
148						
149	http://oceanservice.noaa.gov/education/pd/oceans_weather_climate/media/watercycle.swf	thinkport.org	plastelina.net	http://www.nationalgeographic.com/forcesofnature/interactive/index.html		
150						

Participant ID:	Name (20_1a)	Name (20_2a)	Name (20_3a)	Name (20_4a)
151				
152				
153	virtual dissections	Gizmos		
154	Study Island	Math Blasters	Brain Pop	
155				
156				
157				
159	Acelerated Grammar and Spelling	Study Island	Brain Age	
160				
161	Quia Rags to Riches	Quia Jeopardy		
162	Naming compounds and formulas Naming Game	Titrations	Gas Laws	
163				
164				
165				
166				
167				
168	gamesforthebrain.com			
169	Oregon Trail	Amazon Trail	Insperation	
170				
171				
172				
173				
174				
175	USA Test Prep Smackdown	Quia Quiz Games	Jeopardy Review	Student Responder Games

Participant ID:	Name (20_1a)	Name (20_2a)	Name (20_3a)	Name (20_4a)	Name (20_5a)	Name (20_6a)
176	Game Show Prep					
177						
178						
179	Physiology	ImageJ				
180						
181						
182	Reader Rabbit	Jump Start Second Grade	-			
183						
184	Waterford Early Learning Reading	Reader Rabbit	Riverdeep Learning			
185						
186	Study Island	Raz-Kids				
187						
188						
189	Quiz Show	Calculation Nation	Quizlet	academic skill builders.com	aplus math	smartboard application
190	Accelerated Math	The Factory	Zoombinis	Tom Snyder Games		
191						
192						
193	MindPoint Quiz Show					
194						
195	Sim City	Congressional Simulation				
196						
197						
198						
199						
200						

Participant ID:	Name (20_1a)	Name (20_2a)	Name (20_3a)	Name (20_4a)	Name (20_5a)
201					
202	Conerstone Language Arts	Cornerstone Math			
203					
204	Scholastic Read Alongs	HBJ Math Computation			
205					
206					
207					
208					
209	Compass-Odyessy	Ed-heads	Quia		
210					
211					
212	brainpop.com	funbrain.com	plato (contract with district)	spellingcity.com	learningplanet.com
213					
214	EM Baseball Multiplication	EM Beat the Computer Facts	EM Credits/Debits	EM Division Top It	EM Exponent Ball
215					
216					
217					
218	star gazer	geometry			
219					
220					
221	Math Blaster	Mighty Math Number Heroes	Math Arena	Mighty Math Calculating Crew	
222					
223					
224					
225					
226					
227					
228					
229					
230					
231	math problem solving	math in the real world	computational skill practice		
232	First in Math				
233					
234					
235					
236					
237					
238					
239					
240	Matching caps and lower case letters	Starfall	funbrain.com		
241					
242					
243					
244					
245					
246	English in a flash	starfall	read along ebooks	clifford reading	spelling city
247	IStation	First in Math	Type to Learn		
248					
249					
250					

Participant ID:	Name (20_6a)	Name (20_7a)	Name (20_8a)	Name (20_9a)	Name (20_10a)
201					
202					
203					
204					
205					
206					
207					
208					
209					
210					
211					
212	starfall.com	earobics.com	literacycenter.net		
213					
214	EM Factor Captor	EM Frac-Tac-Toe	EM Multiplication Wrestling	EM Angle Race	EM High Number Toss
215					
216					
217					
218					
219					
220					
221					
222					
223					
224					
225					
226					
227					
228					
229					
230					
231					
232					
233					
234					
235					
236					
237					
238					
239					
240					
241					
242					
243					
244					
245					
246	brain pop	enchanted learning	power typing	read naturally	imagine learning
247					
248					
249	Harcourt Trophies reading - Genres	Harcourt Trophies math	word matching	Phonics	Fluency
250					

Participant ID:	Name (20_1a)	Name (20_2a)	Name (20_3a)	Name (20_4a)	Name (20_5a)
251					
252					
253	Green Globs	Stock Market Simulation			
254	Study Island	Fast Forword	Orchard		
255					
256					
257					
258					
259					
260					
261	EcoBeaker: Ilye Royale	EcoBeaker: Sewage	EcoBeaker: Barnacles	Avida-Ed	
262					
263					

Part Two

Participant ID:	Hours (20_1b)	Hours (20_2b)	Hours (20_3b)	Hours (20_4b)	Hours (20_5b)
1	15	15	10	10	15
2					
3					
5					
6	15	8	20		
7					
8					
9					
10	5				
11	approx 1/2 hour per day per student	approx 1/2 hour per day per student	approx 1/2 hour per day per student		
12					
13					
14	80	daily for 1-2 hrs		daily	30
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28	1 hour	1 hour	1 hour		
29	5	30			
30					
31					
32	4				
33	50	100			
34					
35					
36					
37					
38	4				
39	20	20			
40	5 hours/student	5 hours/student			
41					
42	1	20	10		
43	100	100			
44					
45	3	6	2	5	
46					
47					
48					
49					
50					

Participant ID:	Hours (20_1b)	Hours (20_2b)	Hours (20_3b)	Hours (20_4b)	Hours (20_5b)
51					
52	50	50			
53	0	10			
54	2	3	2		
55					
56					
57					
58					
59					
60	25	15	15	15	
61					
62					
63					
64					
66					
67					
68					
69					
70					
71	1	0.5			
72					
73					
74	36 hours	36 hours	hundreds of hours	36 hours	36 hours
75	5	3	5		
76					
77	2				
78	30 minutes twice a month	30 minutes twice a month	30 minutes twice a month		
79					
80					
81	20 hours	20 hours	10 hours	10 hours	20 hours
82					
83	180	90	45	45	
84					
85					
86					
87					
88					
89	60	60			
90					
91	5				
92					
93					
94					
95					
96					
97					
98	36	30	15	15	15
99	10				
100					

Participant ID:	Hours (20_1b)	Hours (20_2b)	Hours (20_3b)	Hours (20_4b)	Hours (20_5b)	Hours (20_6b)
101	14	14	14	14	14	
102						
103	36					
104						
105						
106						
107	54 min. 2x month					
108						
109						
110	15	20	10	15	60	10
111						
112						
113	20					
114						
115						
116	36					
117						
118						
119						
120						
121						
122						
123						
124						
125						

Participant ID:	Hours (20_1b)	Hours (20_2b)	Hours (20_3b)	Hours (20_4b)	Hours (20_5b)	Hours (20_6b)
126						
127						
128						
129	3 hours	2 hrs	3 hours	5 hours		
130	20	20	30	10	10	20
131						
132						
133	10	5				
134	45					
135						
136	60	40				
137	4	10				
138						
139						
140						
141						
143						
144						
145						
146						
147	5					
148						
149	10	20	10	10		
150						
151						

Participant ID:	Hours (20_1b)	Hours (20_2b)	Hours (20_3b)	Hours (20_4b)
152				
153	20	50		
154	50-100	50	25	
155				
156				
157				
159	10	10	8	
160				
161	30	10		
162	1	1	1	
163				
164				
165				
166				
167				
168	unknown			
169				
170				
171				
172				
173				
174				
175	10	5	5	10

Participant ID:	Hours (20_1b)	Hours (20_2b)	Hours (20_3b)	Hours (20_4b)	Hours (20_5b)	Hours (20_6b)
176	20 hours					
177						
178						
179	10	20				
180						
181						
182						
183						
184	60	5	18			
185						
186	1	1				
187						
188						
189	36	5	18	5	5	36
190	50	30	30	50		
191						
192						
193	30					
194						
195	6	10				
196						
197						
198						
199						
200						

Participant ID:	Hours (20_1b)	Hours (20_2b)	Hours (20_3b)	Hours (20_4b)	Hours (20_5b)
201					
202	45	45			
203					
204	100	100			
205					
206					
207					
208					
209	36	3	10		
210					
211					
212					
213					
214	15	20	10	10	5
215					
216					
217					
218	5	5			
219					
220					
221	75	100	75	100	
222					
223					
224					
225					
226					
227					
228					
229					
230					
231	30 min. per week	9 hours during the year	up to 30 min. per week	up to 30 min. per week	
232	50	50			
233					
234					
235					
236					
237					
238					
239					
240	less than 30 minutes	30 minutes	30 minutes		
241					
242					
243					
244					
245					
246					
247	40	40	40		
248					
249	160	160	160	160	160
250					

Participant ID:	Hours (20_6b)	Hours (20_7b)	Hours (20_8b)	Hours (20_9b)	Hours (20_10b)
201					
202					
203					
204					
205					
206					
207					
208					
209					
210					
211					
212					
213					
214	20	10	10	5	5
215					
216					
217					
218					
219					
220					
221					
222					
223					
224					
225					
226					
227					
228					
229					
230					
231					
232					
233					
234					
235					
236					
237					
238					
239					
240					
241					
242					
243					
244					
245					
246					
247					
248					
249	160	160	160	160	160
250					

Participant ID:	Hours (20_1b)	Hours (20_2b)	Hours (20_3b)	Hours (20_4b)
251				
252				
253	5	10		
254	30	30	30	
255				
256				
257				
258				
259				
260				
261	1.5	1.5	1.5	3
262				
263				

Survey Question 21

Participant ID:	21(1)	21(2)	21(3)	21(4)	21(5)	21(6)	Participant ID:	21(1)	21(2)	21(3)	21(4)	21(5)	21(6)
1			1		1		51						
2							52	1	1	1	1	1	1
3							53	1	1	1		1	1
5							54	1	1	1			
6	1	1	1			1	55						
7							56						
8							57						
9							58						
10			1		1		59						
11			1		1	1	60			1		1	
12							61						
13							62						
14	1	1	1		1	1	63						
15							64						
16							66						
17							67						
18							68						
19							69						
20							70						
21							71	1	1	1		1	
22							72						
23							73						
24							74	1	1	1	1	1	1
25							75		1	1		1	
26							76						
27	1	1					77		1	1		1	1
28	1		1		1	1	78		1	1		1	1
29			1	1		1	79						
30							80						
31							81					1	
32		1	1		1		82						
33			1		1	1	83	1				1	1
34							84						
35							85						
36							86						
37							87						
38	1	1		1	1	1	88						
39	1					1	89			1			
40			1		1	1	90						
41							91			1			
42	1		1	1	1	1	92						
43				1	1	1	93						
44							94						
45			1				95						
46							96						
47							97		1			1	
48					1	1	98		1	1		1	1
49							99		1	1		1	1
50							100						

Participant ID:	21(1)	21(2)	21(3)	21(4)	21(5)	21(6)	Participant ID:	21(1)	21(2)	21(3)	21(4)	21(5)	21(6)
101	1		1	1			151						
102							152						
103			1				153			1		1	1
104							154	1	1	1		1	1
105							155			1		1	1
106					1		156						
107			1				157						
108							159			1		1	
109							160						
110			1	1	1		161	1	1	1		1	1
111							162			1			
112							163						
113			1		1		164						
114							165						
115		1			1	1	166						
116					1		167						
117							168					1	
118							169	1		1	1	1	1
119							170						
120							171						
121			1				172						
122							173						
123							174						
124							175	1	1			1	1
125							176	1	1	1			1
126							177					1	
127							178						
128							179	1		1		1	1
129					1	1	180			1			
130			1		1	1	181						
131							182	1		1		1	1
132							183						
133					1		184	1	1	1	1	1	1
134					1	1	185						
135							186			1		1	1
136			1		1	1	187						
137			1		1	1	188						
138		1	1		1		189	1	1	1		1	1
139							190			1			1
140							191						
141							192						
143							193		1	1			1
144							194						
145	1	1	1	1	1	1	195				1	1	1
146							196						
147	1	1	1		1	1	197						
148							198						
149						1	199						
150							200						

Participant ID:	21(1)	21(2)	21(3)	21(4)	21(5)	21(6)	Participant ID:	21(1)	21(2)	21(3)	21(4)	21(5)	21(6)
201							251						
202		1	1		1		252						
203							253			1		1	1
204			1		1	1	254		1	1		1	
205							255			1		1	1
206							256						
207			1	1	1	1	257						
208							258						
209		1			1	1	259						
210							260						
211							261			1			
212			1		1		262						
213							263						
214	1	1	1	1	1	1							
215													
216													
217													
218			1		1								
219													
220													
221			1		1	1							
222													
223	1	1	1		1	1							
224													
225													
226													
227		1	1		1	1							
228													
229													
230													
231		1	1		1	1							
232	1		1		1	1							
233													
234													
235													
236													
237													
238													
239													
240			1		1	1							
241													
242					1								
243													
244													
245													
246			1		1	1							
247			1		1								
248													
249		1	1		1								
250													

Survey Question 22

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	13	54	5	107	9	161	5	213	13
2		55	13	108	15	162	8	214	5
3	10	56	12	109	22	163	17	215	11
5	10	57	7	110	7	164	10	216	25
6	15	58		111	13	165	20	217	8
7	21	59	16	112		166	5	218	3
8	21	60	13	113	8	167	15	219	16
9	9	61	17	114	14	168		220	
10	13	62	7	115	7	169	22	221	12
11	12	63		116	12	170	15	222	
12	10	64	25	117	15	171	6	223	7
13		66	14	118	13	172	30	224	8
14	21	67	7	119		173		225	12
15	8	68	12	120	5	174		226	11
16	9	69	13	121	19	175	12	227	10
17	4	70	15	122	12	176	8	228	33
18	9	71	20	123	23	177	17	229	16
19	26	72	12	124	14	178	18	230	17
20	10	73	9	125	10	179	27	231	23
21	30	74	10	126	4	180	15	232	9
22	10	75	15	127	6	181	24	233	20
23	9	76	14	128	7	182	18	234	13
24	12	77	4	129	7	183	6	235	12
25	15	78	7	130	24	184	12	236	11
26		79		131	26	185	8	237	9
27	15	80	6	132	7	186	8	238	8
28	15	81	15	133	15	187	13	239	7
29	21	82	22	134	5	188		240	16
30	4	83	13	135		189	13	241	11
31		84	11	136	8	190	6	242	20
32	15	85	10	137	10	191	18	243	12
33	20	86	15	138	10	192	8	244	15
34	18	87	14	139	4	193	7	245	15
35	9	88	22	140	12	194	9	246	10
36	10	89	14	141	19	195	7	247	10
37	13	90		143	6	196	8	248	18
38	5	91	19	144	6	197	11	249	14
39	13	92	20	145	8	198	20	250	14
40	17	93		146	14	199		251	
41	10	94	27	147	15	200	14	252	12
42	26	95	21	148		201	10	253	5
43	11	96	27	149	11	202	17	254	7
44		97	13	150	20	203	16	255	4
45	26	98	18	151	12	204	17	256	
46		99	7	152	8	205	7	257	16
47	7	100		153	19	206	8	258	19
48	21	101	8	154	12	207	10	259	14
49	17	102	18	155	26	208	36	260	8
50	14	103	19	156	26	209	9	261	15
51	12	104	13	157	12	210	10	262	13
52	16	105	10	159	5	211	20	263	6
53	20	106	19	160	6	212	6		

Survey Question 23

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	2	54	1	107	2	161	2	213	2
2		55	2	108	2	162	2	214	2
3	3	56	4	109	2	163	2	215	1
5	1	57	2	110	1	164	2	216	2
6	1	58		111	2	165	2	217	2
7	2	59	2	112		166	2	218	2
8	2	60	1	113	2	167	2	219	2
9	2	61	2	114	2	168		220	
10	2	62	1	115	2	169	2	221	2
11	2	63		116	2	170	1	222	
12	2	64	2	117	1	171	2	223	2
13		66	2	118	2	172	3	224	2
14	2	67	2	119		173		225	1
15	2	68	2	120	2	174		226	1
16	2	69	2	121	2	175	4	227	2
17	2	70	1	122	2	176	2	228	2
18	1	71	2	123	3	177	2	229	2
19	3	72	1	124	2	178	2	230	1
20	2	73	2	125	1	179	2	231	1
21	4	74	1	126	1	180	3	232	2
22	1	75	2	127		181	2	233	2
23	2	76	2	128	2	182	1	234	2
24	2	77	4	129	1	183	2	235	1
25	3	78	1	130	2	184	2	236	2
26		79		131	2	185	1	237	1
27	2	80	2	132	1	186	2	238	2
28	2	81	1	133	2	187	2	239	2
29	2	82	2	134	1	188		240	2
30	2	83	1	135		189	1	241	2
31		84	2	136	1	190	1	242	2
32	1	85	2	137	2	191	2	243	1
33	2	86	2	138	2	192	2	244	2
34	2	87	1	139	2	193	2	245	2
35	1	88	4	140	2	194	2	246	2
36	2	89	2	141	3	195	2	247	2
37	1	90		143	2	196	2	248	1
38	2	91	3	144	2	197	2	249	2
39	2	92	1	145	2	198	2	250	2
40	2	93		146	2	199		251	
41	2	94	2	147	2	200	2	252	2
42	2	95	3	148		201	2	253	2
43	2	96	2	149	2	202	2	254	2
44		97	2	150	2	203	2	255	1
45	2	98	2	151	1	204	1	256	
46		99	1	152	3	205	1	257	1
47	2	100		153	2	206	1	258	1
48	2	101	1	154	2	207	2	259	2
49	3	102	3	155	2	208	2	260	2
50	2	103	2	156	2	209	2	261	2
51	2	104	2	157	2	210	2	262	2
52	2	105	1	159	1	211	2	263	1
53	2	106	2	160	2	212	2		

Survey Question 24

Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response	Participant ID:	Response
1	2	54	2	107	2	161	2	213	2
2		55	2	108	2	162	2	214	2
3	2	56	2	109	2	163	2	215	2
5	2	57	2	110	2	164	2	216	2
6	2	58		111	2	165	2	217	2
7	2	59	2	112		166	2	218	2
8	2	60	2	113	2	167	2	219	2
9	2	61	2	114	2	168		220	
10	2	62	2	115	2	169	2	221	2
11	2	63		116	2	170	2	222	
12	2	64	2	117	2	171	2	223	2
13		66	2	118	2	172	2	224	2
14	2	67	2	119		173		225	2
15	2	68	2	120	2	174		226	2
16	2	69	2	121	2	175	2	227	2
17	2	70	2	122	2	176	2	228	2
18	2	71	1	123	2	177	2	229	2
19	2	72	2	124	2	178	2	230	2
20	2	73	2	125	2	179	2	231	2
21	2	74	2	126	2	180	2	232	2
22	2	75	2	127	2	181	2	233	2
23	2	76	1	128	2	182	2	234	2
24	2	77	1	129	2	183	2	235	2
25	2	78	2	130	2	184	2	236	2
26		79		131	1	185	2	237	2
27	2	80	2	132	2	186	2	238	2
28	2	81	2	133	2	187	2	239	2
29	2	82	2	134	2	188		240	1
30	1	83	2	135		189	2	241	1
31		84	2	136	2	190	2	242	2
32	2	85	2	137	2	191	2	243	2
33	2	86	2	138	2	192	2	244	2
34	2	87	1	139	2	193	2	245	2
35	2	88	2	140	2	194	2	246	2
36	2	89	2	141	2	195	2	247	2
37	2	90		143	2	196	2	248	2
38	2	91	2	144	2	197	2	249	2
39	2	92	2	145	2	198	2	250	2
40	2	93		146	2	199		251	
41	2	94	2	147	2	200	2	252	2
42	2	95	2	148		201	2	253	2
43	2	96	2	149	2	202	2	254	2
44		97	2	150	2	203	2	255	2
45	2	98	2	151	2	204	2	256	
46		99	2	152	2	205	2	257	2
47	2	100		153	2	206	2	258	2
48	1	101	2	154	2	207	2	259	2
49	2	102	2	155	2	208	2	260	2
50	2	103	2	156	2	209	2	261	2
51	2	104	2	157	2	210	2	262	2
52	2	105	2	159	2	211	2	263	2
53	2	106	2	160	2	212	2		

Survey Question 25

Participant ID:	25(1)	25(2)	25(3)	25(4)	25(5)	25(6)	25(7)	Participant ID:	25(1)	25(2)	25(3)	25(4)	25(5)	25(6)	25(7)
1						1		51			1				
2								52						1	
3						1		53						1	
5						1		54						1	
6						1		55						1	
7						1		56						1	
8			1					57				1		1	
9						1		58							
10						1		59						1	
11						1		60						1	
12						1		61						1	
13								62						1	
14						1		63							
15						1		64						1	
16						1		66						1	
17			1					67						1	
18						1		68						1	
19						1		69						1	
20						1		70						1	
21						1		71						1	
22						1		72						1	
23				1				73						1	
24	1					1		74						1	
25						1		75						1	
26								76		1		1			
27						1		77			1				
28	1							78						1	
29						1		79							
30				1				80						1	
31								81						1	
32						1		82			1				
33						1		83						1	
34						1		84			1				
35						1		85						1	
36						1		86						1	
37				1				87				1		1	
38						1		88						1	
39						1		89			1				
40						1		90							
41						1		91						1	
42						1		92						1	
43						1		93							
44								94						1	
45						1		95						1	
46								96						1	
47						1		97						1	
48			1					98						1	
49						1		99						1	
50						1		100							

Participant ID:	25(1)	25(2)	25(3)	25(4)	25(5)	25(6)	25(7)	Participant ID:	25(1)	25(2)	25(3)	25(4)	25(5)	25(6)	25(7)
101						1		151						1	
102						1		152						1	
103						1		153						1	
104						1		154			1				
105		1						155						1	
106						1		156						1	
107						1		157						1	
108								159						1	
109						1		160						1	
110						1		161						1	
111						1		162	1	1				1	
112								163						1	
113						1		164						1	
114						1		165						1	
115			1					166						1	
116						1		167				1			
117						1		168							
118						1		169						1	
119								170						1	
120						1		171						1	
121						1		172						1	
122							1	173							
123						1		174							
124						1		175						1	
125						1		176						1	
126						1		177						1	
127				1				178						1	
128						1		179						1	
129						1		180							
130						1		181						1	
131		1						182						1	
132		1						183						1	
133		1						184				1			
134			1					185						1	
135								186						1	
136						1		187		1					
137						1		188							
138						1		189			1				
139						1		190						1	
140		1						191						1	
141			1					192						1	
143						1		193						1	
144						1		194						1	
145						1		195						1	
146						1		196				1			
147						1		197						1	
148								198		1					
149						1		199							
150						1		200						1	

Participant ID:	25(1)	25(2)	25(3)	25(4)	25(5)	25(6)	25(7)	Participant ID:	25(1)	25(2)	25(3)	25(4)	25(5)	25(6)	25(7)
201						1		251							
202						1		252			1				
203						1		253						1	
204						1		254						1	
205						1		255			1				
206		1						256							
207						1		257						1	
208						1		258						1	
209			1					259						1	
210						1		260						1	
211				1				261						1	
212						1		262						1	
213						1		263						1	
214	1					1									
215		1													
216						1									
217						1									
218						1									
219						1									
220															
221						1									
222															
223						1									
224	1					1									
225						1									
226						1									
227			1												
228						1									
229						1									
230						1									
231	1					1									
232						1									
233						1									
234						1									
235						1									
236						1									
237		1													
238						1									
239		1				1									
240						1									
241		1													
242						1									
243						1									
244						1									
245						1									
246						1									
247					1	1									
248						1									
249															
250			1												

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