ABSTRACT

MACK, NAYO CORENUS-GENEVA. A Research Study Using the Delphi Method to Define Essential Competencies for a High School Game Art and Design Course Framework at the National Level. (Under the direction of Dr. Aaron C. Clark, Dr. Jeremy V. Ernst, Dr. Theodore Branoff and Dr. Lisa L. Grable).

This research study reports the findings of a Delphi study conducted to determine the essential competencies and objectives for a high school Game Art and Design course framework at the national level. The Delphi panel consisted of gaming, industry and educational experts from all over the world who were members of the International Game Developers Association. The expert panelists participated in a four-round consensus building process via the Internet. Spearman's Rank Correlation Coefficient and a chi-squared analysis were used to analyze the resulting consensus among the competencies and objectives. The results of this study provided set of newly generated competencies and corresponding objectives recommended to be taught within a high school Game Art and Design course or curriculum. (Keywords: gaming, Delphi, curriculum, IGDA, competencies, objectives, course framework.)

A Research Study Using the Delphi Method to Define Essential Competencies for a High School Game Art and Design Course Framework at the National Level

by

Nayo Corenus - Geneva Mack

A dissertation submitted to the Graduate Faculty of
North Carolina State University
in partial fulfillment of the
requirements for the degree of
Doctor of Education

Technology Education

Raleigh, North Carolina

March 21, 2011

APPROVED BY:

Dr. Aaron C. Clark Committee Chair	Dr. Jeremy V. Ernst Committee Co-Chair
Dr. Theodore Branoff	Dr. Lisa L. Grable

DEDICATION

This dissertation is dedicated to my nieces,

Emori and *Elon*,

the most amazing girls in the world.

You make being an Aunt my favorite job of all.

To my Grandmother,

Gertrude Gamble Ballard,

the strongest and most beautiful woman I ever had the pleasure of knowing;

her third-grade education propelled me to reach this milestone.

Lastly, this dissertation is dedicated to God.

He knows why.

BIOGRAPHY

Nayo C-G Mack was born in Albany, NY and raised in Sumter, SC. She is the second oldest of nine children to Buster and Margie Ballard-Mack.

Nayo received a Bachelor of Science degree from North Carolina Agricultural & Technical State University and a Master of Science degree from Purdue University. Her undergraduate degree is in Graphic Communications – CAD, and her master's is in Computer Graphics. She also earned her Doctor of Education degree from North Carolina State University in Technology Education with Curriculum & Instruction as her minor area.

Outside of her academic activities, while living in Raleigh, Nayo was active at Lincolnville AME Church. She was hired in the fall of 2010 to teach in the Industrial Technology Education department at South Carolina State University in Orangeburg, SC, where she was the first woman to ever join the department as a tenure-tracked Instructor.

ACKNOWLEDGMENTS

The researcher would like to express her appreciation to *Dr. Aaron C. Clark*, *Dr. Jeremy V. Ernst* and *Dr. Theodore Branoff* for their guidance during this dissertation and doctoral process. A special thank you goes to *Dr. Lisa L. Grable* for being an exceptional mentor, advisor, teacher, employer and friend.

She extends a special thanks to her family, especially: *Mom*, for always believing in me when I did not and could not believe in myself; to *Dad*, for all of the scriptures and pep talks; to *Nataki*, for the constant publicity, love and encouragement; to *Fred Allen*, for the reality checks and wing nights; to *Nailah*, for the guaranteed laughs and constant calming spirit; *Naja*, for the articles, late night talks and brain-storming sessions; *Niara*, for the encouraging texts and; acknowledging James, Naeem, Pete and Takeem, my brothers, who have always encouraged me.

Lastly, the researcher would like to thank her Raleigh family: *Stephanie* and *Shironda*, the best examples of extended family I've ever known; *Kathleen*, my God-sent classmate, friend and lunch buddy that made this journey bearable and; *Lincolnville African Methodist Episcopal Church*, for welcoming me and giving me an outlet to fulfill my purpose while I traveled on this path.

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Chapter One: Introduction

In 2008, more than 298.2 million computer and video game units were sold in the United States (ESA, 2009). In early 2009, the Entertainment Software Association (ESA) reported that sixty-eight percent of households in the United States play computer or video games (ESA, 2009), calculating to approximately 2.6 games for every household in America. The sale of video games in the U.S. represents an $11 billion industry; the combined revenue for video games and software sales reached $20.2 billion in 2009 (Riley, 2009). The U.S. spent over $520 million dollars on elementary, secondary and post-secondary education and billions more on workforce training in 2006 (U. S. Census Bureau, 2006), yet it spends little on research and development to improve the productivity and effectiveness of learning (The Federation of American Scientists, 2006). Additionally, the Corporation for Public Broadcasting (2003) published a study stating the time spent using digital media by children aged 13-17 has now surpassed the time they spend watching television. It would be a natural progression for the field of education to continue society's technological trend and incorporate this mode of learning into the contemporary classroom learning environment. How can this be done effectively?

The International Game Designers Association (IGDA) reported that in order for gaming and the study of gaming to reach their full potential, industry and academia must cultivate a deeper understanding of the ideas that drive games, the experiences games can offer, and the implications of those ideas and experiences on the social and cultural significance of this young medium (2008). The post-secondary education level has a wealth of Game Design/Game Art and Design related programs to pull from, however, there is a lack of similar curriculum available at the secondary level (Degree Directory, 2010). At the post-secondary level, Game Art and Design generally included computer programming skills, creative writing, storytelling, artistic techniques and visual arts. Some programs focused on games played purely for entertainment; others concentrated on instructional games, training games for corporations and multimedia simulations for specific industries (Degree Directory, 2010). Because of the immersion of video games as learning aids in the 21st century classroom, a formal list of necessary competencies would be largely beneficial to the field of gaming education.

According to the Federation of American Scientists (2006), educational games could teach many things in an engaging and motivating manner, including, but not limited to, higher order thinking skills, practical skill training, provide high performance situations, unearth rarely used skills and develops expertise, all while promoting team building. Computer games and video games are primarily categorized as captivating forms of entertainment. Increasingly, however, they are becoming recognized as providing a powerful means for learning, both among educators and the game development community (Stapleton, 2004). Abate, Stamatakis and Haggett (2003) report that curriculum development encompasses student learning outcomes, instructional methods and concepts, approaches, student learning, evaluation and curriculum mapping. Though generic curriculum development can be described involving the aforementioned competencies, the same attention would be beneficial regarding the gaming education community, in particular are those pertaining to the K-12 level.

Though increasing numbers of classrooms are utilizing educational gaming as a learning tool, there has still been no concrete decision on how best to utilize and integrate technology effectively into schools and classrooms – this question generated many diverse responses (Williams, Boone & Kingsley, 2004). As a result, a major challenge to contemporary classroom teachers was to meet the needs of a diverse K-12 learning population. The contemporary K-12 classroom is filled with diversity in culture, language and learning styles. The phrase 'K-12' refers to the compulsory education years required of all children in the United States that progress from kindergarten (age 5 or 6) through the 12th grade (age 18 or 19), which is traditionally the end of secondary school (Lewis, 2000). As reported by the Federation of American Scientists (2006):

> "The power of gaming is particularly relevant to today's K-12 students – the so-called "digital natives" – who have grown up with interactive digital technologies. These students are not merely technology savvy, they are approaching their lives differently as they integrate digital technologies – such as computers, the Internet, instant messaging, cell phones, and e-mail – seamlessly throughout their daily activities."

Because gaming education is such a novel field, little research has been done on the effectiveness and worth of these games. An over-reliance of leisure-based games has led to an array of problems, including a mismatch between methods and content, the use of inappropriate terminology and concepts, and the use of approaches not built upon evidence-based research (deFreitas, 2006). According to Gee (2007), good games give information "on demand" and "just in time", not out of the contexts of actual use or apart from people's purposes and goals, which he asserts is something that happens too often in schools. Video and other types of leisure games, while often challenging, yet do-able, offer a very motivating state for human beings (Gee, 2007; 2003). Furthermore, Gee has found that good games allow players to customize the game to their own levels of ability and styles of learning. Once properly acknowledged, promoting this kind of progress will be best established when academia and industry work together (IGDA, 2008).

Expert contributors

The population of interest in contributing to this research was the International Game Developers Association (IGDA). A contemporary example of academia and industry working together was displayed within the IGDA. IGDA is comprised of twenty-six Special Interest Groups (SIGs) which were centered on a topic of interest relevant to game development. Of the twenty-six IGDA SIGs, the Game Education SIG – comprised of over 500 voluntary members that included educators, industry workers and students – will be one facet explored within this research (IGDA, 2009a).

Within the Game Education SIG are seven initiatives – EdSIG Wiki, Curriculum, GDC Content, Knowledge Base, International Outreach, Student Outreach and Internship/Co-Op (IGDA, 2009a). The Game Education Curriculum Initiative is responsible for the nine core topics that served as the major platform for this study. This Education SIG Committee was chosen because its goals – to help foster interaction between developers and educators, to facilitate the development of educational programs, and contribute to the evolution of games – lent valuable credence and significance to this research (IGDA, 2008). The mission of the Game Education SIG as a whole was to create a community resource that strengthened the academic membership of IGDA while enhancing the education of future and current game developers (IGDA, 2009c), which lined up with the scope of this research area.

Background of IGDA Game Education SIG

The Game Education SIG was created in the year 2000 as a cooperative effort between academia and game industry (IGDA, 2008). In that same year, the Education committee, a section of the Game Education SIG, was also created to improve communication and collaboration between academia and industry. In 2003, the Education committee assembled the first version of a two phase curriculum framework titled IGDA Framework: The Study of Games and Game Development Version 2.3 Beta (IGDA, 2008). During phase one, course outlines were collected and used to develop a knowledge base for educators to utilize as a reference. This growing knowledge base, once revised, provided new insights and incorporated feedback from game developers. The current version, v3.2 beta, is a compilation of these efforts.

As published by IGDA (2008), the nine core topics created from the aforesaid principles are briefly explained. The first core topic, *Critical Game Studies,* encompasses the criticism, analysis and history of electronic and non-electronic games, while *Games and Society* encourages the understanding of how games reflect and construct individuals and groups, as well as how games reflect and are constructed by individuals and groups. *Game Design* covers the principles and methodologies behind the rules and play of games; *Game Programming* includes the aspects of traditional computer science and software engineering – modified to address the technical aspects of gaming. The fifth and sixth core topics, *Visual Design* and *Audio Design*, cover designing, creating and analyzing the visual components of games, creating sound and sound environments. Traditional storytelling and the challenges of interactive narrative are involved within *Interactive Storytelling*, the seventh core topic. *Game Production* contains the practical challenges of managing the development of games, while the last core topic, *Business of Gaming*, embraces the economic, legal and policy aspects of games. These nine core topics were created to reflect how IGDA considers the approach to gaming. IGDA (2003) felt that the core topics intuitively address the unique, practical and theoretical concerns of games. This list of core topics was used as a platform for creating a Game Art and Design course framework for secondary schools.

Statement of the Problem

The problem surrounding this study brought awareness to the lack of a dedicated framework, and how that has produced a significant impediment for implementing games and simulations, particularly in formal learning contexts (deFreitas, 2005). Because gaming education is such a novel field, little research has been done on the effectiveness and worth of these games; considering that educational games are viewed as having instructive potential in the contemporary classroom, there needed to be competencies that clearly outlined the most effective integration route (Prensky, 2006).

Guiding this study was the absence of recognized and identifiable gaming competencies in the secondary level curriculum for gaming in the United States; literature showed that the few existing curricula were limited due to time constraints and most projects were unfortunately abandoned after one term regardless of their status (Divotkey, et.al, 2009). IGDA has created a pathway within the field of educational gaming and developed a list of Core Topics in order to have a broad view of games-related education (IGDA, 2008).

This Core Topic list was built upon via this study. The existing core topics were intended for the post secondary level; the purpose of this study was to create a framework for the high school classroom based off of the core topics.

While this is the initial and necessary step in building an educational gaming course, a further investigation into competencies for each of the nine Core Topics (IGDA, 2008) will be essential for meticulously developing the course framework. As of now, the vast majority of literature pertaining to gaming courses is concerning those at the post-secondary (College/University) level.

From this research, a list of competencies for a high school general gaming course was generated at the conclusion of this study. This study sought direction to begin to answer the primary research question: What are the appropriate curriculum competencies for a secondary level Game Art and Design curriculum for technology education in the United States? There was an absence of research related to gaming education in the secondary level classroom, particularly in the field of technology education. This research strove to alleviate any impediments, while establishing curriculum competencies for a secondary Game Art and Design course framework.

Purpose of the Study

The purpose of this study was to create a list of essential competencies that would be taught in a high school Game Art and Design course based on the IGDA Core topics by utilizing the Delphi method (Turoff, 1975). The finished product – a list of statistically valid essential competencies and objectives – is capable of serving as a model for a high school Game Art and Design course framework. This was done by utilizing experts to help define what the competency areas and objectives were. The collection occurred via a consensus in the form of the web-based Delphi method based on an initial competency list created from the IGDA essential components list from 2006 (Scott, Washer & Wright, 2006). There was no existing curriculum or course framework based off of the IGDA core topics; this study delved into unchartered areas. Additionally, while there was no high school course framework based off of the IGDA core topics, there was no set of objectives in existence for this particular group of topics. This study created a list of newly established competencies and objectives for the secondary level based off of the IGDA core topics.

The Core Topics that the IGDA developed were a valuable platform. The six reasons the Core Topics will be helpful, the first listed by the IGDA was that they would be helpful to educators and administrators who are developing curricula for games related programs at their institutions (IGDA, 2008). The remaining reasons that complete why the Core Topic list would be helpful included game companies wishing to know or influence what they can expect from new graduates seeking jobs; students who were trying to determine which area of games suits their interests, goals and skills; professionals who were considering how to continue their education in a rapidly-changing field; public education organizations, government officials, accreditation bodies, and others who sought a deeper understanding of the games area; and anyone who is trying to make sense of the wide range of games-related programs that are now available (IGDA, 2008).

Significance of the study

In the midst of working to advance the knowledge base in gaming, a comprehensive list of core competencies and objectives that should be addressed within the Core Topic

Framework would be beneficial to the field once created (IGDA, 2008). In a 1997 study, Boone, Higgins, and Williams found that commercial educational software publishers were generally unwilling to talk when asked about their instructional design process and evaluation procedures. Many do not have a set of procedures, and few have teachers or students evaluate their software prior to marketing (Higgins, Boone & Williams, 2000). Similarly, educational publishers do not invest in research-based development. Evaluating a product is very costly, evaluations rarely involve performance data (as a post follow-up of an implementation), and there is no significant incentive for serious improvement (Burkhardt & Schoenfeld, 2003).

While the IGDA forged the path for this research, it opened the door for more exploration. As such, this study was significant in the educational field because, as of yet, there were no national high school level educational gaming competencies in existence for a Game Art and Design course that are free and focused on the IGDA gaming framework for curriculum development.

Research Questions

Because the IGDA recently formulated a curriculum framework to be used as a conceptual guide for game-related educational programs (IGDA, 2008), the need for core competency areas became even more important. Therefore, the following questions guided this research investigation:

1. What core competency areas can be created in addition to each Core Topic in IGDA's game-related Technology Education course framework for the secondary level?

2. What objectives will correspond with the impending competency list created from IGDA's game-related Technology Education course framework for the secondary level?
3. Does the Delphi Method clearly identify curriculum competency and objective areas for a Game Art and Design course framework at the secondary level?

Assumptions

The following assumptions were considered throughout the process and procedures used within the study:

1. Each Delphi panel member had experience either teaching in the field of technology education, industry experience, or experience with (or using) some type of educational game.
2. Panel members had experience with high school learners in technology education or career and technical education courses.
3. Technology education teachers, game experts, and industry leaders responded to the data collecting instrument in a non-biased way based on place of employment, affiliation, etc.
4. Teachers, game experts and industry leaders participating within the study were knowledgeable of the IGDA core topics and the alignment with national standards.
5. All information gathered was accurate, current, and related to the curriculum of technology education.

6. Teachers, participants and other experts participating in the study owned a computer with Internet connection and email accounts, and were committed to participating in all four rounds of the Delphi process.

Limitations

The following limitations were considered during the process and procedures to be used throughout the study:

1. The majority of correspondence with the participating Delphi panelists was electronic.
2. Because electronic correspondence was employed, the feedback and participation was limited to persons with Internet access.
3. Panel members were compiled from those that were willing to participate and were participants in the IGDA Game Education Special Interest Group.
4. High school teachers were desired, but experts in gaming and high school curricula were sufficient for the purposes of this study.
5. The core competencies were formulated based on the Core Topics developed by the International Game Developers Association.
6. The results of this study were based on information provided by the following: IGDA Game Education Core Topics List, a literature review, and data gathered through instruments derived by the researcher of this study.
7. While IGDA has a member base of experts from all over the world, this study was limited to English and English as Second Language speakers.

Research Methodology

According to deFreitas (2005), the lack of a dedicated framework could produce a significant impediment, particularly in formal learning contexts. Therefore, this study utilized the core topics produced by the IGDA as a platform for generating core competencies for a good Game Art and Design curriculum. An online version of the Delphi method was employed to identify what core competencies should be taught within the IGDA Core Topics for Game Art and Design at the high school level. The vital players in this study included the educators, industry experts and students that are a part of the IGDA game education special interest group and also had experience in this field.

This research incorporated a web-based Delphi technique based on an initial competency list created from the IGDA essential components list from 2006 (Scott, Washer & Wright, 2006) and Version 3.2 Beta, which was released in February of 2008 by the IGDA Game Education Special Interest Group (IGDA, 2008). The Delphi was used to confidentially consult a body of experts chosen based on their demographic information and formulate a group consensus (Linstone & Turoff, 1975) while limiting the complications and disadvantages of a face-to-face group interaction (Isaac & Michael, 1981). In addition, the electronic Delphi was used to reduce the potential for dominance by a panel member or distortions ("group-think") arising from decisions based on panel member feedback (Clayton, 1997).

The Delphi method was chosen because of the associated time, cost and travel. The turn-around time for disseminating and receiving information is nominal, the cost associated was inexpensive because of the mode of delivery (via the Internet), while utilizing the

Internet eliminated the need to travel (Turoff & Hiltz, 1996). As established by Turoff (1975), these combined variables were reasons the Delphi method was the best collection approach for this study. Based on the fact that the Delphi panel members were potentially scattered all over the world and had varying schedules, it was decided that the most effective method of compiling this information would be by employing a four round web-based Delphi study (Effermeyer et. al., 1986).

The expert panel and the review panel were extracted from the same pool of participants – those from the IGDA game education special interest group. The experts and review panel were comprised of industry affiliates, game players, game designers, game developers, teachers and graduate students in the game education field. This was controlled by the information gathered from the demographics survey. Regarding the total group of panelists, the participants were broken into three groups – Industry, Research and Teachers. The panelists were assigned to one of the three aforementioned groups per their self-reported data on the demographics questionnaire. Furthermore, assigning the panelist to a group provided an added measure of fairly representing each of the three areas for the desired review panel. As such, by utilizing a random number generator, the review panelists were comprised of three randomly chosen persons - one person from industry, one from a research background and one from the education field (teachers).

For this study, the expert and review panels were primarily comprised of persons that attended and/or taught in a United States high school for at least one calendar school year, hold a two-year or four-year degree in a field related to technology, and had two or more years of experience teaching. Also considered for potential panelists were any experiences in course development, course construction or curriculum and instruction. All potential panelists had the opportunity to volunteer and complete the demographics survey, which allowed the researcher to track those with the desired qualifications. Once thirty three members were selected – thirty for the expert panel and three for the review panel, the study formally began. The members of the expert panel were utilized for creating the list of competencies and objectives, and the review panel was used to maintain consistency within the instruments, as well as for editing purposes (Ferris, et. al., 2005).

It has been suggested that reasonable results can be obtained with small panels of 10-15 individuals (Adler & Ziglio, 1996); however, Turoff (1975) recommended that a Delphi sample size should be between 10 and 50 participants. After taking the aforementioned recommendations regarding qualifications and sample size into consideration, it was determined that thirty experts, combined with the three review panel experts, would be a desirable panel size for this study, which ensured that members from education and industry will be represented. Furthermore, the expert panel was comprised of thirty expert members (Adler & Ziglio, 1996) while the review panel had three expert members, reflective of the larger panel of members – all of whom were gathered via a random number generator from the Internet. The review panel provided a higher degree of consistency among each round while preventing any potential researcher bias that may arise (Whiting, et. al., 2003).

A participant letter and demographic instrument was emailed to the listserv of the IGDA game education special interest group, and those who were interested responded. The thirty three total panel members were randomly selected from the qualified respondents. Powell (2003) reported that heterogeneous rather than homogeneous groups produced a higher proportion of high quality, highly acceptable solutions; hence the combination of the review panel and the expert panel. Because this was such a new field, gathering the ideas of experts at different levels ensured that as many cross-themed ideas were covered.

The Delphi method process was designed to yield consensus through a series of rounds (Custer, R., Scarcella, J and Stewart, B., 1999) which had three characteristic features: anonymity, controlled feedback and statistical group response (Adler & Ziglio, 1996). Each round presented an instrument to panel members who completed and returned it to the researcher. The responses were analyzed and compiled to build the next round's instrument. The number of rounds in any Delphi study depends on reaching a consensus among panel members, and most Delphi studies discover that more than three rounds does not add significant value (Clayton, 1997), however, for this research, the four-round Delphi was utilized for final verification of findings.

Delphi Study Instruments

Demographics

The demographics instrument allowed all participants to be pooled together as potential panel members, but they were ultimately selected based on criteria set forth by the researcher. The information to be gathered included, but was not limited to: major area for each degree held, which grade level was currently being taught, and number of years of experience with gaming, teaching, course development, course construction, or curriculum and instruction.

The required criteria that determined which panelists chosen as expert panel members included members that matriculated through a secondary United States program and received a diploma; have at least two years of experience with gaming and; at least two semesters experience teaching gaming. Preferred criteria included at least one year expertise in course development, course construction or curriculum and instruction. The criteria may have been modified pending respondents information; however, being regarded as an expert is an imminent factor in participating in the study (White & Russell, 1995).

There were thirty expert panelists, with three review panelists (Adler & Ziglio, 1996) chosen from the same pool of qualifications to ensure that researcher bias is eliminated, as well as promoting a seamless approach to the instruments for each round. Once a panelist had been selected to participate based on their respective demographic information and qualifications, they were emailed with an IRB approved Informed Consent form and a link for the first round of the Delphi.

Round I

The instrument for Round One of the web-based Delphi was created based on the nine Core Topics developed by IGDA (2003; 2008). Round I consisted of an unstructured, open-ended instrument that had spaces for additional suggestions, as recommended by Finch & Crunkilton (1999). In addition to the nine core topic areas listed by IGDA (2008) – Critical Game Studies, Games and Society, Game Design, Game Programming, Visual Design, Audio Design, Interactive Storytelling, Game Production, Business of Gaming – the spaces allotted for additional competencies enabled the expert panelists to add to this list or modify it if they were compelled to do so.

Before the expert panelists were able to access the Round One instrument, the review panel received the instrument and checked for jargon, consistency and clarity of the content;

they had 48 hours to provide any feedback before the instrument was sent to the expert panelists. This was the role of the review panel at the beginning of each round of the Delphi. It was not only in place to create a degree of uniformity, but to remove any potential researcher bias. Once the review panel approved the researcher edits of the first instrument, the expert panel was to be granted access to the instrument via the web. One week after the expert panelists were invited to participate in Round One, they received a reminder via email to complete and return their responses if they have not done so. There was an opportunity to revise and/or give input on the components in each round.

Panel members received a link to the online survey, and were only identified by their initials, which they had the option of reporting at the end of the Round One Delphi instrument, which assisted in maintaining their anonymity during the research process (Hsu & Sandford, 2007). In this round, they had the option to ‘Accept’, ‘Reject’, ‘Modify’ or ‘Add’ new competencies to the core topic list provided by IGDA; they were also asked to provide objectives for the core topics and any new competencies they create. After completing the first round instrument, the panelist submitted their responses within the online survey system; the researcher then had access to the data and downloaded it accordingly.

Round II

The Round Two instrument was developed based on the information compiled from Round One and sent to the review panel for authentication before being sent to the expert panel. Round Two of the web-based Delphi method began with the review panel examining the instrument for consistency in content and jargon. Once verified by the review panel, the expert panel was notified via email of the availability of the Round Two instrument. The core topics/competencies from Round One were placed in random order on the instrument using a random number generator (Adler & Ziglio, 1996); Round Two of the Delphi included rating of the results from Round One, which were randomized within each competency and objective grouping (Linstone & Turoff, 1975). Panelists had the option to 'Accept', 'Reject', 'Modify' or 'Add' new competencies to the core topic list from Round One.

The rating of 51 percent (or 3.01 on a five-point scale) was used to determine the quality competencies and objectives to be retained for the impending Game Art and Design course framework. A mean cutoff value of 3.01 was used on the Likert scale responses; this five-point scale ranged from '1' being the lowest and '5' being the highest. Once the data was examined by the researcher, quality competencies were put in order from highest rated to lowest rated, and those with a mean value of 3.01 or above were retained for Round Three (Katsioloudis, 2007); the others were discarded (Clark & Wenig, 1999). This was the beginning of consensus building among the competencies and objectives while allowing for ranking in the following round.

Round III

Panelists in Round Three ranked the competencies and objectives from Round Two that had a mean value of 3.01 or above; in this round descriptive information was provided about how the group responded, as a whole. Round Three of the web-based Delphi method included the ranking of the competencies and objectives from Round Two based on the needs of a secondary level Game Art and Design course. The review panel examined and approved the information for the Round Three instrument before the expert panel was notified of its availability. Within this round, experts ranked the items from 1 to *n* where '1' was the highest and '*n*' was the lowest. This was also the last time the panelists were able to 'Accept', 'Reject', 'Modify' or 'Add' new competencies to the competency list.

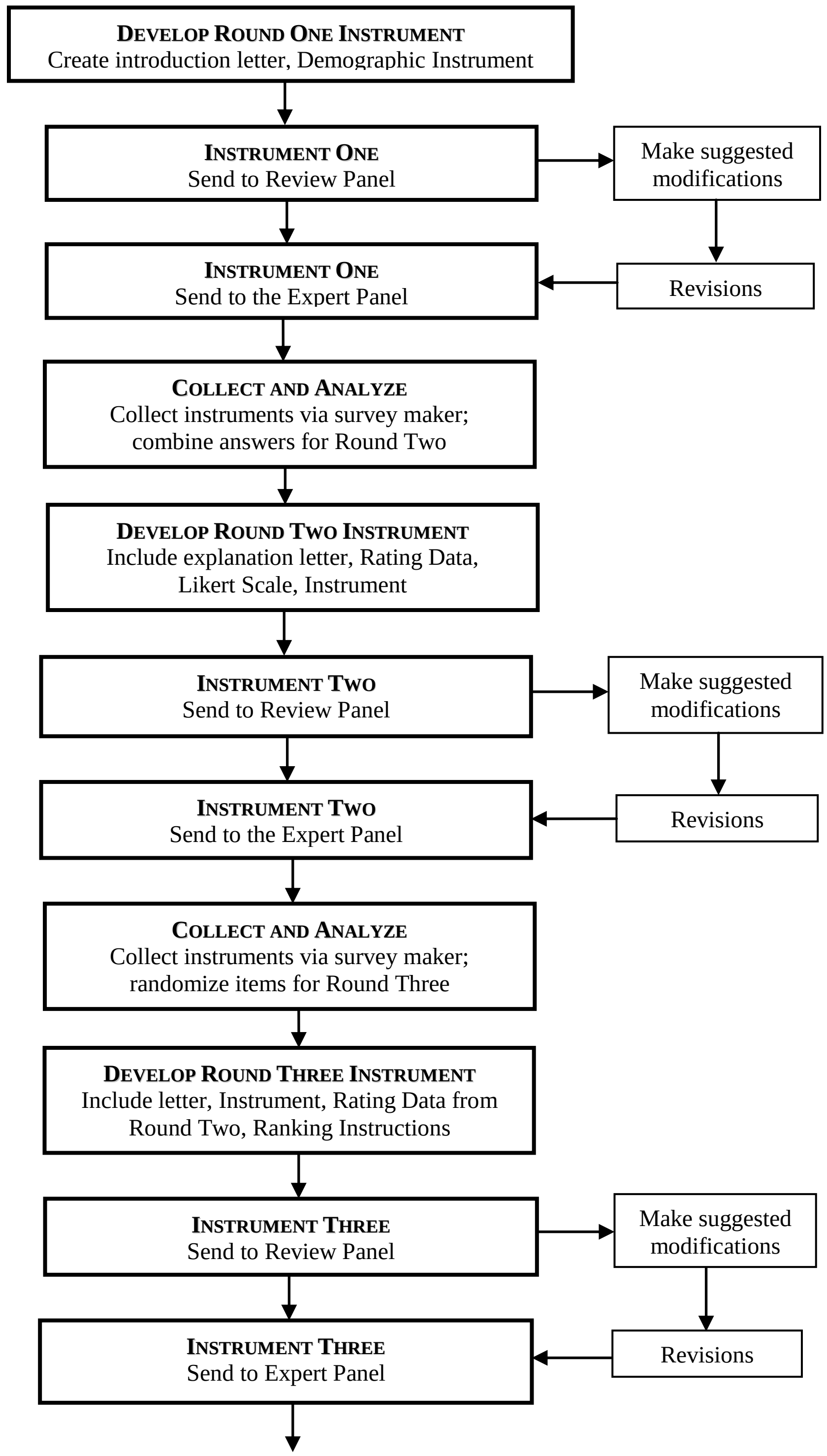
Once the expert panel completed Round Three by ranking the competencies and objectives in order and submitting their responses, the results were collected by the researcher. Upon receiving the instrument, the researcher collected and analyzed the data by using Spearman's Rank Correlation Coefficient; this nonparametric analysis was used to show correlation by comparing the ranked scores to their corresponding medians from the previous round. The resulting correlation enabled the researcher to further observe favored competencies from the expert panelists among the population, while identifying if consensus, in fact, was being reached.

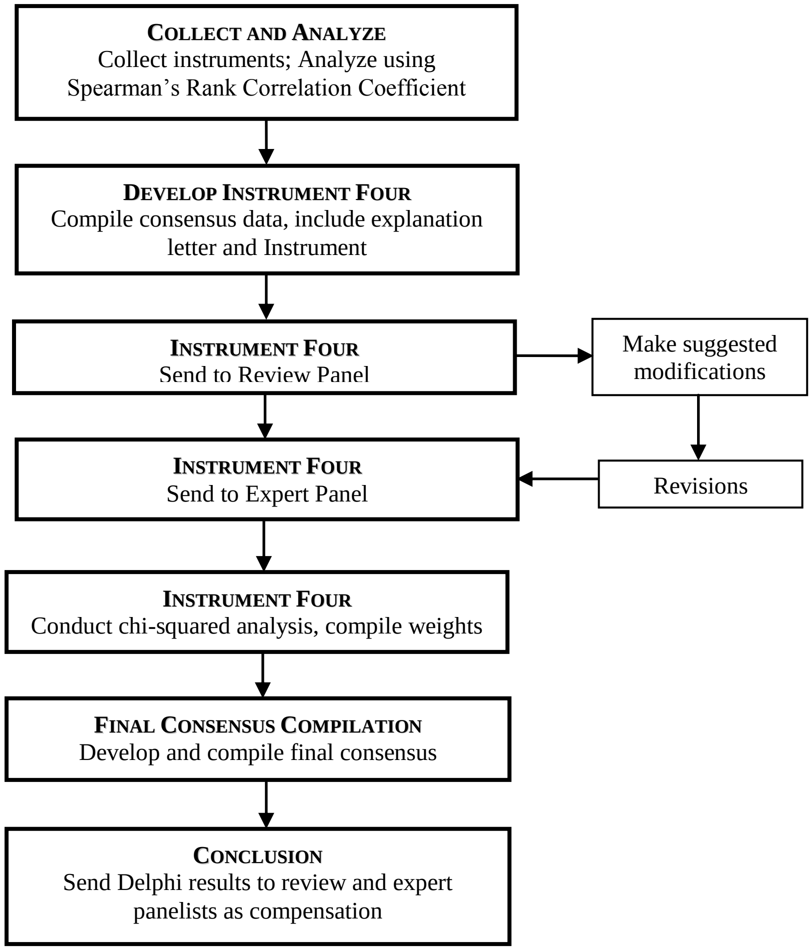
Round IV

Round Four stood as the final round in the study; it determined the consensus of the competencies and objectives kept from Round Three. Once the review panel approved the final instrument, it was made available to the expert panel for final responses. The expert panelists were asked only to 'accept' or 'reject' any remaining competencies from Round Three – no modifications were allowed at this stage. After the results were collected, they were analyzed by utilizing the Chi-squared nonparametric test. This analysis of choice was displayed in contingency tables to indicate the relationships between the variables. As an additional measure, once all data was collected from the Delphi, the population of Delphi experts from IGDA was broken into two samples – those with experience teaching and those without. The Spearman's Rank Correlation Coefficient was employed, observing how the data correlated among the two samples (Skeskin, 2007); it was used as further descriptive information.

Upon completion of Round Four of this study, there was a concise list of competency areas to be taught in a secondary Game Art and Design course. This list indicates to the field of gaming and education what an appropriate secondary level Game Art and Design course framework should look like; it was sent to the review panel members and expert panel members along with a thank you email as partial compensation for contributing to the study. As a final compensatory measure, all panelists had the opportunity to be listed as an expert panelist that contributed to this study. Figure 1 outlines a flowchart of the research process and Delphi method in order to visually simplify the process.

Figure 1. *Research Methodology Flowchart*.


DEVELOP ROUND ONE INSTRUMENT
Create introduction letter, Demographic Instrument
INSTRUMENT ONE
Send to Review Panel
Make suggested modifications
Revisions
INSTRUMENT ONE
Send to the Expert Panel
COLLECT AND ANALYZE
Collect instruments via survey maker; combine answers for Round Two
DEVELOP ROUND TWO INSTRUMENT
Include explanation letter, Rating Data, Likert Scale, Instrument
INSTRUMENT TWO
Send to Review Panel
Make suggested modifications
Revisions
INSTRUMENT TWO
Send to the Expert Panel
COLLECT AND ANALYZE
Collect instruments via survey maker; randomize items for Round Three
DEVELOP ROUND THREE INSTRUMENT
Include letter, Instrument, Rating Data from Round Two, Ranking Instructions
INSTRUMENT THREE
Send to Review Panel
Make suggested modifications
Revisions
INSTRUMENT THREE
Send to Expert Panel


COLLECT AND ANALYZE
Collect instruments; Analyze using Spearman's Rank Correlation Coefficient
DEVELOP INSTRUMENT FOUR
Compile consensus data, include explanation letter and Instrument
INSTRUMENT FOUR
Send to Review Panel
Make suggested modifications
Revisions
INSTRUMENT FOUR
Send to Expert Panel
INSTRUMENT FOUR
Conduct chi-squared analysis, compile weights
FINAL CONSENSUS COMPILATION
Develop and compile final consensus
CONCLUSION
Send Delphi results to review and expert panelists as compensation

Definition of Terms

Benchmark – Written statements that describe the specific developmental components by various grade levels that student should know or be able to do in order to achieve a standard (ITEA, 2007).

Commercial educational computer games – Also called edutainment, focuses on teaching the player certain specific skills, generally Algebra, Spelling, Problem-solving and other similar basic skills (Okan, 2003).

Commercial Games – Used for education, they rarely focus on an exclusive topic or on basic skills (Van Eck, 2006).

Core Competency – An expected outcome or behavior based on the designated course blueprint (VoCATS Course Blueprint, 2002).

Curriculum – Encompasses learning experiences set forth by a program or school and should include all aspects of these experiences. In addition to content, curriculum considers student learning outcomes, teaching and learning processes, student evaluation, and program (student learning outcomes) assessment (Abate, 2003); the sum of the learning activities and experiences that a student has under the auspices or direction of the school (Finch & Crunkilton, 1999).

Delphi – A method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem (Linstone and Turoff, 1975); a procedure for structuring a communication process among a large group of individuals (Mitroff, & Turoff, 2002).

Digital Natives – K-12 students who have grown up with interactive digital technologies. They are technology savvy and integrate digital technologies such as computers, the Internet, instant messaging, cell phones and e-mail seamlessly throughout their daily activities (The Federation of American Scientists, 2006).

Edutainment – The act of learning through a medium that both educates and entertains; entertainment that is intended to be educational (Okan, 2003).

Expert – An expert is someone that has acquired extensive knowledge that affects what they notice and how they organize, represent, and interpret information in their environment (Council, 2000).

Game – A set of activities involving one or more players. It has goals, constraints, payoffs and consequences. A game is rule-guided and artificial in some respects. Finally, a game involves some aspect of competition, even if that competition is with oneself (Dempsey, et. al, 1996).

Gaming – Credible interactive simulations (Foreman, 2004).

Indie Games – Where independent game creators lead to innovation in a multitude of game genres, the revitalization of classic game styles and the creation of entirely new blends of art and playability. Games include strategy, adventure, and puzzle games (CMP Game Group, 2011).

Research-based educational computer games – Present new approaches and have strong documentation for learning outcomes (Egenfeldt-Nielsen, 2007).

Serious Games – Games that allow learners to experience situations that are impossible in the real world for reasons of safety, cost, time, etc., but they are also claimed to have positive impacts on the players' development of a number of different skills (Susi, et.al, 2007).

Special Interest Group (SIG) – SIGs connect IGDA members interested in a specific topic or discipline relevant to the art or business of making games. SIG members learn from each other, promote their specialties, identify upcoming challenges and endeavor to advance the state of the art and the industry (IGDA, 2003).

Technology Education – The principal rationale for technology education in the United States is that every citizen should be technologically literate and, thereby, is able to use, manage and understand technology (Rasinen, 2003).

Technological Literacy – Knowledge about what technology is, how it works, what purposes it can serve, and how it can be used efficiently and effectively to achieve specific goals (NCREL, 2008).

Web-Based Delphi – Web-based Delphi, a kind of technology enhanced Delphi, is an electronic form of Delphi using the Internet and the World Wide Web as primary data collection (Andrews & Allen, 2002).

Chapter Summary

Since educational games are increasingly viewed as having educational potential (Elspa, 2003; Prensky, 2001), it was imperative for there to be a compilation of necessary factors that would promote the learners with a well-rounded learning experience. By utilizing the nine core topics created by the IGDA, an expanded list was generated by a list of well-versed experts from IGDA, professionals from the gaming and education field. Once compiled, a model of what a good secondary level Game Art and Design course framework looks like was in place to lend credence to the gaming and education field. The aforementioned research questions provided the basis of this study, the Delphi method helped to create a consensus among the ideas, and the answers enabled the field of educational gaming to continue progressing via meaningful avenues in the high school level classroom.

Chapter Two: Literature Review

Given the all-encompassing influence of video games on American culture, many educators have taken an interest in what the effects of these games have on players and how some of the motivating aspects of video games might be harnessed to facilitate learning (Squire, n.d.). According to Egenfeldt-Nielsen (2007), there are three kinds of educational computer games that are in use today – commercial educational computer games, commercial game titles used for education and research-based educational computer games. Even though Egenfeldt-Nielsen asserts that there are three broad areas of educational games, this does not imply that the intended knowledge is transferred to the user, or that all possibilities of games have been exhausted within the aforementioned three games.

Educational games have become an innovative learning tool brought into the classroom, yet few address the problem of adapting complex games to the classroom context and the need for curriculum-based scenarios (Dawes & Dumbleton, 2001). This underlying knowledge must be transferrable and applicable in the workplace as well as in the classroom.

Technology Education and the history of gaming

Vocational education is considered efficient as long as it meets the needs of the students and the industry, yet a large sector of secondary education can be attributed to the increasing demand for new types of knowledge, skills, attitudes, values, and experiences originating from more pluralistic communities and the use of more sophisticated technologies in the workplace (Cuadra, et.al, 2005). This trend has caught the attention of businesses as well as educators:

> Games are widely used as educational tools, not just for pilots, soldiers and surgeons, but also in schools and businesses…Games require players to construct hypotheses, solve problems, develop strategies, and learn the rules of the in-game world through trial and error. Gamers must also be able to juggle several different tasks, evaluate risks and make quick decisions…Playing games is, thus, an ideal form of preparation for the workplace of the 21st century, as some [institutions] are already beginning to realize (The Economist, 2005).

Students unquestionably need quality education in order to meet competency levels required by the workplace (Yildirim & Simsek, 2001). Vocational schools need rigorous programs integrating academic and vocational subjects that meet the future needs of a young population by addressing workplace realities and the changing world of technology (Yildirim & Simsek, 2001). There is a move away from aligning technology with the 'trade' or 'technical' subjects and an effort to place it more central to the curriculum (Treagust & Rennie, 1993).

It is a well established notion that games have been used as instructional tools throughout history. Except for the earliest years of the games industry, the freedom to be relentlessly innovative had to be constrained by the financial needs of the companies that create games (Bateman, 2003). As outlined by Dempsey, et.al, (1996):

> There is evidence that games were used in China as early as 3000 B.C. Since the early 1960's there has been a rapid growth in the use of gaming and simulation in all areas of teaching. Children in elementary schools play word games. The military uses games and simulations in training. Medicine uses games to practice skills

> needed when assessing patient conditions. Business uses management games and simulations to create experiential environments for learning managerial behavior.

It is obvious that games, in many forms, have infiltrated many fields that were unrelated, yet equally affected. The military still implements games for training purposes – they are constantly looking for ways to improve training in the most cost-effective ways possible (Dalesio, 2004). Cost-effective improvements are not only important in the military arena; educational systems have a need for cost effective games as well. An examination of gaming in education will shed light on the inception of games as a learning tool, and expose what the future trends may develop.

Gaming in Education

Games, particularly computer games, are considered by many to be powerful tools to increase learning (Dempsey, et. al, 1996). Historically, computers have been used in education primarily as tools for supporting drill and practice for factual recall (Jonassen, 1988). For years, games of various types have been used in education, and since the time computers first made their entrance into the classroom, computer-based games have had their place as well (Jones & Kalinowski, 2006). The prevalence of video games has shaped how younger adults and children – both males and females – think and learn (Beck & Wade, 2004). Klopfer and Yoon (2004) report that constructively promoting the educational development of today's young tech savvy students and fostering the productive technological facility of tomorrow's youth requires harnessing new technological tools creatively. The MIT Teacher Education Program (TEP) focuses on the research and development of educational computer-based simulations and games for K-12 students and teachers.

Computer games provide strong experiences that can be expanded to deeper knowledge through instruction; increasing numbers of active researchers worldwide are looking at computer games as a topic of serious research (Egenfeldt-Nielsen, 2007).

Video games have the potential to change the landscape of education as we know it. The answers to fundamental questions will make it possible to use video games to move our system of education beyond the traditional academic disciplines – derived from medieval scholarship and constituted within schools developed in the industrial revolution – and towards a new model of learning through meaningful activity in virtual worlds as preparation for meaningful activity in our postindustrial, technology-rich, real world (Shaffer, et. al., 2005). The structure of activities embedded in computer games (as opposed to the game content) develops a number of cognitive skills (Robertson & Howells, 2008). Linderoth et.al. (2004) offers that when regarding what the usage of computer games enhances, a number of different abilities have been suggested – for instance, media and computer literacy, cognitive skills (problem solving and spatial awareness), social skills (the ability to collaborate), and the learning of content in different subjects (Dawes & Dumbleton, 2002; Erstad, 2002). Clark (2008) complements Linderoth by reporting that students are not only playing games – they have to understand programming, logic, design, physics and math to comprehend all the facets of gaming.

The majority of existing literatures on educational games focuses on what players learn from video games rather than how video games can be designed to facilitate learning (Dondlinger, 2007). Players are faced with a stream of both long and short term decisions, and must plan problem solving strategies which involve monitoring a series of complex tasks and nested sub-tasks (Johnson, 2005). Computer games enable the development of different learning styles, since speed and level difficulty can be adjusted according to the player (Jenkins, 2002). Computer games also provide a forum in which learning arises as a result of tasks stimulated by the content of the games, knowledge is developed through the content of the game, and skills are developed as a result of playing the game (McFarlane, 2002).

Learning occurs while playing video games (Baird & Silvern, 1997). What elements must a video game have in order to become an instructional tool? Enjoyable educational programs must include elements of challenge: clear, meaningful and multiple goals, uncertain outcomes, variable difficulty levels, randomness and constant feedback, fantasy and metaphors, sensory curiosity (audio and visual effects) and cognitive curiosity (surprises and constructive feedback) (Kafai, 1997; Lepper & Malone, 1987; Dondlinger, 2007).

The most noted features of effective video games are: clear goals – almost all video games are goal-oriented, adequate level of complexity, high speed – most video games are have a much faster speed than traditional mechanical games, incorporated instructions: in most video games, children understand instructions while playing the game and do not need to read instructions, independence from physical laws – video games normally do not follow they physical laws of the universe, and holding power – they capture players' attention and continue to do so as the game builds a micro world with its own rules and regulations (Malone, 1980; Provenzo, 1991; Turkle, 1984). With gaming, key elements entail interaction within a predetermined context, often involving forms of competition, cooperation, conflict or collusion. These interactions are constrained by set rules and procedures (Lean, et. al, 2006).

Gee (2005) asserts that traditional schools are still locked in endless and pointless battles between traditionalism and progressivism, between lecture-style teaching and immersion learning, as if these were the only two alternatives. In contrast, given that good commercial games have been so successful in attracting and maintaining learners, it is clear that they appear to have solved this central paradox of learning. This is in large part because good commercial games are based on good theories of learning (Gee, 2005). Video games add value in that they create a micro-world of their own, which players act on based on their natural tendencies towards learning (Rieber, 1996). At the level of basic research, major gaps exist in knowledge of the gaming process, the specific design elements that contribute to its effective use, and the influence of play context and pedagogical support (Wolfe & Crookall, 1998). There is skepticism in the educational community regarding the applicability of gaming to education, which can only be addressed through basic research, design experiments, and successful demonstration projects that are rigorously evaluated and show clearly documented benefits (Bonk & Dennen, 2004).

As software companies market titles with educational potential as “edutainment” educators have begun using video games, particularly simulations in classrooms (Okan, 2003). From the students’ point of view, integrating games into the school culture dilutes the experience of game playing. From the teacher’s point of view, games are too long, too immersive, and focused on the wrong outcomes, motivating students to achieve defined win states rather than to seek knowledge. The problem is that educational game designers have approached the problem backward; rather than striving to get games into education, educators should be investing ways to get education into games (Royal, 2008). Research has revealed a fundamental mismatch between the goals of games and the object of school-based learning (Becta, 2002; Sanford, 2006; Squire, 2005). The challenge for educators is to take the learning that does take place in a game from activities, such as exploring a route through a maze or improving a motor skill on a keyboard, and apply that incidental knowledge or ability to an intentional learning task (Dempsey, et.al, 1996).

Educational games are appealing because they provide meaningful choices (Zimmerman and Salen, 2003). As these [research] inquiries progress, a better understanding of educational game design and the production of improved educational games will ensue (Dondlinger, 2007). Educational video games require strategizing, hypothesis testing, or problem-solving, usually with higher order thinking than rote memorization or simple comprehension (Dondlinger, 2007). The next challenge for game and school designers alike is to understand how to shape learning and learning environments based on the power and potential of games – and how to integrate games and game-based learning environments into the predominant arena for learning: schools (Shaffer, et. al., 2005).

Current curricula in Gaming Education

The existing emphasis towards nationalized testing of the established objectives puts the future of educational gaming in jeopardy. Many schools are hesitant to invest resources in any new or unproven technology and may have doubts about the educational use of video games without the authoritative research to support their pedagogical value (Jones & Kalinowski, 2006). Without a process of aligning games with standardized testing objectives and state educational standards, proponents of the instructional use of video games will be hard pressed to have games accepted in their classrooms (Jones & Kalinowski, 2006).

Whereas schools are moving toward increasingly standardized learning experiences, games offer the prospect of user-defined worlds in which players try out (and get feedback on) their own assumptions, strategies, and identities (Halverson, 2005).

Little, if any research has been done on the effectiveness of these games, but there is little reason to believe that a well designed video game will produce results which are substantially different from non-computer based games (Clark, 1983); even fewer empirical studies have been done on how these games are used, and the existing research has failed to yield a useful research framework (Gredler, 1996). Educators have long advised that instructional designers look for existing gaming strategies when developing or adapting games for instructional purposes (Driskell & Dwyer, 1984). While serious games (edutainment) are becoming more and more widespread in education, very little is known about how they work. Much of the research in this area has focused on comparing game playing to lecturing, which is often inappropriate because each is a different pedagogical technique which usually embodies different values on the part of the instructional designer and is suited for different types of learning experiences (Squire, n.d.). Instead of isolating variables which contribute to good game design or comparing games versus other instructional approaches, instructional technologists would benefit from studying programs that use simulations, in the form of case studies, or design experiments (Brown, 1992).

There are independent game developers that are beginning to reach out to educators since the possibility of profiting from the development of video games for the education market increases as each year passes (Jones & Kalinowski, 2006). Perhaps the influx of independent developers will add the needed push for gaming implementation in today's high school system? Gee (2003) writes that games have recently developed a reputation for being fun, engaging and immersive while recruiting deep thinking and complex problem solving, all while allowing players to customize the game to their own levels of ability.

A brief examination of Game Art and Design

While the vast majority of Game Art and Design (GAD) courses and curricula are within the post-secondary level, if there were a GAD course in the secondary level, it would likely be placed within the Career and Technical Education (CTE) curriculum area (or a curriculum area that closely matches CTE). For instance, the North Carolina Department of Public Instruction (NCDPI) promotes the Career and Technical Education curriculum area with a mission to empower all students to be successful citizens, workers and leaders in a global economy (NCDPI, 2010). Examining the mission and curriculum overview of post-secondary GAD courses and curricula reveals a very similar vocation.

More examples of Game Art and Design curricula are available at the post secondary level; possibly due to the fact that these graduates may enter the related workforce sooner than students at the secondary level. The Game Art & Design program at The Art Institute of Vancouver operates a curriculum that exposes students to more effective leadership techniques and deepens their understanding of the complexities of working within a group environment, thereby challenging the students to learn to become more effective team members (2010). Also promoted and developed are writing and communication skills, both necessary and integral in the contemporary workforce. Courses within the curriculum that support this endeavor include Preproduction for Games, Production Team, Postproduction

Team, Professional Writing, Documentation and Design, Creative Writing & Research, and Interactive Story Telling I and II (The Art Institute of Vancouver, 2010).

The Game Art & Design curriculum at The Art Institute of Pittsburgh emphasizes the artistic side of games, including strengthening design skills, creating environments, and the application of knowledge towards industry (2010). Similarly, the Game Art and Design program at Ex’pression College for Digital Arts endorses core-competency areas including fine arts, theory and projects, creating a solid pipeline for students as they more toward entering the industry of video game design and development (Ex’pression College for Digital Arts, 2010). From the research, it is noticeable that GAD courses and curricula promote leadership, teamwork, communication skills, applying all in empowering the learners to be successful in their future endeavors. Two stockholders in the future of games in education are the International Game Developers Association and the International Technology and Engineering Educators Association, both comprised of experts and leaders in the field, all invested in the promising future that gaming in education possesses.

International Game Developers Association

The International Game Developers Association (IGDA) initially operated under the name Computer Game Developers Association (CGDA). In 1994, it became evident to game developers that an organization was needed for a variety of reasons, including: There was no one to speak on behalf of the gamers at the USA Congressional debates; People within the gaming industry wanted an organization to join, but none existed; It was evident that a true organization was needed to give game developers a voice; and the community needed a way to share experience and work together on issues on an ongoing basis (Hoffman, 2007; IGDA, 2009b). After a major personnel shift in 1999, the CGDA changed its name to the International Game Developers Association to better reflect its growing global scope and platform agnosticism (Hoffman, 2007).

According to the International Game Developers Association's (IGDA) website, IGDA is a non-profit membership organization that advocates globally on issues related to digital game creation. The IGDA's mission is to advance the careers and enhance the lives of game developers by connecting members with their peers, promoting professional development, and advocating on issues that affect the developer community (IGDA, 2009). IGDA is a worldwide group of game developers that may also be designers, educators, researchers, programmers, artists, producers, musicians, etc. (Read, 2005). These members dedicated to improving developers' careers through community, professional development and advocacy; its core values include community, professionalism, expression, innovation, impact, leadership and fun (IGDA, 2009). This professional society for game developers broadcasts that the main benefit of membership is "knowing that you are developing your career and personally contributing the betterment of the industry by supporting IGDA's mission" (IGDA, 2009). A brief history of the IGDA will be highlighted for a more concrete view of the organization:

> The IGDA was established by Ernest Adams in 1995, originally operating under the name Computer Game Developers Association (CGDA), which later morphed into the CMP. The primary reason it was formed was because developers had no one to speak for them in the USA Congressional debates of early 1994. There was a need for people in the game industry to have an

> organization that gave them a voice, advanced the state of the art, and do the things that professional associations do. Around 1999, when the CGDA was having a tough time with the volunteer labor that ran the organization, the name was changed to the International Game Developers Association to better reflect its growing global scope and platform agnosticism. As of January 1, 2005, the IGDA ended its agreement with CMP and has been running the day-to-day operations under the governance of the elected board of directors (IGDA, 2009).

The structure of the IGDA is primarily comprised of local chapters and Special Interest Groups (SIGs), which are tools used to connect game developers (Read, 2005). The twenty-six SIGs include Alternate Reality Games (ARGs); Artificial Intelligence; Casual Games; Diversity; Education/Game Education; Flash; Game Accessibility; Game Design; Game Preservation; Human Resources; Indies; IP Rights, LGBT; Localization; Mobile Game Development; Online Games; Outsourcing; Positive Impact Games; Production; Quality of Life; Quality Assurance; Sex in Games; Students; Tools; Women in Games and Writing (IGDA, 2009c). It is notable that the IA-SIG, the SIG for Interactive Audio, and ACM SIGGRAPH, the SIG of the Association for Computing Machinery graphics research and technology, are both viewed as important special interest groups within IGDA and relevant within the game industry, though they are not involved with the IGDA. IGDAs SIGs connect game developers while allowing them to learn from each other, promote their specialties, and identify upcoming challenges and endeavor to advance the industry (IGDA, 2009c). Because all of the aforementioned SIGs have expertise in some aspect of game development, all have valuable contributions to the field, however; the Game Education SIG will be focused on within the scope of this research.

IGDA collaborates with many other gaming and technology based organizations; among their ‘partnerships’ are connections with the Entertainment Software Association (ESA), The Independent Game Developers Association (TIGA), Entertainment and Leisure Software Publishers Association (ELSPA), Digital Games Research Association (DiGRA) and Special Interest Group on GRAPHics and Interactive Techniques (SIGGRAPH) (Read, 2005). IGDA is committed to excellence in the gaming community nationally and abroad, and is dedicated to partnering with similar organizations to enhance the field, industry, and world of game development.

IGDA’s Core Topics

As mentioned in Chapter 1, the International Game Developer’s Association (IGDA) is comprised of twenty-six Special Interest Groups (SIGs), all of which are centered on a topic of interest relevant to game development. The Game Education SIG of the IGDA is comprised of over 500 voluntary members that include educators, industry workers and students. Within the Game Education SIG are seven initiatives – EdSIG Wiki, Curriculum, GDC Content, Knowledge Base, International Outreach, Student Outreach and Internship/Co-Op (IGDA, 2009a). This Education SIG Committee was chosen because their goal – to help foster interaction between developers and educators, to facilitate the development of educational programs, and contribute to the evolution of games (IGDA, 2008). The mission of the Education SIG as a whole is to create a community resource that will strengthen the academic membership of IGDA while enhancing the education of future and current game developers (IGDA, 2009c).

The Game Education SIG was created in the year 2000 as a cooperative effort between academia and game industry (IGDA, 2008). In that same year, the Education committee, a section of the Game Education SIG, was also created to improve communication and collaboration between academia and industry. In 2003, the Education committee assembled the first version of a two phase curriculum framework titled IGDA Framework: The Study of Games and Game Development Version 2.3 Beta (IGDA, 2008). During phase one, course outlines were collected and developed a knowledge base for educators to use as a reference. This growing knowledge base, once revised, provided new insights and incorporated feedback from game developers. The current version, v3.2 beta, is a compilation of these efforts. The principles that guided the development of the curriculum framework are Shared Identity, Fields of Study, Collaboration and Shared Vocabulary, Theory and Practice, and Living Document. As published by IGDA (2008), the nine core topics created from the aforesaid principles are: Critical Game Studies, Games and Society, Game Design, Game Programming, Visual Design, Audio Design, Interactive Storytelling, Game Production and Business of Gaming.

The first core topic, *Critical Game Studies*, encompasses the criticism, analysis and history of electronic and non-electronic games, while *Games and Society* encourages the understanding of how games reflect and construct individuals and groups, as well as how games reflect and are constructed by individuals and groups. *Game Design* covers the principles and methodologies behind the rules and play of games; *Game Programming* includes the aspects of traditional computer science and software engineering – modified to address the technical aspects of gaming. The fifth and sixth core topics, *Visual Design* and *Audio Design*, cover designing, creating and analyzing the visual components of games, creating sound and sound environments. Traditional storytelling and the challenges of interactive narrative are involved within *Interactive Storytelling*, the seventh core topic. *Game Production* contains the practical challenges of managing the development of games, while the last core topic, *Business of Gaming*, embraces the economic, legal and policy aspects of games (IGDA, 2008; 2003).

These nine core topics were created to reflect how IGDA considers the approach to gaming. IGDA (2003) feels that the core topics intuitively address the unique, practical and theoretical concerns of games.

Curriculum Development

Historically, changes in technology curriculum have been successful only when initiated by classroom teachers (Waltisbuhl, 1995). Teachers generally implement new changes in classroom curriculum when they feel the changes are beneficial and they have an investment in them. Loepp (1999) identified several important factors in implementing an integrated curriculum: educators need to shift their approach to teaching from didactic instruction to constructivism to allow students to discover and apply knowledge in their problem-solving; professional development is required for teachers in other content areas and in different pedagogy so teacher can move from isolation to members of learning communities; teachers need to be proficient in facilitating small group learning, especially experimental, hands-on, lab-based instruction.

Instructional principles can guide the practice of teaching and the design of learning environments (Savery & Duffy, 2001). Individual learning activities can be of any type – the important issue is that the learner clearly perceives and accepts the relevance of the specific learning activities in relation to the larger task complex (CTGV, 1992; Honebein, et. al, 1993). Creating instructional principles is an integral part of curriculum development.

Curriculum development should be an ongoing process that is responsive to changes (Abate, 2003). The curriculum should be planned around student learning outcomes that link knowledge, skills and behavior/attitudes/values, rather than simply using content or subject areas as a road map for curricular development (Kern, et. al., 1998). As the first step in course development, instructors should prepare outcomes for individual courses that are in accord with the program's student learning outcomes. Outcomes should complement or build upon those in other related or previous courses, be appropriate for the level of the student, and be action-oriented (Abate, 2003).

While broad goals and frameworks of subject matter may be nationally determined, the school has a definite responsibility in transforming these generalities into actual curricula. Thus, the responsibility of the school for curriculum development cannot be determined by the individual school alone or by reference only to what schools do: The school is part of a wider (statewide, national) context, usually of a system whose elements interact. It is important to note that within that system it is not simply a delivery agency; it has to create the curriculum within the national (or state/regional etc.) framework (Skilbeck, 2005). The curriculum should be well researched, continuously updated, and innovative courses should be designed (Yildirim & Simsek, 2001). Curricula are traditionally designed by creating overarching competencies that the students must know and objectives that break the competencies down into separate but related tasks.

Competencies

Though increasing numbers of classrooms are utilizing educational gaming as a learning tool, there has still been no concrete decision on how best to utilize and integrate technology effectively into schools and classrooms – this question generates many diverse responses (Williams, Boone & Kingsley, 2004). As a result, a major challenge to contemporary classroom teachers is to meet the needs of a diverse K-12 learning population.

Technology Education (TE) teachers in particular have been challenged to prepare students for life in a society dominated and driven by technology (Scott, Washer, & Wright, 2006). To meet these challenges, technology stakeholders have collaborated to develop a variety of technology literacy standards and teaching methods. In particular, the ITEEA published *Standards for Technological Literacy: Content for the Study of Technology* (STL) (ITEA, 2000). This document established a definition of technology, technological literacy, and the content standards needed for K-12 classrooms. The publication also established content benchmarks for the core areas of technology (Scott, Washer & Wright, 2006).

Objectives

Finch & Crunkilton (1999) report that when considering the arrangement of objectives, developers must identify which kinds of objectives they hope to prepare. Bearing examination are two types of objectives – terminal and enabling – as being useful while serving a distinct purpose. The terminal objective represents performance in the worker role or role very close to it, while focusing on the way a student should perform when in the intended situation (1999). The enabling objective, however, focuses on what the student must learn and be doing to attain the terminal objective (Biggs, 2003; Finch & Crunkilton, 1999). It serves as a progress guide for the students and may focus on factual knowledge, awareness, fundamental skills, or attitudes (Finch & Crunkilton, 1999). The aforementioned information should be considered when defining the intended outcomes – the objectives (Biggs, 2003).

The theory of the Delphi method

When there is a need for consensus on a particular topic or subject area, it is recommended to employ the knowledge of subject-matter experts. Instead of holding various meetings and sending information along an assortment of avenues, it is suggested to hold a focus group where all of the subject-matter experts meet together, giving the researcher better control of the time and consensus aim (Piskurich, 2009). Finch & Crunkilton advocate for educators remaining concerned about the future:

> Educators, particularly vocational and technical educators, are very much concerned about the future. Common questions regularly arise, such as what technological changes might affect the need for graduates, or what sorts of continuing education will be needed by students who are in school right now? These and other questions are often raised by educators who think in futuristic terms. Persons responsible for the contemporary vocational and technical curriculum need to ensure that ongoing curricula are considered in relation to what will or may occur in the future (1999).

As briefly outlined in Chapter 1 and paralleled with Horton's views (1999), the Delphi process should include three phases: collection, collation and summarization of available information and results in the production of foresight knowledge.

Goal and Statistical Comparison of Decision-Making Methods

The decision making methods examined in this chapter have aspects that are comparable to the Delphi method, yet do not fully encompass and support the needs for this study in the fashion that the Delphi does. Bearing examination in relation to the Delphi method are the Group Decision Support Systems (GDSS), Multi-Criteria Decision Making (MCDM), and the Analytic Hierarchy Process (AHP). These decision-making methods are briefly examined to display their inherent procedures.

Group Decision Support Systems

According to Watson, DeSanctis & Poole, Group Decision Support Systems (GDSS) combine computer, communication, and decision support technologies to support problem formulation and solution in group meetings (1988). The goals of a GDSS are to reduce the "process loss" associated with disorganized activity, member dominance, social pressure, inhibition of expression, and other difficulties commonly encountered in groups and, at the same time, to increase the efficiency and quality of the resulting group decision (Watson, DeSanctis & Poole, 1988). The GDSS has direct parallels with the Delphi method in the organized process, eradicating difficulties of meeting in groups, and increased efficiency.

Multi-criteria decision making (MCDM)

The first step in any multi-criteria decision making (MCDM) problem is to define the set of alternatives and the set of decision criteria that the alternatives need to be evaluated with (Triantaphyllou, 2000). While a critical step in the MCDM process is to accurately estimate the pertinent data, this process is more geared towards quantitative data (2000). Within this study, qualitative statistics will be more effective in creating a list of competencies for a Game Art and Design course. While the usage of statistical analysis may differ, this study and MCDM share the most important step – to first correctly define the problem.

Analytic Hierarchy Process

According to the Analytic Hierarchy Process (AHP), to make a decision in an organized way, the problem needs to be broken down into the following steps: (1) Define the problem and determine the kind of knowledge sought; (2) Structure the decision hierarchy from the top with the goal of the decision, then the objectives from a broad perspective, through the intermediate levels, to the lowest level; (3) Construct a set of pairwise comparison matrices; and (4) Use the priorities obtained from the comparisons to weigh the priorities in the level immediately below (Saaty, 2008). This study has defined the problem and structured the decision hierarchy from the top with the goal of the decision using the IGDA core topics, yet comparison matrices and weighing priorities (2008) are neither helpful nor necessary within this study. The first two steps of the aforementioned AHP are where the Delphi methods' similarities end, however, the Delphi method is long-standing and widely used to achieve consensus among experts.

History of the Delphi Method

A number of techniques have been utilized that are generally associated with the competency-based approach to curriculum development. These include tools such as

DACUM (Developing a Curriculum) and the Delphi technique (Custer, Scarcella and Stewart, 1999). Consensus methods such as the Delphi survey technique are being used to help enhance effective decision-making in many social fields, and, when used effectively, the Delphi can contribute significantly to broadening knowledge within chosen professions (Hasson, Keeney and McKenna, 2000). Volk (1993) utilized the Delphi method for acquiring consensus on technology education curriculum development. Because of the consensus format that is central to the Delphi, it is one of the most used methods for structuring a group communication process; hence the process is effective in allowing a large group to deal with a complex problem (Linstone & Turoff, 1975).

The Delphi technique was introduced by the Rand Corporation in 1958 to predict alternate national defense features. This particular procedure was utilized to obtain the most reliable consensus of opinion of a group of experts by a series of intensive questionnaires interspersed with controlled opinion feedback (Dalkey and Helmer, 1963). The Delphi is a group facilitation technique that employs an iterative multistage process, designed to transform opinion into group consensus (Hasson, Keeney & McKenna, 2000). Delbecq, Van de Ven and Gustafson (1975) specifically indicate that the Delphi technique can be used for achieving the following objectives:

1. To determine or develop a range of possible program alternatives;
2. To explore or expose underlying assumptions or information leading to different judgments;
3. To seek out information which may generate a consensus on the part of the respondent group;

4. To correlate informed judgments on a topic spanning a wide range of disciplines, and;
5. To educate the respondent group as to the diverse and interrelated aspects of the topic.

The Delphi method is based on a structured process for collecting and distilling knowledge from a group of experts by means of a series of questionnaires intersected with controlled consensus opinion feedback (Clayton, 1997). According to Turoff (1970), the four objectives that called for the use of the Delphi method are (1) to explore or expose underlying assumptions or information leading to differing judgments; (2) to seek out information which may generate a consensus on the part of the respondent group; (3) to correlate informed judgments on a topic spanning a wide range of disciplines; and (4) to educate the respondent group as to the diverse and interrelated aspects of the topic. Along with the aforementioned objectives, the iterative nature and controlled feedback are uniquely associated with the Delphi method.

Iterative Process & Controlled Feedback

Linstone & Turoff (1975) purport that there are four individual phases in the web-based Delphi process, written with more detail within this section. The first phase explores the subject being researched, giving participants the opportunity to contribute information they feel is appropriate. The second phase moves to determine an understanding of how the entire group views the issue. If significant disagreement is determined, the third phase is used to explore that disagreement and determine reasons for differences. The fourth phase is a final evaluation of all gathered information (Linstone & Turoff, 1975).

Increased advances in communication technology have enabled computer-mediated communication among large numbers of geographically dispersed individuals, groups, virtual teams, etc., and created opportunities for them to collaborate as well as to participate in socio-political decisions at the local, national and global level (Hiltz and Turoff, 1993). Because the Delphi technique has been so effective in predicting future trends and forming group consensus on new topics, it was a natural progression for the groups to convene in the virtual world rather than continuing costly trips to meeting locations around the world. As published by Linstone & Turoff (1975), besides the cost-effective portion of the Delphi technique, some other reasons for choosing Delphi included:

1. The problem does not lend itself to precise analytical techniques but can benefit from subjective judgments on a collective basis.
2. More individuals are needed than can effectively interact in a face-to-face exchange.
3. Time and cost make frequent group meetings infeasible.
4. Disagreements among individuals are so severe or politically unpalatable that the communication process must be referred and/or anonymity assured.
5. The heterogeneity of the participants must be persevered to assure applicability of the results, i.e., avoidance of domination by quantity or strength of personality.

The Delphi exhibites three distinct characteristics: anonymity, interaction with controlled feedback, and statistical group response (Dalkey, 1972; Judd, 1972; Scott, Washer & Wright, 2006). While the three aforementioned characteristics are unique to the Delphi, there are strengths and weaknesses to be examined for a thorough overview.

Strengths/Weaknesses of the Delphi Method

Experts

The Delphi is exceptionally useful where the judgments of individuals are needed to "address a lack of agreement or incomplete state of knowledge… [thus] the Delphi is particularly valued for its ability to structure and organize group communication" (Powell, 2003). The Delphi method should be used whenever a consensus is needed from persons who are knowledgeable about a particular subject (Borg & Gall, 1983). Regarding the selection of subjects for a Delphi study, choosing the appropriate subjects is the most important step in the entire process because it directly relates to the quality of the results generated (Jacobs, 1996; Judd, 1972; Taylor & Judd, 1989). Since the Delphi technique focuses on eliciting expert opinions over a short period of time, the selection of Delphi subjects is generally dependent upon the disciplinary areas of expertise required by the specific issue (Hsu & Sandford, 2007).

Delphi subjects should be highly trained and competent within the specialized area of knowledge related to the target issue (Hsu & Sandford, 2007). Investigators need to closely examine and seriously consider the qualifications of Delphi subjects. A conscious effort should be made to make contacts with those who have a firsthand relationship with a particular issue or topic. When compiling information, one wishes to collect opinions of experts and, to the greatest extent possible, achieve consensus among them (Stitt-Gohdes & Crews, 2004).

Delphi is one of the most utilized methods for structuring group communication among experts (Yetim, & Turoff, 2004); however, it should be mentioned that some Delphi implementations include knowledgeable individuals rather than just experts. For example, in a Delphi on poverty, one would include some poor people as well as various experts who study poor people and other groups such as administrators of programs for poor people (Yetim & Turoff, 2004). Besides being used to consult a body of experts, the Delphi technique gathers information, and formulates a group consensus while limiting the complications and disadvantages of a face-to-face group interaction (Isaac & Michael, 1981). The Delphi study is flexible in its design, and amenable to follow-up interviews. This permits the collection of richer data leading to a deeper understanding of the fundamental research questions (Okoli & Pawlowski, 2004). Primarily, within structured group communication is that a large facet crucial to Delphi groups – the ability to attain consensus among the panel members.

Attaining Consensus

Consensus among educators in a specific area about what technologies should be taught in today's technology-based world would be essential information to many educators and their students. This goal presents a unique research situation (Stitt-Gohdes & Crews, 2004); it also brings about the possibilities of distinctive solutions. The Delphi method may be characterized as a method for structuring a group communication process, so that the manner is effective in allowing a group of individuals, as a whole, to deal with a complex problem while yielding a distinct solution. To accomplish this "structured communication", the following is provided: some feedback of individual contributions of information and knowledge; some assessment of the group judgment or view; some opportunity for individuals to revise views; and some degree of anonymity for the individual responses

(Linstone & Turoff, 1975). It was designed as a group communication process that aimed at conducting detailed examinations and discussions of a specific issue for the purpose of goal setting (Ludwig, 1997; Turoff & Hiltz, 1996; Ulschak, 1983).

The Delphi method is a widely used and accepted technique for achieving convergence of opinion concerning real-world knowledge solicited from experts within certain topic areas (Hsu & Sandford, 2007). It allows educators, amongst others, to communicate and effectively develop trends, needs, or other factors relative to a particular area of education (Stitt-Gohdes & Crews, 2004). Specifically, the feedback process allows and encourages the selected Delphi participants to reassess their initial judgments about the information provided in previous iterations. Thus, in a Delphi study, the results of previous iterations regarding specific statements and/or items can change or be modified by individual panel members in later iterations based on their ability to review and assess the comments and feedback provided by the other Delphi panelists (Hsu & Sandford, 2007).

Knowing that participants are in agreement on a topic is another key element of the Delphi. Consensus or convergence of opinion is an underlying principle of the Delphi (McCallister, 1992). Weatherman and Swenson (1974) stated that there should be a convergence of opinion as individual estimations move closer to the statistical survey of the group responses. It may be expected that, even if the views expressed initially are widely divergent, the individual estimates will show a tendency to converge as the experiment continues (Dalkey & Helmer, 1963). Theoretically, the Delphi process can be continuously iterated until consensus is determined to have been achieved (Hsu & Sandford, 2007). However, Cyphert and Gant (1971), Brooks (1979), Ludwig (1997), and Custer, Scarcella and Stewart (1999) point out that carrying out three mailings (rounds of correspondence) are often sufficient to collect the needed information and to reach a consensus in most cases.

Adler and Ziglio (1996) describe the Delphi method as a communication process that is structured to produce a detailed examination of a topic/problem and discussion from the participating group, but not one that forces a quick compromise. The procedure allows the search for consensus to proceed in an orderly, systematic fashion without some of the problems inherent in bringing a group together for meetings (Starling, 1988). Results are then summarized and fed to the participants, allowing reassessment and new recommendations (Grunenwald & Ackerman, 1986). Finally, on the outcome question, there are no clear criteria available for the moment when consensus has been reached in a Delphi study. Some studies suggest that most changes occur in the transition from the first to the second round, and that four rounds suffice to reach consensus (Effermeyer et. al., 1986). However, a reduction of rounds is possible in a computer-implementation of Delphi (Turoff et. al., 2004). Regardless of the number of rounds utilized in the Delphi, the advantage of anonymity is one factor that remains consistent.

Anonymity/Confidentiality

One of the primary characteristics and advantages of the Delphi process is subject anonymity which can reduce the effects of dominant individuals which often is a concern when using group-based processes used to collect and synthesize information (Dalkey, 1972). Anonymity is an important Delphi technique characteristic. Without the identification of those contributing information or making specific judgments, candor may be increased (Stitt-Gohdes & Crews, 2004). Turoff and Hiltz (1996) cite these advantages to anonymity:

If a participant provides an idea/suggestion/judgment and in the end it is deemed unsuitable, no one loses face; when a participant commits his/her name to an idea/suggestion/judgment, it is harder to reject/change it later and; the idea/suggestion/judgment may be biased by who introduced it if anonymity is not used.

These characteristics are designed to offset the shortcomings of conventional means of pooling opinions obtained from a group interaction, such as influences of dominant individuals or group pressure for conformity (Dalkey, 1972). Other notable characteristics inherent with using the Delphi technique are the ability to provide anonymity to respondents, a controlled feedback process, and the suitability of a variety of statistical analysis techniques to interpret the data (Dalkey, 1972; Douglas, 1983; Ludlow, 1975).

A key advantage of the approach is that it avoids direct confrontation of the experts (Okoli & Pawlowski, 2004). That is, each subject would have no pressure, either real or perceived, to conform to another participant's responses that may originate from obedience to social norms, customs, organizational culture, or standing within a profession (Hsu & Sandford, 2007). Keeping in mind that group communication is an essential component of the Delphi; the anonymity will remove common biases and social interaction that normally occur in face-to-face group communication (Stitt-Gohdes & Crews, 2004). This mode of controlled interaction among the respondents represents a deliberate attempt to avoid the disadvantages associated with more conventional uses of experts, such as round-table discussion or other milder forms of confrontation with opposing views (Dalkey & Helmer, 1963).

As observed by Dalkey and Helmer (1963), the controlled interaction appears to be more conducive to independent thought on the part of the experts and to aid them in the gradual formation of a considered opinion. Direct confrontation, on the other hand, all too often induces the hasty formulation of preconceived notions, an inclination to close one's mind to novel ideas, a tendency to defend a stand once taken, or, alternatively and sometimes alternately, a predisposition to be swayed by persuasively stated opinions of others. As such, certain downsides associated with group dynamics such as manipulation or coercion to conform or adopt a certain viewpoint can be minimized (Adams, 2001; Helmer & Rescher, 1959; Oh, 1974). When the proper steps are followed in a Delphi study, including anonymity, the panel members can express their opinions freely (Stitt-Gohdes & Crews, 2004). Furthermore, the Delphi technique permits interactions that help the participant sort their thoughts and come to a comprehensive appreciation of a problem but still provide for independent assessment and evaluation that requires individual expression and personal creativity (Grunenwald & Ackerman, 1986). This expert participant interaction is what makes the Delphi a reliable source of consensus attainment. Whereas a group meeting to participate would cause problems singular to being in-person, the web-based version of the Delphi aids in assuring anonymity within this survey process.

Web-based Delphi

The best way to develop a consensus of ideas for this study is through a group of experts; a panel study most appropriately answers the research questions, rather than any individual expert's responses. As such, Delphi is an appropriate group method (Okoli & Pawlowski, 2004). This technique has been used in a number of fields for long-range planning, which often includes planning for the educational field (McCampbell & Stewart, 1992).

According to Nesbary (2000), many existing research studies are utilizing the Internet and World Wide Web as media to collect consensus. Utilizing the Internet to distribute information is not only economical, but enables a virtually instantaneous response. The validity of web-based survey research is a strong contender for researchers that target specific population samples (Watt, 1999). Initially, Internet-based data collection consisted of the instrument being implanted directly into the body of an email message, which made responding without modifications quite tricky. White, Carey and Dailey (2001) write that researchers are progressively directing participants to complete instruments that have been published as web pages. Delphi is desirable in that is does not require the experts to meet physically, which could be impractical for international experts (Okoli & Pawlowski, 2004).

According to Turoff and Hiltz (1996), the computer-based Delphi method has a number of advantages over the traditional paper-and-pencil Delphi: (1) asynchronous interaction used in Delphi procedures is more easily accomplished; (2) contributors can have continuous access to the emerging database by contributors without prior summarization and possible introduction of bias by the investigators; (3) participants can update themselves frequently about the discussion before contributing, enabling a more informed contribution and less duplication of responses; (4) responses can be screened more easily prior to distribution – record keeping, data processing and statistical analyses are facilitated; (5) communication among participants is faster and less costly; participants who are geographically distanced can be includes; (6) a structure for the dynamic contribution of knowledge over time can be provided. While employing a web-based Delphi could create a pool of hundreds of potential experts, the stipulations on who an expert is and how many will be allowed to participate is just as crucial as choosing to utilize the Delphi method.

Panel Selection & Size

The Delphi technique is a group decision mechanism requiring qualified experts who have deep understanding of the issues. Therefore, one of the most critical requirements is the selection of qualified experts (Delbecq, Van de Ven & Gustafson, 1975). Careful selection of the panel experts is the keystone to a successful Delphi study. Key aspects include panel selection (including experts' qualifications) and size and participant commitment (Stitt-Gohdes & Crews, 2004). Jairath and Weinstein (1994) suggest that the study participants be experts who are knowledgeable about current information and perceptions regarding the topic under investigation but are open-minded to the findings. Gibbs, Graves and Bernas (2001) in their study of evaluation guidelines for multimedia software used these criteria to determine who should be selected and invited to participate: Participants had published articles in the last five years on computer-based courseware design, development or evaluation; Participants had taught courses about these topics; or participants' primary employment responsibilities related to these areas; Participant has published literature in the field in the last five years.

Okoli & Pawlowski (2004) researched and found several incentives that may lead experts to participate in a Delphi study where they might decline to participate in other studies: being chosen in a diverse but selective group; the opportunity to learn from the consensus building; and increasing their own visibility in their organization and outside.

These incentives can provide strong inducements needed to attract busy experts (Okoli & Pawlowski, 2004). Recognition of being selected for a particular study in which participants are noted as experts in their field may be encouragement enough to get participants to agree to provide their opinions to complete all rounds of the study (Stitt-Gohdes, & Crews, 2004).

To motivate participants to remain active and complete all the rounds in a Delphi study, it is important they understand the goal of the study and feel they are a part of the group. The participants must also believe they are able to contribute valuable judgments and help examine the problem and help examine the problem via discussion with their peers. If the Delphi researcher can locate the expert group of peers and invite them to individually participate, the likelihood of increased participation is stronger (Stitt-Gohdes & Crews, 2004). If the response rate seems to cause a longer than anticipated lag time, emails will be sent to gently prod the panel members in submitting their responses.

Powell (2003) reported that heterogeneous rather than homogeneous groups produce a higher proportion of high quality, highly acceptable solutions. To avoid homogeneity in career and technical education research, one might solicit participation from high school educators, technical college educators, and college/university faculty. Delbecq, Van de Ven, and Gustafson (1975) suggest that ten to fifteen subjects could be sufficient if the background of the Delphi subject is homogeneous. In contrast, if various reference groups are involved in a Delphi study, more subjects are anticipated to be needed. In 1997 Ludwig documented that the majority of Delphi studies have used between 15 and 20 respondents. It is notable that the number of respondents in this round fall below the recommended 10 – 50 panel size (Delbecq, 1975); it is unusual to have a small panel size, but not uncommon. Wynekoop &

Walz (2000) performed a Delphi with nine respondents; Nambisan et.al. (1999) utilized a panel size of six; Gustafson, Shukla, Delbecq & Walster carried out a Delphi with four panelists in 1973; and in 2000, Lam, Petri and Smith had a sample size of three! The nature of the Delphi is cyclical, and attrition is a major drawback to this research method. The Delphi group size does not depend on statistical power, but rather on group dynamics for arriving at consensus among experts.

Researcher Bias

Advantages of using the Delphi technique include reducing the effects of bias due to group interaction (Dalkey, 1972; Judd, 1972). Linstone and Turoff (1975) further elaborate on the potential problems of Delphi studies with a checklist of either pitfalls including: discounting the future; the prediction urge, the simplification urge; illusory expertise; sloppy execution, optimism-pessimism bias, overselling, and deception. To avoid these pitfalls, Delphi researchers must make sure that they are open-minded, not biased, and willing to put the time into the study that it requires. All of these characteristics combined are what makes the Delphi such a specific and unique testing method.

Chapter Summary

In order to understand what it takes to define essential competencies for a high school level Game Art and Design course, some background information must be established. This study includes technology education and the history of gaming, gaming in education, current curricula in gaming education, the International Game Developer's Association, the International Technology and Engineering Educators Association, curriculum development, standards for technological literacy and the theory behind the Delphi method. The combination of literature from these areas help to show why students need quality education in order to meet competency levels required by the workplace (Yildirim & Simsek, 2001). It is a well established notion that games have been used as instructional tools throughout history. Games, particularly computer games, are considered by many to be powerful tools to increase learning (Dempsey, et. al, 1996).

From the research, it is apparent that certain skills and knowledge bases need to be developed for the future workforce. Game Art and Design encompasses much of what the vocational education and technical education fields strove to promote for decades. Taking into account the core topics created by the IGDA, this study will utilize a panel of experts from IGDA in the role of subject-matter experts. These experts will participate in a Delphi study, which in theory is the best analysis for creating consensus among an expert population (Horton, 1999; Linstone & Turoff, 1975). This research will use all of the aforementioned literature, and the ensuing results will provide a list of competencies and objectives to serve as an example of what a good Game Art and Design course should look like.

CHAPTER THREE: METHODOLOGY

The Delphi Method

This study was designed to create competencies and objectives for a game-related Technology Education course by utilizing the Delphi method. This research methodology began with exploring books and articles written on the topic of gaming, educational games, edutainment and educational video games. Consensus methods such as the Delphi survey technique historically have been used to help enhance effective decision-making in many social fields, and, when used effectively, the Delphi can contribute significantly to broadening knowledge within chosen professions (Hasson, Keeney and McKenna, 2000). Once the information proved to be absent in providing what specific items needed to be addressed and taught in a gaming curriculum - specifically a high school level gaming curriculum – the concept of creating a list of essential competencies for an IGDA-based gaming curriculum was chosen to pursue further. The Delphi technique had much applicability when curriculum content is being determined (Finch & Crunkilton, 1999). This technique was quite valuable with persons desiring to reach consensus regarding the content of a particular curriculum (Finch & Crunkilton, 1999).

This research was used to create a consensus among experts in the gaming field by defining competencies and objectives for a high school level Game Art and Design course framework. An obstacle facing many educators has been identifying an appropriate research methodology for developing course frameworks when teaching vocational subjects. This is especially true when a research topic is very broad and when new curricular areas are being developed. In such situations there are often a large number of competencies to be evaluated by recognized experts in the content area.

Research Methodology

The Delphi exhibited three distinct characteristics useful for this study: anonymity, interaction with controlled feedback, and statistical group response (Dalkey, 1972; Judd, 1972; Scott, Washer & Wright, 2006). Delphi instruments were administered using e-mail, a database website and the Internet via the World Wide Web. The panelists were free to use whichever of these media was most convenient; they had the option to either select the survey link embedded into the correspondence email, save the link into their history file, or type the website into the web toolbar each time. The advantage of "rapid" media was that it sped up the turnaround time between instruments. This was quite important using the Delphi method, which is notorious for the elapsed time required for data collection (Okoli & Pawlowski, 2004). Cornish (1977) similarly noted that the Delphi has been used widely as a way to forecast trends in technology, education and other fields. Since the field of technology is so dynamic and evolves at such a rapid pace, the Delphi technique is not only effective, but the best choice when faced with developing and predicting new inclinations in the field. Additionally, Delbecq, et. al. (1975) estimated that the average Delphi study could take from 45 days to 5 months. This assumed a scenario where the panelists are all in one country, and the researchers relied on the postal system to return the questionnaires.

Following the recommendation of Delbecq et. al. (1975) and Okoli & Pawlowski (2004), the first instrument and correspondence was sent to each expert panelist on the same day they confirmed their desire to participate. The panelists were able to immediately take part in the data collection portion of the study. As the facilitator of the information, the researcher chose the format of the Delphi process for this study. The flowchart for this study was based on that of Beech (1999) (refer to Figure 1.0 in Chapter 1).

Selection of Participants

Utilizing subject-matter experts to construct new knowledge is widely used and respected as a form of theme generation. It is commonly used to confidentially consult a body of experts chosen based on their demographic information and formulate a group consensus (Linstone & Turoff, 1975). The experts used in this study were compiled from the Game Education Special Interest Group (SIG) of the International Game Developers Association along with participants from the International Technology Education Association. Potential panel members were identified from respondents of the IGDA, which included a database of worldwide and renowned members of academia and industry. Weaver asserts that Delphi operates on the principle that several heads are better than one in making subjective conjectures about the future, and that experts will make conjectures based upon rational judgment rather than merely guessing (1971). Initial consideration for those nominated as a Delphi panel member was based on their knowledge of gaming, curriculum design, classroom pedagogy, and familiarity and alignment with national standards. As reported by Clark (2003), in order to establish any novel or revised course of study, past curricula must be continuously examined to bring about reform. Additionally, he elaborated by stating that practice prepares individuals to look towards the future in order to shape it based on their current views. The Delphi method should be used whenever a consensus is needed from persons who are knowledgeable about a particular subject (Borg & Gall, 1983); utilizing the IGDA experts in this study is an avenue that allowed them to exercise their current views by examining the curricula while focusing on the future. All potential expert panel members were contacted via e-mail requesting voluntary participation in the study.

As advised by Gibbs, Graves & Bernas (2001), the criteria for each expert panelist was based on the following qualifications; each expert needed to have four of the five criteria qualifications: panelist had 3-5 years experience teaching a technology course or a comparable one; participant had matriculated through a high school level program in the United States; panelist had experience in course development, course curriculum and/or course construction; panelist had two years experience with gaming in an educational capacity and; panelist had at least two semesters experience teaching gaming or technology education.

The expert review panel utilized in this research was a compilation of an industry expert, a college professor (for the area of research) and a high school teacher, randomly selected from the three aforementioned areas within the entire pool of participants. The expert panel and the review panel will be extracted from the same pool of participants – those from the IGDA game education special interest group. This will be controlled by the information gathered from the demographics survey. Regarding the selection of subjects for a Delphi study, choosing the appropriate subjects is the most important step in the entire process because it directly related to the quality of the results generated (Jacobs, 1996; Judd, 1972; Taylor & Judd, 1989). Referencing the total group of panelists, the participants were broken into three groups – Industry, Research and Teachers. The panelists were assigned to one of the three aforementioned groups per their self-reported data on the demographics questionnaire; once assigned, one panelist was randomly chosen from each group. Furthermore, assigning the panelists to a particular group provided an added measure of fairly representing each of the three areas for the desired review panel. As such, the review panelist was comprised of one person from industry, one from a research background and one from the education field (teachers).

According to Horton (1999), the Delphi process should include three phases: collection, collation and summarization of available information and results in the production of foresight knowledge. Because subject-matter experts will be employed in this study, there will be a high level of credibility in relation to the forthcoming results. The duty of the review panelists was to review the information compiled from each round, comment on the direction of the content and give suggestions for the next round. This effectively eliminated any researcher bias that may have been present. Initial consideration for those nominated as a Delphi panel member was based on their content knowledge, ability to represent feasible yet diverse viewpoints, willingness to communicate feedback to the research panel, and/or a demonstration of expertise that established each participant as knowledgeable (Finch & Crunkilton, 1999; Walker & Echternacht, 1992). The demographic instrument that each potential participant fills out provided a large degree of evidence towards their expert status.

Panel Size

The experts in the aforementioned fields, combined with a review panel, enhanced the qualitative area of research. The experts and review panel were comprised of industry affiliates, game players/designers, teachers and students in the game education field. This was controlled by the information gathered from the demographics survey. Key aspects include panel selection (including experts' qualifications) and size and participant commitment (Stitt-Gohdes & Crews, 2004). It had been suggested that reasonable results can be obtained with small panels of 10-15 individuals (Adler & Ziglio, 1996); however, Turoff (1975) recommended that a Delphi sample size should be between 10 and 50 participants. After taking the aforementioned recommendations into consideration, it was determined that thirty experts, combined with the three review panel experts, would be a desirable panel size for this study, which ensured that members from education and industry will be represented. The expert panel was comprised of thirty expert members (Adler & Ziglio, 1996) while the review panel had three expert members, reflective of the larger panel of members. The review panel provided a higher degree of consistency among each round while preventing any potential researcher bias that may arise.

Demographics Instrument

The demographics instrument allowed all participants to be pooled together as potential panel members, but they were ultimately selected based on criteria set forth by the researcher. Kennedy (2004) recommended that the researcher specified the specializations and qualifications of each panelist, which was done via a demographics instrument. Similarly with this study, in their study of evaluation guidelines for multimedia software, Gibbs, Graves and Bernas (2001) used participants that published in the last five years, had taught courses on the subject, whose primary employment related to the area and had published literature in the field. While those particular instructions were not employed, they helped shape the demographics gathered for the Delphi review and expert panelists. The information gathered, as recommended by Passmore, et.al. (2002), was as follows: What is your highest degree obtained; List the major area for each degree you hold; Which title most accurately describes your current position; Which of the following grade level(s) do you currently teach; How many years of experience do you have with gaming; How many years of experience do you have teaching; Do you have any experience in course development, course construction or curriculum and instruction? If yes, please explain; and Current country of residence. This compilation of questions helped to gather a well-rounded collection of panelists that were capable of creating a high school Game Art and Design course framework.

The required criteria that determined which panelists were chosen as expert panel members included members that have matriculated through a secondary United States educational program and received a diploma, at least two years of experience with gaming and/or at least two semesters experience teaching gaming at the secondary level or beyond. Preferred criteria included having at least one year expertise in course development, course construction or curriculum and instruction; the panelists chosen for the study fit all four requirements of having received a high school diploma from the United States, having experience with gaming and having one year of expertise in a version of course development.

The criteria were not modified pending respondents information; however, being labeled as an expert was an imminent factor in participating in the study (Powell, 2002). There were thirty expert panelists, with three review panelists (Adler & Ziglio, 1996) to ensure that researcher bias is eliminated, as well as promoting a seamless approach to the instruments for each round. This instrument was emailed to any potential panelist that showed interest in participating in the study by responding to the solicitation via the IGDA Game Education SIG listserv.

Instrument and Execution

Within this study, all participants were recruited via the Game Education SIG on the IDGA listserv. An email was sent to the IGDA Game Education SIG listserv requesting participation in this study. The 'Call for Participation' instructed interested parties to complete the demographics instrument within Survey Monkey, an online survey maker. Survey Monkey is a website that allowed the user to create web-based survey tools, collect responses and analyze the results at will. Once the survey for each round was created, the link was emailed to the review panel with instructions for completion of the round; review panelists commented on the clarity and consistency of the instructions and instrument. After review panelists had the opportunity to respond, recommended changes were made and the modified instrument and instructions were sent to the expert panelists. A brief explanation of the purpose of the study – to create a competency and objective list for a high school level Game Art and Design course framework based on the IGDA Core Topics – was included in the initial Call for Participation. The expert panelists had one week to respond to each round, with a reminder email sent after one week had lapsed.

The respondents that fit the demographics profile for the study were notified with an email containing the IRB approved Informed Consent form. Once all Informed Consent forms were received by the researcher, the instructions for the first round were sent to the review panel, along with the Round One survey instrument link. The correspondence was confidential, and panelists will had the option to input their initials, but not their names, in the instrument. Additionally, consistency and researcher bias was controlled by the review panel, which had access to the survey instrument before each round, providing the chance for modifications before the experts panelists participate. Linstone & Turoff (1975) report four individual phases in the web-based Delphi process. The first phase explores the subject being researched, giving participants the opportunity to contribute information they feel is appropriate. The second phase moves to determine an understanding of how the entire group views the issue. If significant disagreement is determined, the third phase is used to explore that disagreement and determine reasons for differences. The fourth phase is a final evaluation of all gathered information (Linstone & Turoff, 1975). This particular study will employ all four rounds of the web-based Delphi technique.

Round I

The instrument for Round I of the web-based Delphi was created based on the nine Core Topics developed by IGDA (2003; 2008). Round I consisted of an unstructured, open-ended instrument that had a space for additional suggestions, as recommended by Finch & Crunkilton (1999). In addition to the nine core topic areas listed by IGDA (2008) – Critical Game Studies, Games and Society, Game Design, Game Programming, Visual Design, Audio Design, Interactive Storytelling, Game Production, Business of Gaming – the space allotted for additional suggestions enabled panelists to add to this list if they are compelled to do so (see Round I instrument in Appendix C).

Once the review panel approved the researcher edits of the first instrument, the expert panel was granted access to the instrument via the web. Delbacq, Van deVen, and Gustafson (1975) suggested that the first phase of a Delphi study allow participants to address the issue by writing their thoughts or ideas. They recognized the benefits of doing such by providing adequate time for participants to think and reflect on responses, the evasion of unwarranted focus on a particular idea, the prevention of opposition, rank or position pressures, and conformity issues, the ability to remain problem-centered, the avoidance of selecting ideas too hastily, the allowance of participants to maintain more flexibility through convenience, and confidential communication. Additionally, the feedback process allows and encourages the selected Delphi participants to reassess their initial judgments about the information provided in previous iterations. Thus, in a Delphi study, the results of previous iterations regarding specific statements and/or items can change or be modified by individual panel members in later iterations based on their ability to review and assess the comments and feedback provided by the other Delphi panelists (Hsu & Sandford, 2007).

Before the expert panelists were able to access the Round One instrument (see Appendix C), the review panel received the instrument and checked for jargon, consistency, clarity of the content, thereby eliminating any researcher bias. An advantage of using the Delphi technique included reducing the effects of bias due to group interaction (Dalkey, 1972; Judd, 1972). This was be the role of the review panel at the beginning of each round of the Delphi; they had 48 hours to provide feedback before the instrument was sent to the expert panelists. One week after the expert panelists were invited to participate in Round One, they received a reminder via email to complete and return their responses if they had not done so. There was an opportunity to add, modify and/or give input on the components in each round.

Consensus or convergence of opinion is an underlying principle of the Delphi (McCallister, 1992). The first round was where the consensus process began. This open-ended instrument was given to a panel of selected experts to solicit specific information about a subject or a content area. Examples of competencies were placed in the instrument as a guide and the instrument had ‘accept’, ‘reject’ or ‘modify’ at the end of each section. The expert panelists had the opportunity to not only ‘accept’, ‘reject’ or ‘modify’ the competencies, but they were requested to ‘add’ new competencies and create objectives to correspond with each existing and new competency listed.

Panel members had a username and password in order to access the online survey system containing the Round One Delphi instrument, which assisted in maintaining their anonymity during the research process (Hsu & Sandford, 2007). After completing the first round instrument, the panelist submitted their responses within the online survey system; the researcher then had access to the data and downloaded it accordingly. Once the researcher collected and compiled the data, it was examined for similarities in new or emerging competencies, as well as completeness in the objectives. Results were then summarized and fed to the participants, allowing reassessment and new recommendations (Grunenwald & Ackerman, 1986). In subsequent rounds of the Delphi, participants rated the relative importance of individual items and also made changes to the phrasing or substance of the items (Fink, et. al, 1984).

Round II

The Round Two instrument was developed based on the information compiled from Round One and sent to the review panel for authentication before being sent to the expert panel. Once approved by the review panel, the expert panel was notified via email of the availability of the Round Two instrument (see Appendix D). The core topics/competencies from Round One were placed in random order on the instrument using a random number generator (Adler & Ziglio, 1996); Round Two of the Delphi included rating of the results from Round One, which had been randomized within each competency and objective grouping (Linstone & Turoff, 1975).

Participants were requested to rate the importance of the competencies as represented from Round One, using a 5 point Likert scale with a score of ‘5’ representing the highest degree of importance and ‘1’ representing the lowest (Osborne, et. al, 2001); this rating helped determine which competencies and objectives should be taught in a high school Game Art and Design course. This non-parametric analysis allowed ranking of the competencies and objectives. Expanding further, the Likert scale will exist as: 1 = Strongly Disagree/This competency or objective should not be taught in a high school Game Art and Design curriculum, 2 = Disagree/ This competency or objective may not be beneficial if taught in a high school Game Art and Design curriculum, 3 = Neither Disagree nor Agree/ This competency or objective could or could not be taught in a high school Game Art and Design curriculum, 4 = Agree/ This competency or objective could be beneficial if taught in a high school Game Art and Design curriculum, 5 = Strongly Agree/ This competency or objective should be taught in a high school Game Art and Design curriculum. Considering the Likert Scale, Linstone & Turoff (1975) reported that “these scales must be carefully defined so that there is some reasonable degree of assurance that the individual respondents make compatible distinctions between concepts". Once the results were collected, the like responses were combined and analyzed in preparation for Round III.

In addition to rating each competency and objective from 1 to 5, the expert panelists had the option of adding, rejecting and/or modifying the competency and objective statements at this stage. The information was uploaded into the online survey system as each expert panelist completes the round; it was then accessible to the researcher for analysis.

The rating of 51 percent (or 3.01 on a five-point scale) was used to determine the quality competencies and objectives to be retained for the impending Game Art and Design course. This calculation was generated by the number of responses per each Likert category, whereas four respondents scoring a 'strongly agree/5' and one scoring an 'agree/4' would yield a score of 24. The score would be divided by the number of respondents, so for this item, the score would be a 4.8, and would be kept for the proceeding round because it is higher than 3.01. This was calculated for each competency and objective in Round Two.

As stated, a statistical mean cutoff value of 3.01 was used on the Likert scale responses (Clark & Wenig, 1999); competency and objective means were calculated for further consensus review. Once the data was examined by the researcher, quality competencies were put in order from highest rated to lowest rated, and those with a mean value of 3.01 or above were retained for Round Three (Katsioloudis, 2007), where they were ranked from highest to lowest; the others were discarded (Clark & Wenig, 1999). This was the beginning of consensus building among the competencies and objectives while allowing for ranking in the following round.

Round III

Panelists in Round Three ranked the competencies and objectives from Round Two that had a mean value of 3.01 or above; in this round descriptive information was provided about how the group responded, as a whole. Round Three of the web-based Delphi method included the ranking of the objectives within each competency from Round Two based on the needs of a secondary level Game Art and Design course. All of the competencies and objectives from Round Two with a mean value of 3.01 or above were integrated into the instrument for this round. The review panel examined and approved the instructions and instrument for clarity in content and jargon. This took place regarding the Round Three instrument before the expert panel was notified of its availability; the expert panel had one week to respond before being prompted to participate in the round if they have not done so. Again, the panelists had the opportunity to 'Accept', 'Reject', 'Modify' or 'Add' new competencies to the generated course framework list.

Within this round, the expert panel ranked the objectives from most important competency to be taught in a high school Game Art and Design course to the least important competency to be taught in a high school Game Art and Design course (Clark & Wenig, 1999). Once the expert panel completed Round Three by ranking the competencies and objectives in order from 1 to *n* and submitting their responses, the results were collected by the researcher. Upon receiving the instrument, the researcher collected and analyzed the data by using Spearman's Rank Correlation; this nonparametric analysis was used to show correlation by comparing the ranked scores to their corresponding medians (Schmidt, 2007).

According to Skeskin (2007), there are five levels of correlation: perfect, high, moderate, low and absence of correlation. Perfect correlations are those that remain in the same ratio, which is the exact opposite of an absence of correlation – those values range from .0 to .25, which shows that there is no correlation. A high degree of correlation scores above .75, moderate correlations score from .50 to .75, and low degrees of correlation range from .25 to .50. The correlations from round three were used to determine which competencies were retained for the final round of research.

The resulting correlations garnered from the data enabled the researcher to further observe favored competencies from the expert panelists among the population while identifying if consensus, in fact, was being reached. Competencies in the overall correlation range of .50 to 1.00, or moderate to perfect correlations, advanced to Round Four in order to be ranked a final time (Fink, et. al, 1984; Katsioloudis, 2007; Skulmoski, et. al, 2007); the mean and median values assisted in showing whether or not consensus was being reached.

Round IV

Round Four stood as the final round in the study; it determined the consensus of the competencies and objectives kept from Round Three. In the final round - Round Four, the competencies from Round Three that received higher consensus from the expert panel were summarized. Once the review panel approved the final instrument, it was made available to the expert panel for final responses. The expert panelists were asked only to 'accept' or 'reject' any remaining competencies from Round Three – no modifications were allowed at this final stage. After the results had been submitted to the researcher, they were collected and analyzed by utilizing the Chi-Square non-parametric test. This analysis of choice was displayed in contingency tables to indicate the relationship and significance between the variables (O'Hara, De Souza & Ide, 2000). Chi-square also gave the ability to measure the degree of stability among the answers collected in the Delphi study, adding to the validity of the responses garnered (Holey, et.al, 2007).

Upon completion of Round Four of this study, there was be a concise list of competency areas to be taught in a secondary level Game Art and Design course framework. This list indicated to the field of gaming and education what an appropriate secondary level Game Art and Design course framework should look like; it was sent to the review panel members and expert panel members as compensation for contributing to the study.

As additional compensation for the voluntary participation in this study, expert panelists were given the option of having their name and institution listed as being an expert contributor. Recognition of being selected for a particular study in which participants are noted as experts in their field may be encouragement enough to get participants to agree to provide their opinions to complete all rounds of the study (Stitt-Gohdes, & Crews, 2004); this was true for the data collected in this study. In addition to being acknowledged, each panelist was sent the final list of competencies and objectives that were created among the panel. The review panelists were given the same considerations that the expert panelists received.

Chapter Summary

This chapter described the various areas of the Delphi itself, while delving into the procedures that the researcher took when implementing the web-based Delphi method study. This technique was determined to be the best research method for the previously stated purpose of this study. Recall that the purpose of this study was to create a list of competency areas that would be taught in a high school level Game Art and Design course (based on the IGDA Core Topics) and objectives to be taught with each competency. The study was structured around the nine topics reported by IGDA with the option of suggesting others. This was done by soliciting experts to help define what the competency areas would be via a consensus in the form of the Delphi method.

The Delphi was chosen because of the asynchronous interaction capabilities; the continuous access to the emerging database without bias by the investigators; frequent self-updates without duplication, ease in distribution, speed and cost efficiency, and optimal structure. The two panels consisting of thirty three experts total – thirty on the expert panel and three on the review panel –not only came to a consensus without physically meeting, but they effectively eliminated any bias on the part of the researcher. These participants took part in four web-based survey instruments that was approved by the review panel and monitored by the researcher.

CHAPTER FOUR: RESEARCH FINDINGS

The problem that this study researched was the lack of a high school Game Art and Design course framework based on the core topics by the International Game Developers Association (2008), priorly established experts in the field of gaming. Therefore, the purpose of this study was to define essential competencies and objectives that would comprise a high school Game Art and Design course framework. Of the nine original core topics that were created for the post secondary level, seven of them were modified for the high school level. Additionally, the seven competencies had all new objectives generated to correspond to each. Furthermore, research was conducted to establish whether the Delphi method was the most appropriate data collection means to clearly identify competency and objective areas for a Game Art and Design course framework at the secondary level.

The data presented in this chapter includes the following results from the Delphi rounds conducted in the study to identify and draw consensus on a secondary level Game Art and Design curricula at the national level. To be examined is: (a) the demographic information about the review and expert panels, their combined professional experiences and backgrounds related to the subject of study, and (b) the results from the four Delphi rounds. Detailed information about the expert panel members are revealed within this chapter through the data collected using a demographic survey instrument. This data addresses the study's requirements as to the needed background and experience, as well as descriptive information about the panel members and their response rates to the different questionnaires. Next, each round of the Delphi is reviewed to display information and knowledge gained from that particular round. The goal of consensus-building was revealed for each round through the statistical analysis and procedures used.

Questions

The following questions drove this study and were answered through the Delphi method of confidentially drawing consensus through experts. The three questions addressed via this study were as follows: What core competency areas can be created in addition to each Core Topic in IGDA’s game-related Technology Education curriculum, what objectives will correspond with the impending competency list created from IGDA’s game-related Technology Education curriculum and does the Delphi Method clearly identify curriculum competency and objective areas for a Game Art and Design curriculum at the secondary level?

Participant Demographic Information

Prior to recruiting any panelists for the study, all materials were sent to the Institutional Review Board at North Carolina State University in Raleigh, NC (see Appendix B). The study received approval with an exemption status, and the corresponding materials were readied in preparation to contact the Game Education SIG of IGDA.

All potential panelists were approached via an All Call for Participation that was posted on IGDA’s Game Education forum (see Appendix A). The request for study participants was posted three times; a total of fifteen members expressed interest in participating. While the number of interested participants was less than the desired thirty three, historically, Turoff (1975) recommended that panel sizes span between 10 and 50 members. The fifteen members were sent email correspondence with the instructions for completing the demographics survey instrument. There was a return rate of 100 percent for the demographics survey instrument; once the results were examined; fourteen members were invited to participate in the study. The members, now termed expert panelists, were sent Informed Consent forms (see Appendix A). Recall that the panelists were grouped by the delineation of industry, researcher and teacher. Using an online random number generator, one member from each of the three groups was randomly chosen to serve as expert review panelists. As reported in chapter three, the duty of the review panelist was to check for clarity and jargon, thereby eliminating any researcher bias from each Delphi round. The expert panel was only required to complete the four rounds of the Delphi. The following information delineating the panelists was compiled from the demographic survey instrument.

The review panel was comprised of three randomly selected members: one technology researcher, one industry person and one educator, as described in chapter three of this study. All panelists were grouped based on their self-described profession – technology researcher, industry and educator; one panelist was randomly selected from each of the three areas to cover the expert review panel. These three titles encompass the panelists; similarly, 100% of the sample had experience in Course Development, Course Construction, or Curriculum and Instruction, lending to a well-informed and appropriate group of panelists to contribute to this study. While there were two self-proclaimed Game Designers in the expert sample, there was a mix of Technology Instructors, Technology Researchers, Industry affiliates, Administrator of high school programs including programming, animation and robotics, and University Faculty Members.

Among the entire panel population, the panelists had an average of 7.4 years of teaching experience, and over 60% of the sample had more than ten years of experience with gaming. A majority of the sample (35.7%) had six to nine years of experience with gaming in an educational capacity, which lines up with the desired demographic population. The entire sample of panelists had teaching experience, with the majority (78.6%) currently teaching at the College/University level while 14.3% currently taught at the high school level. As the sample population was derived from an international interest organization, the majority of respondents currently resided in the United States of America (85.7%), while 14.3% lived outside of the USA. Table 1 shows summaries of demographic information on the expert panelists in terms of: degree obtained, title/position and grade levels currently taught. Table 2 shows the number of years of experience as they relate to: teaching experience, experience with gaming and gaming in an educational capacity.

Table 1

Summary of Demographic Information on Expert Panel Members

Description	**Frequency**	**Percent**
Degrees Obtained		
Bachelor's	13	92.9
Master's	7	50.0
Doctorate	4	28.6
Other	3	21.4
Title/Position		
Game Designer	0	0.0
Technology Instructor	4	36.4
Technology Researcher	1	9.1
Industry	1	9.1
Student	0	0
Other	5	45.5

Table 1 (continued)

Grade level currently taught		
Middle School	0	0.0
High School	2	14.3
Community/Technical	3	21.4
College/University	11	78.6
Does not currently teach	1	7.1

Note. Total percent for Degrees Obtained is over 100% to account for multiple degrees; Total percent for Grade level currently taught is over 100% to account for dual employment.

Note. Under Degrees Obtained, Other accounts for: one panelist with a Master's Degree and working on a Ph.D., a BFA/MA and an Associate's Degree.

Note. Under Title/Position, Other accounts for: game designer and doctoral research fellow, freelance game designer & programmer, two Professors, one Game Design Senior Lecturer, one Game Design Instructor, and an Administrator of high school programs, programming, animation and robotics. Panelists chose which category best fit them; the Other selection was used as an additional explanation.

Table 2
Number of Years of Experience Regarding Teaching and Gaming

Description	**Frequency**	**Percent**
Teaching Experience		
0 – 2	2	14.3
3 – 5	6	42.9
6 – 10	3	21.4
11 – 15	1	7.1
16 – 20	2	14.3
21 – 25	0	0.0
Over 25	0	0.0
Gaming Experience		
0 – 2	0	0.0
3 – 5	2	14.3
6 – 9	3	21.4
> 10	9	64.3

Table 2 (continued)

Gaming in an Educational Capacity		
0 – 2	3	21.4
3 – 5	4	28.6
6 – 9	5	35.7
> 10	2	14.3
I do not have experience	0	0.0
Experience in Course Development, Course Construction and/or Curriculum & Instruction		
Yes	14	100
No	0	0.0

Note. Total percent for all categories combined is 100 percent.

The questionnaire asked the expert panel to list the area each degree was obtained in. The degree areas (and counts) for the Bachelor's degrees include Music, Law, Fine Arts (2), Architecture, Game Arts and Design, Education, Engineering (3), Computer Science (4), Communication Arts and Mathematics. Of the Master's degrees, the areas covered were Engineering (2), Communication, Instructional Media, Architecture, Interaction Design/Game Development and Interactive Technologies. Four of the expert panelists have doctorate degrees in the following areas: Architectural Engineering, Computer Science (2) and Cognitive Studies. Other listed degree areas included Natural Science, Performing Arts, Information Technology/Media and Design Arts, and Game Studies. Of all educational areas covered, the majority of the panelists (70%) come from an engineering and/or technical background.

Round One of the Delphi Study

Round one of the Delphi research began by the development of a questionnaire based on the nine core topics from IGDA's version 3.2 beta curriculum document (see Appendix C). The panelists were reminded that the purpose of the study was to create a set of core competencies and objectives that could be taught in a high school Game Art and Design course framework; their primary duty was to create more competencies and new objectives. Each of the nine existing core topics was listed with an example of the content area and a definition of the content that would potentially be covered (IGDA, 2008). This information was included so that each panelist had the same information and considerations as a whole. Once the suggestions from the review panel were incorporated, the survey was released to the expert panel. As this was round one, the expert panelists were asked to either 'Accept' or 'Reject' the existing core topic, and to create objectives for each corresponding core topic. Panelists could accept or reject any core topics given to them; they also had the option to modify any core topic as they chose.

There was a 100 percent response rate from round one of the Delphi study; all panelists completed and returned the round. All core topics were accepted in varying percentages, as shown in Table 3. In addition to the existing core topics, Table 4 outlines the eight additional core topics that were suggested, along with corresponding objectives. Overall, there were 141 objectives created from the existing nine core topics; the eight new competencies garnered sixteen objectives. Those objectives that were similar in meaning but worded differently were combined into one objective for round two.

Table 3

Delphi Round One Suggested Core Topics to be Accepted, Rejected or Modified by the Expert Panel; New Objectives

Core Topic 1: Critical Game Studies	Accepted	Rejected	Modified
Definition - Critical game studies offer insight into the textual analysis of game play. Also included here are: the history of computers and digital games and toys; the construction and critique of cannon of significant and influential games; and game criticism and journalism.	7	2	2

Objectives for Critical Game Studies

- Discuss the history of games and identify the different game genres and important examples of each.
- Understand history of games and related issues.
- Understand the historical significance of electronic and non-electronic games.
- Develop critical literacies in novice game designers.
- Discuss the roles games play within a society and how specific games fulfill their roles.
- Students will be able to identify historical innovations in game-play.
- To understand the history of computers and digital games and toys.
- Understand the difference between game reviews, critiques, and reporting
- Develop appropriate critical tools to the study of games.
- Demonstrate an understanding of the vocabulary for discussing games and play
- Enable novices to develop skills when applying critical practices.
- Identify the elements that make up a game and evaluate them as independent components
- Students will be able to analyze a game's mechanics, including rules, narrative mechanics, social interactions, and physical affordances.
- To critique significant and influential games.
- Provide insights into the development and use of computer games.
- Provide exposure to a range of cultural issues, in order to broaden and deepen their engagement with practices.
- Identify important designers, games, and events in game development and adoption by society.
- Students will be able to tell the difference between a game's design and its execution.
- To offer insight into the textual analysis of game play.

Table 3 (continued)

Core Topic 2: Games and Society	Accepted	Rejected	Modified
Definition - This topic offers insight into worldwide gaming culture; psychological facets of games including studies of media effects and the ongoing debate about the psychological impact of games on individuals and groups; examines how individuals and groups construct games; explores how values, identities, and cultural images shape game production.	9	2	0

Objectives for Games and Society

- Analyze important games in terms of their social and cultural contexts.
- Understand the social issues of computer games.
- Understand legal issues that affect games, developers and players.
- To provide students with exposure to tools which assist in developing social engagements in game play.
- Demonstrate understanding of the role games play at various stages of human development.
- Students can identify psychological predispositions of human beings that influence their reception and use of games.
- To understand worldwide gaming culture.
- Recognize key signs and symbols (semiotics) in terms of racial and cultural depictions and how they affect the interpretation of a game.
- Understand the psychological impact of computer games.
- Describe the impact of the video game industry on the economy.
- To enable students to gain an understanding of the impacts of cultural expectations and structures on what is considered "good" game play.
- Provide examples of how various cultures differ in the assumptions, expectations and taboos of games.
- Students can identify at least five ways in which gamers may differ from each other (age, gender, race, culture, language, religion, SES, etc.) and be able to analyze the impact of those factors on the play experience.
- To understand the psychological facets of games.
- Understand how cultural values affect computer games.
- To understand how individuals and groups construct games as well as how their values/culture shape them.

Table 3 (continued)

Core Topic 3: Game Design	Accepted	Rejected	Modified
<u>Definition</u> - This topic addresses the fundamental ideas behind the design of electronic and non-electronic games. Includes game play, storytelling, challenges and basic interactive design, including interface design, information design and world interaction. Perhaps most important is a detailed study of how games function to construct experiences, including rule design, play mechanics, game balancing, social game interaction, and the integration of visual, audio, tactile and textual elements into the total game experience.	9	1	3

Objectives for Game Design

- Analyze the key components of the game experience of important games.
- Understand how computer games are designed using appropriate methods and principles
- Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design.
- Develop understanding of the variety of theoretical approaches to game mechanics
- Identify elements which make games "fun".
- Students can construct a simple non-digital game.
- To understand how game play, storytelling, and design affect the fun or value in games.
- The student will be able to design an original non-electronic game, including mechanics, objective, and theme.
- Discuss the interrelationship of different game elements and their impact on the game experience.
- Demonstrate how games are developed as experiential tools and environments.
- Describe the complex interaction between video games and players and the role it plays in the popularity of a game.
- Provide opportunities to reflect upon the relation of game mechanics and design process.
- Explain the importance of challenge within game play.
- Students understand the difference between mechanics, interface, narrative, visuals - as well as the interaction between them.
- To understand how rule design, play mechanics, game balancing, social game interaction, and the integration of visual, audio, tactile and textual elements affect the fun or value in games.

Table 3 (continued)

- Student will be able to analyze a game of their own or someone else's design to determine potential improvements to the game play.
- Distinguish the critical strengths and weaknesses of various principle and methods used in computer game design.
- Discuss how genres of games vary in how they utilize elements such as storytelling, mechanics, art, etc.
- Students can identify major game design elements in a commercial digital game.
- Student will be able to conceive of ideas for small-scale electronic games and work alone or in a team to implement and playtest them.

Table 3 (continued)

Core Topic 4: Game Programming	Accepted	Rejected	Modified
Definition - This topic includes physics, mathematics, programming techniques, algorithm design, game-specific programming and the technical aspects of game testing.	7	2	3

Objectives for Game Programming

- Identify key components of a game engine.
- Develop appreciation of programming and issues relevant to computer games.
- Become familiar with popular game tools such as DirectX, 3DMax, and different gaming engines.
- Provide a basic exposure to pragmatic game development processes.
- Identify the various branches of mathematics used in programming as well as which portions of the game use which branch.
- Students can write a design document for a simple digital game.
- Be able to identify an ill-defined problem in the game implementation.
- To understand the math/physics of game play.
- Understand how different components of a game engine interrelate.
- Understand decisions made and why certain programming methods are used.
- Demonstrate the effective use of 3D hardware such as scanners, tablets, and motion capture.
- Gain experience in development, leading to competencies in scripting.
- Demonstrate skills in listing the logical steps of everyday complex processes (such as answering a phone, making a sandwich, etc).
- Students can, working together, construct a simple digital game.

Table 3 (continued)

- Be able to define a small subset of the problem that may be tested with a minimal digital prototype.
- To understand the programming of 3D and AI.
- Understand basic game logic and framework structure.
- Provide opportunities for students to implement designs within the constraints of technical development.
- Demonstrate ‘C’ grade-level appropriate skills in creating flowcharts and solving equations.
- To be able to trouble shoot a game (QA).

Table 3 (continued)

Core Topic 5: Visual Design	Accepted	Rejected	Modified
Definition - This topic includes visual design fundamentals, both on and off the computer, across a broad range of media. Content areas include: history, analysis and production in traditional art media such as painting, drawing and sculpture; communication fields like illustration, typography and graphic design; other design disciplines such as architecture and industrial design; and time-based media like animation and filmmaking.	10	0	3

Objectives for Visual Design

- Recognize key art and design styles and their influence on important games.
- Demonstrate understanding of visual design strategies.
- Demonstrate language arts knowledge and skills.
- Provide a basic survey of art and design practices, such that students can develop practical visual literacies.
- Describe the process (pipeline) by which visual assets are created for games.
- Modeling and Animation.
- To be able to create the graphics for a game.
- The student will be able to create drawings and illustrations in both electronic and non-electronic form.
- Understand how visual design decisions impact the overall game experience.
- Develop critical reflections on the interrelation of aesthetics and the audience.

Table 3 (continued)

- Understand the significance of historical and cultural heritage of art and artistic styles as it relates to 3D game graphics.
- Enable students to develop skills in applying theoretical and practical knowledge from related areas.
- Explain the importance of brainstorming, experimentations and pre-visualization during the creation process.
- User Interface Theory and design.
- To be able to design and implement the interface for a game.
- The student will be able to use computer tools to create two-dimensional drawings and three-dimensional models.
- Demonstrate an understanding of the terminology, methodology, and creation process of various visual art disciplines.
- The student will be able to create screen mockups and layouts for a game's user interface.

Table 3 (continued)

Core Topic 6: Audio Design	Accepted	Rejected	Modified
Definition - This topic includes a range of theoretical and practical audio-related areas, such as: music theory and history; music composition; aesthetic analysis of music; recording studio skills; and electronic sound generation. Audio relating specifically to digital game technologies, such as 3D sound processing and generative audio structures, is also included.	7	3	3

Objectives for Audio Design

- Understand the impact of sound and music on the overall game experience.
- Understand the specific audio issues of video games.
- Provide students with an exposure to the relevant practical and theoretical material.
- Identify the roles music and sound play in game.
- To be able to create and utilize sound effects and voice into a game.
- Recognize how sound and music can be used to enhance game play.
- Enable students to gain experience in the application of sound within a game design context.

Table 3 (continued)

Core Topic 7: Interactive Storytelling	Accepted	Rejected	Modified
Definition - Writers and designers of interactive works need a solid understanding of traditional narrative theory, character development, plot, dialogue, back-story, and world creation, as well as experimental approaches to storytelling in literature, theatre, and film with relevance to games.	11	0	2

Objectives for Interactive Storytelling

- Identify key storytelling techniques or structures in games
- Demonstrate understanding of narrative theory
- Demonstrate language arts knowledge and skills
- Provide students with experience in developing, analyzing and implementing narrative in games
- Discuss how and when narrative is used in games and for what purpose
- Students understand the trade-offs between player participation and authorial control.
- To be able to write a script for a level.
- The student will be able to write traditional linear stories that can be integrated with a linear game.
- Discuss the interrelationship (or conflict) between story and game play
- Extend the examples and potential of interactive narrative
- Determine and document the graphical and animation needs of a game using design documents including art direction and reference material
- Providing exposure to a range of appropriate theoretical tools that allow for the construction and analysis of effective non-linear narratives
- Discuss the role of the writer in an interactive environment and how it varies from novels, film, and television
- Students understand at least three ways to deliver narrative content (ambient, dialogue, cut-scene, emergent) and can identify them in existing digital games.
- The student will be able to write non-linear stories for games that involve choices on the part of the player, leading to multiple outcomes.
- Identify the components of traditional narrative structures and devices, comparing/contrasting them with the structures and devices as they are used in video games.
- Students can design a simple participatory story, perhaps using a non-digital system such as FUDGE.

Table 3 (continued)

Core Topic 8: Game Production	Accepted	Rejected	Modified
Definition - Games are among of the most complex forms of software to create, and game development and publishing are complex, collaborative efforts. Along with all the technical challenges of software development, issues of design documentation, content creation, team roles, group dynamics, risk analysis, people management, and process management are addressed in this competency.	8	2	3

Objectives for Game Production

- Understand the basics of game project management.
- Show understanding of the game production process.
- Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- Expose students to a range of possible project management techniques.
- Demonstrate skills in team-work and leadership as used in the game industry.
- Students can write a design document for their game.
- To be able to lead the production process of a game or level.
- Recognize the value and importance of team and collaborative work.
- Develop design documents along with, if possible, a real game design project.
- Demonstrate personal money-management concepts, procedures, and strategies.
- Develop students' capacity to structure and manage their own projects.
- Describe the pipeline of a video game from conception to customer support.
- Students understand the impact of current industry practices on the games that are created.
- Describe the importance of communication to the design process and give examples of effective communication methods.

Table 3 (continued)

Core Topic 9: Business of Gaming	Accepted	Rejected	Modified
Definition - The economics of the game industry – how games are funded, marketed and sold, and the relationships among publishers, developers, distributors, marketers, retailers, and other kinds of companies are addressed here. Market and industry trends, licensing management, the dynamics of company and product value, and business differences between major game platforms are all important aspects within this competency.	6	4	3

Table 3 (continued)

Objectives for Business of Gaming

- Demonstrate understanding of the business issues behind computer games.
- Describe the importance of professional ethics and legal responsibilities.
- Provide an opportunity for students to engage with the relevant issues in legal compliance.
- Students can identify the impact of current industry practices on games that are created.
- To understand the economic and legal side of game of game development.
- Create and present business summaries and market pitches of imagined or actual games.
- Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- Provide an opportunity for students to engage with the relevant issues in market structure.
- Students can identify games beyond the marketing mainstream (i.e. indie games).
- Students can write a business plan for a game, including platform choice and monetization strategies.

The following table (Table 4) lists the new core topic areas that were created, along with the suggested objectives to correspond with each area. These areas will be included with the original nine core topics to create a complete competency list for a Game Art and Design course framework. The newly created competencies were also expanded upon in round three with objectives that match the content areas. The new competencies stand as Usability, Career Readiness, Studio Practice, Computer Technologies, Indie and Do It Yourself Games, Simulation Project, Games Beyond Play and Physical Interfaces (see Table 4).

Table 4.

New Core Topics and Objectives Created by the Expert Panel

Core Topics	Proposed Objectives
Usability	1. Understand the usability issues of game design. 2. Create and run small usability tests of game play. 3. Explain the functionality of game related components of a computer/console such as Save systems, Input/Output devices, processors, network cards, etc.
Career Readiness	1. Investigate career opportunities in the game industry. 2. Internship, job shadow, or collaborate within industry.
Studio Practice	1. Specific integrative subject, about 50% of the curriculum, which ties together the subjects so far in a pragmatic application of theory to the design of playable outcomes. 2. Demonstrate the ability to perform standard maintenance and performance related tasks on common operating systems.
Computer Technologies	1. Describe the essential parts of a computer and how they function. 2. Students are familiar with at least three art/expressive/unusual games.
Indie and Do It Yourself Games	1. Students can identify tools for rapid game. prototyping and development, and understand what they can do with each after the course ends.
Simulation Project	1. Create a working game or simulation individually or as part of a team. 2. Participate in large scale or individual real world design projects.

Table 4 (continued)

Games Beyond Play	1. To offer opportunities for students to engage with games as learning systems, training systems, marketing systems etc. 2. Assist in developing students' understanding of games as a medium, rather than as systems of play.
Physical Interfaces	1. Students can identify at least five types of interface with a game and describe the affordances for design that each provides. 2. Students can build a controller of their own using pre-existing kits.

Core topics used as the basis of round one were either accepted, rejected or modified. Because all of the core topics received a majority of 'accept' votes, all remained for round two. All modifications were approved by the expert review panel before being sent out as round two for the expert panel to complete. Table 5 includes the modifications and/or combinations that were made from round one to round two (see Appendix C). The order was changed from round one; a random number generator was used to change the order of the competencies as a measure of ensuring no bias from competency to competency in each ensuing round. Round two used Likert scale responses and collected Means as evidence towards the beginning of consensus building among the competencies and objectives. Any consensus achieved lends credence to the compilation of essential competencies and objectives for a high school Game Art and Design course.

Round Two of the Delphi Study

Round two of this Delphi study permitted the panel of experts to rate all competencies and objectives from round one via a Likert scale (see Appendix D for all round two correspondences). All competencies with modifications from round one were incorporated into the round two instrument along with the Likert scale. The modifications were sent to the review panel for suggestions on content, jargon and clarity. Additional modifications were made before the round two instrument was made available to the expert panel. Round two was implemented with instructions for the panelists to rate the competencies and objectives from 1 to 5, where: 1 = Strongly Disagree (SD) / This competency or objective should not be taught in a high school Game Art and Design course, 2 = Disagree (D) / This competency or objective may not be beneficial if taught in a high school Game Art and Design course, 3 = Neither Disagree nor Agree (ND/A) / This competency or objective could or could not be taught in a high school Game Art and Design course, 4 = Agree (A) / This competency or objective could be beneficial if taught in a high school Game Art and Design course, 5 = Strongly Agree (SA) / This competency or objective should be taught in a high school Game Art and Design course. In addition to rating in round two, the panelists had the opportunity to modify anything brought over from round one, and to create more objectives if necessary.

The Likert rating, mean average and number of respondents is included for each competency and objective for round two (see Table B in Appendix D). Note that Computer Technologies, Career Readiness, Usability, Simulation Project and Games Beyond Play all have objectives without a Likert rating, mean average or number of respondents. This was due to new objectives that were created; they were not given scores until round three. There was an 82% response rate (*n* = 9) for Round Two. It is notable that the number of respondents in this round fall below the recommended 10 – 50 panel size (Delbecq, 1975); it is unusual to have a small panel size, but not uncommon. Wynekoop & Walz (2000) performed a Delphi with nine respondents; Nambisan et.al. (1999) utilized a panel size of six; Gustafson, Shukla, Delbecq & Walster carried out a Delphi with four panelists in 1973; and in 2000, Lam, Petri and Smith had a sample size of three! The nature of the Delphi is cyclical, and attrition is a major drawback to this research method. While this round only had nine respondents, a panel size of this number is not unheard of.

Once all Round Two data was collected, statistical means were calculated for each competency and objective. All competencies and objectives with a mean cutoff of 3.01 or higher were kept for the creation of the round three instrument. Any objective with 3.00 and below was discarded for having a low mean rating. By keeping only the competencies and objectives that had a rating at or above the statistical median of 3.00 on the rating scale of one to five, the mean of 3.01 indicated that the Delphi process was beginning to reach consensus. This was confirmation that overall, those with at least 51 percent and higher would serve as appropriate content areas for a Game Art and Design curriculum (Loughlin & Moore, 1979). Table 6 lists all competencies and objectives along with the Likert rating counts, the statistical means (M) and the number of respondents (N).

All competencies received a rating of 3.01 or above and were kept for round three; however, there were objectives that did not make the statistical mean cutoff, indicating that they would not be necessary content areas in a Game Art and Design course framework. Under the competency Visual Design, the following objective was discarded with a 2.88 mean rating: Understand the significance of historical and cultural heritage of art and artistic styles as it relates to 3D game graphics. In reference to Games and Society, 'provide students with exposure to tools which assist in developing social engagements in game play' was discarded with a 3.00 mean rating. The objective stating ‘demonstrate the ability to perform standard maintenance and performance related tasks on common operating systems’ was discarded from Computer Technologies for a 2.88 mean rating. Game Programming yielded two discards with a 2.75 mean rating – ‘Understand the programming of 3D and Artificial Intelligence’ and ‘Demonstrate the effective use of 3D hardware (scanners, tablets, motion capture)’. The competency Studio Practice was discarded from round two because of the lack of sufficient objectives once ‘Specific interactive subject’ was discarded with a 3.00 mean rating.

Career Readiness was another competency that was discarded for round three – not for having a low mean rating, but for having multiple low rated objectives. Two objectives were discarded, ‘Internship or job shadow within the industry’ and ‘Collaboration within the industry’ with mean ratings of 2.88 and 3.00 respectively. A discrepancy missed by the researcher and review panelists in regards to the competency Business of Gaming. The mean ratings for Business of Gaming objectives are less than the 3.01 cutoff due to a discrepancy in the chart. The scale for this competency was out of 4.0 rather than 5.0; therefore, the cutoff was 2.01, whereas 2.01 represented the majority value on a 1.0 – 4.0 scale. As such, ‘Engage with the relevant issues in market structure’ received a 2.00 rating, ‘Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance’ received a 1.75 rating and ‘Engage with the relevant issues in legal compliance’ earned a 2.00 mean rating.

Game Production lost the objective stating ‘Demonstrate personal money-management concepts, procedures, and strategies’ with a 3.00 rating. Interactive Storytelling had a discard of two objectives, 'Write traditional linear stories that can be integrated with a linear game' with a 3.00 rating and 'Extend the examples and potential of interactive narrative' with a 2.88 rating. Games Beyond Play (modified to Games Beyond Entertainment) and Physical Interfaces were the two competencies discarded for having a low mean rating; they earned a 2.88 and 2.38 rating respectively. All nine of the previous topics remained – Visual Design, Games and Society, Game Programming, Game Design, Business of Gaming, Interactive Storytelling and Critical Game Studies. The new competencies that remained after the statistical mean cutoff include Computer Technologies, Audio Design, Usability, Simulation Project and Indie and Do It Yourself Games (DIY Games).

Both panels made suggestions to modify particular competencies and objectives (see Table 7). Some suggestions by the expert panelists were on wording and clarity; suggestions by the review panel were more on the order of the survey instrument. It was suggested to begin the instrument with a few shorter competencies, as beginning with a longer one would appear instantly daunting. Modifications made to competencies, objectives and the order of the content were approved by the review panel, and then made available to the expert panelists.

Table 5

Modifications to Round Two Competencies and Objectives for the Creation of Round Three

	Competency from Round Two	Modification for Round Three
Visual Design	Visual design fundamentals, designing and creating, analysis and production in traditional art media, communication fields like illustration, typography and graphic design; and time-based media like animation and film making; all relative practical components.	Visual design fundamentals, designing and creating, analysis and production in traditional art media, communication fields like illustration, typography and graphic design; and time-based media like animation and film making, human anatomy, product and industrial design; all relative practical components.
Games and Society	Worldwide gaming culture; psychological facets of games including studies of media effects and theories, and the ongoing debate about the psychological impact of games on individuals and groups; examines how individuals and groups construct games; anthropological methods; explores how values, identities, and cultural images shape game production.	Worldwide gaming culture; psychological facets of games including studies of media effects and theories, and the ongoing debate about the psychological impact of games on individuals and groups; professional gaming; examines how individuals and groups construct games; anthropological methods; explores how values, identities, and cultural images shape game production.
Audio Design	Designing and creating sound and sound environments; music theory and history; music composition, sound effects editing/generation, voice over direction; recording studio skills; sound as an aspect of game play mechanics.	Designing and creating sound and sound environments; music theory and history; music composition, sound effects editing/generation, voice over direction; recording studio skills; exposure to parameterized audio and in engine digital signal processing; sound as an aspect of game play mechanics.
	Additional Objectives	
Usability	Connecting consoles to various televisions standards; Competent in play-testing.	
Simulation Project	Classroom should mirror studio settings (departments, managers); Created a simple, non-digital simulation game. Analyze existing simulation game subjects, themes, and executions.	
Indie and DIY Games	Open source, Indie Game community, GameJam.	

Once round two was completed, the competencies and objectives were put in order according to the means, from the highest rated to the lowest rated. This was done in order to allow comparison of these statistically ranked means of competencies and objectives conducted in round three; this will demonstrate that consensus was being achieved by the Delphi method.

Round Three of the Delphi Study

The third survey instrument in this Delphi study allowed the expert panel to rank the competencies and objectives. Mean averages for each competency and objective were included in the survey; this information was not included to sway the panelists, but rather to keep them informed of the current group opinion. Round three was used as a ranking from 1 – *n*, where '1' was the most important and '*n*' was the least important, thereby creating an opposite scale from round two. This was done to assure that consensus was being drawn by comparing ranked competency and objective means from round two to rated competencies and objectives from round three. Again, panel members had the option of adding new objectives or modifying existing ones, but only if they deemed it necessary. The mean averages from round two and the mean ranks from round three were analyzed using the non-parametric Spearman's Rank Correlation Coefficient analysis; this was done to show the correlation between information found in round three.

In this round, there was an increase to a 91% response rate, an increase of 11% from round two. Ten expert panel members responded to the survey instrument for this round; only one member was lost due to attrition in round three. The only suggestions from this round were in reference to combining similarly worded objectives. The changes were made and sent to the review panel. Once the instrument was approved, it was made available to the expert panelists (see Appendix E). After the data was collected from round three, the mean rankings were assembled and compared to with the medians for each competency and objective. Table 6 shows the number of respondents for each competency and objective, with round two ratings, round three rankings, the median and correlation coefficient from Spearman's Rank Correlation Coefficient. Competencies with a correlation of .50 and above were retained for the final round; scoring within this correlation shows that there is a moderate, high or perfect level of correlation (Dallal, 2008).

Of the twelve competency sets that were carried over from round two to round three, 83.3% (*n*=10) had a high degree of correlation; high correlations are represented as ranges of .75 – 1.00 (Sheskin, 2007). The top ten competencies and correlation coefficients stand as: Audio Design (.765), Games and Society (.899), Game Programming (.868), Usability (1.00), Visual Design (.960), Game Production (.942), Interactive Storytelling (.970), Critical Game Studies (.935), Game Design (.937) and Indie and Do It Yourself Games (1.00). While the majority of competencies had high degrees of correlation, 16.6% (n=2) had moderate correlations – Business of Gaming (.716) and Simulation Project (.500). Simulation Project was on the border of a moderate to low degree of correlation; additional analysis will determine the strength of this competency. It can be noted that while Usability and Indie and Do It Yourself Games both have a perfect correlation of +1, both also have few objectives (three and two respectively), thus the chance of being robust enough to last through all four rounds and statistical analyses is slim; it is recommended that at least three objectives are paired with each competency in order to fully complete mastery of a subject (NERC, 2007).

Table 6

Objectives with Mean Rating from Round Two, Mean Ranking, overall Mean 'M' and Medians 'x' from Round Three.

Audio Design						
Objectives	N	R2 Rate	R3 Rank	M	x	r
Identify the roles music and sound play in a game.	10	4.13	4.4	4.13	4	.765
Understand the impact of sound and music on the overall game experience.	10	4.38	3.3	4.38	3	
Understand the specific audio issues of video games.	10	4.13	4.0	4.13	4	
Expose to relevant practical and theoretical material.	10	3.50	3.9	3.50	4	
Recognize how sound and music can be used to enhance game play.	10	4.13	4.8	4.13	5	
Create and utilize sound effects and voice into a game.	10	3.75	3.9	3.75	3.5	
Gain experience in the application of sound within a game design context.	10	3.88	3.7	3.88	4	

Note. Audio Design is significant at the 0.05 level.

Table 6 (continued)

Games and Society						
Objectives	N	R2 Rate	R3 Rank	M	x	r
Understand how cultural values affect computer games.	8	4.00	4.5	4.00	3.0	.899
Understand how individuals and groups construct games as well as how their values/culture shapes them.	8	3.88	3.2	3.88	2.0	
Analyze important games in terms of their social and cultural contexts.	8	4.13	4.1	4.13	3.5	
Understand the social issues of computer games.	8	4.13	6.8	4.13	4.5	
Understand legal issues that affect games, developers and players.	8	3.88	9.1	3.88	10.5	
Demonstrate understanding of the roles games play at various stages of human development.	8	3.38	8.2	3.38	8.0	

Table 6 (continued)

Games and Society						
Objectives	N	R2 Rate	R3 Rank	M	x	r
Identify psychological predispositions of human beings that influence their reception and use of games.	8	3.88	8.3	3.88	7.5	.899
Understand worldwide gaming culture.	8	4.00	7.7	4.00	7.0	
Recognize key signs and symbols (semiotics) in terms of racial and cultural depictions and how they affect the interpretation of a game.	8	3.50	9.8	3.50	10.0	
Understand the psychological impact of computer games.	8	3.50	7.5	3.50	7.5	
Describe the impact of the video game industry on the economy.	8	3.50	10.5	3.50	11.5	
Enable an understanding of the impacts of cultural expectations and structures on what is considered "good" game play.	8	3.88	7.9	3.88	9.0	
Provide examples of how various cultures differ in the assumptions, expectations and taboos of games.	8	3.75	10.2	3.75	10.0	
Identify at least five ways in which gamers may differ from each other (age, gender, race, culture, language, religion, socio-economic status, etc.) and be able to analyze the impact of those factors on the play experience.	8	4.25	7.2	4.25	8.5	

Note. Games and Society is significant at the 0.05 level.

Table 6 (continued)

Game Programming						
Objectives	N	R2 Rate	R3 Rank	M	x	R
Troubleshoot a game.	8	3.63	10.4	3.63	11.5	
Demonstrate grade-level appropriate skills in creating flowcharts and solving equations.	8	4.25	7.6	4.25	6.5	
Implement designs within the constraints of technical development.	8	3.75	8.5	3.75	10.0	
Understand basic game logic and framework structure.	8	4.50	1.8	4.50	1.0	
Identify key components of a game engine and how they interrelate.	8	4.00	9.1	4.00	8.5	.868

Table 6 (continued)

Game Programming (continued)						
Objectives	N	R2 Rate	R3 Rank	M	x	R
Develop appreciation of programming and issues relevant to computer games.	8	4.38	4.4	4.38	3.5	.868
Become familiar with popular game tools such as DirectX, 3DMax, and different gaming engines.	8	3.25	12.3	3.25	13.0	
Understand why certain programming methods are used.	8	3.75	6.7	3.75	5.5	
Provide a basic exposure to pragmatic game development processes.	8	4.38	5.5	4.38	3.5	
Identify the various branches of mathematics used in programming (which portions of the game use which branch).	8	3.75	9.0	3.75	8.5	
Write a design document for a simple digital game.	8	3.75	11.0	3.75	13.0	
Identify an ill-defined problem in the game implementation.	8	4.13	7.4	4.13	11.0	
Gain experience in development, leading to competencies in scripting.	8	3.63	10.2	3.63	10.5	
Demonstrate skills in listing the logical steps of everyday complex processes (such as answering a phone, making a sandwich, etc.)	8	4.38	9.1	4.38	8.0	
Be able to define a small subset of the problem that may be tested with a minimal digital prototype.	8	4.25	10.2	4.25	11.5	
Construct a simple digital game.	8	4.13	10.6	4.13	10.5	

Note. Game Programming is significant at the 0.05 level.

Table 6 (continued)

Business of Gaming						
Objectives	N	R2 Rate	R3 Rank	M	x	*R*
Write a business plan for a game including platform choice and monetization strategies.	8	2.75	3.7	2.75	2.5	.716
Identify games beyond the marketing mainstream (i.e. Indie games).	8	3.00	4.4	3.00	4.5	
Create and present business summaries and market pitches of imagined or actual games.	8	2.88	3.4	2.88	3.5	
Understand the economic and legal side of game development.	8	3.13	3.3	3.13	3.0	
Identify the impact of current industry practices on games that are created.	8	2.75	5.8	2.75	6.5	
Describe the importance of professional ethics and legal responsibilities.	8	3.13	3.9	3.13	3.5	
Demonstrate understanding of the business issues behind computer games.	8	3.13	3.4	3.13	3.0	

Note. Business of Gaming was an original core topic. The mean ratings for Business of Gaming objectives are less than the 3.01 cutoff due to a discrepancy in the chart. The scale for this competency was out of 4.0 rather than 5.0; therefore, the cutoff is 2.01.

Table 6 (continued)

Usability						
Objectives	N	R2 Rate	R3 Rank	M	x	*r*
Understand the usability issues of game design.	8	4.00	1.4	4.00	1.0	1.00
Create and run small usability tests of game play.	8	4.00	2.1	4.00	2.0	
Explain the functionality of game related components of a computer/console such as Save systems, Input/Outputs devices, processors, network cards, etc.	8	3.50	3.5	3.50	4.0	

Note. Usability is significant at the 0.05 level.

Table 6 (continued)

Visual Design						
Objectives	N	R2 Rate	R3 Rank	M	x	*R*
Demonstrate an understanding of the terminology, methodology, and creation process of various visual art disciplines.	9	4.33	4.2	4.33	3.5	.960
Create screen mockups and layouts for a game's user interface.	9	3.89	8.4	3.89	8.0	
Recognize key art and design styles and their influence on important games.	9	4.22	6.3	4.22	5.0	
Demonstrate understanding of visual design strategies.	8	3.88	6.2	3.88	7.0	
Demonstrate language arts knowledge and skills.	8	3.63	10.5	3.63	11.0	
Provide a basic survey of art and design practices, such that students can develop practical visual literacies.	8	4.25	5.9	4.25	4.0	
Describe the process (pipeline) by which visual assets are created for games.	8	4.13	8.9	4.13	7.5	
Create the graphics for games; modeling and animation.	8	3.38	9.3	3.38	9.0	
Create drawings and illustrations in both electronic and non-electronic form.	8	4.25	4.6	4.25	2.5	
Understand how visual design decisions impact the overall game experience.	8	3.88	6.6	3.88	7.0	
Develop critical reflections on the interrelation of aesthetics and the audience.	8	3.50	10.4	3.50	11.0	
Enable students to develop skills in applying theoretical and practical knowledge from related areas.	8	3.25	12.8	3.25	13.0	
Explain the importance of brainstorming, experimentations, and pre-visualization during the creation process.	8	4.25	6.9	4.25	7.0	
Design and implement the interface for a game; interface theory and design.	8	3.75	9.9	3.75	10.5	
Use computer tools to create two-dimensional drawings and three-dimensional models.	8	3.25	9.6	3.25	11.5	

Note. Visual Design is significant at the 0.05 level.

Table 6 (continued)

Simulation Project						
Objectives	N	R2 Rate	R3 Rank	M	x	*R*
Participate in large scale or individual real world design projects.	8	3.38	2.3	3.38	2.0	.500
Create a working game or simulation individually or as part of a team.	8	3.75	1.9	3.75	1.0	
Classroom should mirror studio settings (departments, managers).	8	-	2.2	-	2.5	

Note. Simulation Project is significant at the 0.05 level.

Table 6 (continued)

Game Production						
Objectives	N	R2 Rate	R3 Rank	M	x	*r*
Describe the importance of communication to the design process and give examples of effective communication methods.	7	4.29	3.4	4.29	2.5	.942
Understand the basics of game project management.	7	4.14	5.4	4.14	5.0	
Show understanding of the game production process.	7	4.00	6.3	4.00	6.0	
Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.	7	4.43	4.5	4.43	4.0	
Exposure to a range of possible project management techniques.	7	3.43	8.0	3.43	10.5	
Demonstrate skills in team-work and leadership as used in the game industry.	7	3.71	7.8	3.71	7.5	
Write a design document for their game.	7	4.14	9.2	4.14	10.0	
Lead the production process of a game or level.	7	4.00	9.4	4.00	10.5	
Recognize the value and importance of team collaborative work.	7	4.43	4.8	4.43	3.5	
Develop design documents along with, if possible, a real game design project.	7	4.14	6.9	4.14	6.5	
Develop students' capacity to structure and manage their own projects.	7	4.14	6.6	4.14	7.5	
Describe the pipeline of a video game from conception to customer support.	7	4.00	7.0	4.00	8.0	
Understand the impact of current industry practices on the games that are created.	7	3.43	9.4	3.43	9.5	

Note. Game Production is significant at the 0.01 level.

Table 6 (continued)

Interactive Storytelling						
Objectives	N	R2 Rate	R3 Rank	M	x	r
Design a simple participatory story.	8	4.38	5.9	4.38	3.5	.970
Identify the components of traditional narrative structures and devices, comparing/contrasting them with the structures and devices as they are used in video games.	8	4.13	6.0	4.13	6.0	
Identify key storytelling techniques or structures in games.	8	4.25	2.9	4.25	2.5	
Demonstrate understanding of narrative theory.	8	4.13	5.9	4.13	6.5	
Demonstrate language arts knowledge and skills.	8	4.25	5.6	4.25	4.0	
Provide experience in developing, analyzing and implementing narrative in games.	8	3.75	9.1	3.75	9.0	
Discuss how and when narrative is used in games and for what purpose.	8	4.00	6.9	4.00	6.5	
Understand the trade-offs between player participation and authorial control.	8	4.25	5.1	4.25	5.5	
Write a script for a level.	8	4.13	10.1	4.13	10.0	
Discuss the interrelationship (or conflict) between story and game play.	8	4.13	7.0	4.13	7.5	
Determine and document the graphical and animation needs of a game using design documents including art direction and reference material.	8	3.38	11.1	3.38	13.5	
Provide exposure to a range of appropriate theoretical tools that allow for the construction and analysis of effective non-linear narratives.	8	3.13	13.0	3.13	13.0	
Discuss the role of the writer in an interactive environment and how it varies from novels, film and television.	8	3.88	9.8	3.88	11.0	
Understand at least three ways to deliver narrative content (ambient, dialogue, cut-scene, emergent) and can identify them in existing digital games.	8	3.88	10.5	3.88	11.0	
Write non-linear stories for games that involve choices on the part of the player, leading to multiple outcomes.	8	4.00	8.7	4.00	8.0	

Note. Interactive Storytelling is significant at the 0.05 level.

Table 6 (continued)

Critical Game Studies						
Objectives	N	R2 Rate	R3 Rank	M	X	*r*
Offer insight into the textual analysis of game play.	8	3.50	10.7	3.50	13.0	
Tell the difference between a game's design and its execution.	8	4.25	10.5	4.25	10.5	
Identify important designers, games, and events in game development and adoption by society.	8	4.13	9.0	4.13	8.0	
Provide exposure to a range of cultural issues, in order to broaden and deepen their engagement with practices.	8	3.38	14.3	3.38	16.5	
Provide insights into the development and use of computer games.	8	3.50	16.8	3.50	17.5	
Understand the history of computers and digital games and toys.	8	4.25	5.5	4.25	3.0	
Identify historical innovations in game play.	8	4.00	9.6	4.00	10.0	
Discuss the roles games play within a society and how specific games fulfill their roles.	8	4.00	10.8	4.00	10.5	
Develop critical literacies in novice game designers.	8	3.63	12.9	3.63	14.0	.935
Understand the historical significance of electronic and non-electronic games.	8	3.88	13.2	3.88	15.0	
Understand history of games and related issues.	8	4.00	7.9	4.00	9.0	
Discuss the history of games and identify the different game genres and important examples of each.	8	4.00	9.3	4.00	10.5	
Critique significant and influential games.	8	4.13	6.8	4.13	6.5	
Analyze a game's mechanics, including rules, narrative mechanics, social interactions, and physical affordances.	8	4.25	8.8	4.25	9.5	
Identify elements that make up a game and evaluate them as independent components.	8	4.00	7.8	4.00	7.0	
Enable novices to develop skills when applying critical practices.	8	3.38	13.1	3.38	17.5	
Demonstrate an understanding of the vocabulary for discussing games and play.	8	4.38	4.5	4.38	3.5	
Develop appropriate critical tools to the study of games.	8	4.00	7.6	4.00	6.0	
Understand the difference between game reviews, critiques, and reporting.	8	4.00	11.5	4.00	10.5	

Note. Critical Game Studies is significant at the 0.01 level.

Table 6 (continued)

Game Design						
Objectives	N	R2 Rate	R3 Rank	M	x	r
Conceive of ideas for small-scale electronic games and work alone or in a team to implement and play-test them.	8	3.75	14.8	3.75	17.0	
Distinguish critical strengths and weaknesses of various principles and methods used in computer game design.	8	4.13	10.8	4.13	10.0	
Identify major game design elements in a commercial digital game.	8	4.50	6.4	4.50	6.0	
Discuss how genres of games vary in how they utilize elements such as storytelling, mechanics, art, etc.	8	4.00	12.5	4.00	15.0	
Analyze a game (of their own or someone else's) to determine potential improvements to the game play.	8	4.13	9.5	4.13	10.0	
Understand how rule design, play mechanics, game balancing, social game interaction, and the integration of visual, audio, tactile and textual elements affect the fun or value in games.	8	4.38	5.3	4.38	4.0	
Analyze the key components of the game experience of important games.	8	4.25	10.4	4.25	11.0	.937
Discuss the interrelationship of different game elements and their impact on the game experience.	8	3.88	13.5	3.88	14.0	
Understand how computer games are designed using appropriate methods and principles.	8	4.13	10.0	4.13	12.0	
Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design.	8	4.25	9.5	4.25	9.0	
Demonstrate how games are developed as experiential tools and environments.	8	3.38	17.1	3.38	18.0	
Describe the complex interaction between video games and players and the role it plays in the popularity of a game.	8	3.38	15.8	3.38	16.0	
Provide opportunities to reflect upon the relation of game mechanics and design process.	8	4.13	13.5	4.13	16.0	

Note. Game Design is significant at the 0.05 level.

Table 6 (continued)

Game Design *continued*						
Objectives	N	R2 Rate	R3 Rank	M	x	r
Provide opportunities to reflect upon the relation of game mechanics and design process.	8	4.13	13.5	4.13	16.0	
Develop understanding of the variety of theoretical approaches to game mechanics.	8	4.13	10.6	4.13	11.0	
Identify elements that make games "fun".	8	4.13	14.0	4.13	13.0	
Construct a simple non-digital game.	8	4.63	3.7	4.63	3.0	
Explain the importance of challenge within game play.	8	4.25	10.7	4.25	10.0	
Understand the difference between mechanics, interface, narrative, visuals - as well as the interaction between them.	8	4.50	4.5	4.50	3.0	
Understand how game play, storytelling, and design affect the fun or value in games.	8	4.13	9.5	4.13	10.0	
Design an original non electronic game, including mechanics, objective and theme.	8	4.50	6.2	4.50	3.0	

Note. Game Design is significant at the 0.05 level.

Table 6 (continued)

Indie and DIY Games						
Objectives	N	R2 Rate	R3 Rank	M	X	r
Identify tools for rapid game prototyping and development, and understand what they can do with each after the course ends.	7	4.14	1.0	4.14	1.0	1.00
Students are familiar with at least three art/expressive/unusual games.	7	4.00	1.6	4.00	2.0	

Note. Indie and DIY Games is significant at the 0.05 level.

There were minimal modifications and recommendations from the review panel in reference to round four. The suggestion was made to restructure the study as there was so much information within this study; those suggestions will be noted in chapter five as a follow-up recommendation. As indicated in Table 7 below, when the rate from round two was correlated with the rank from round three, all competencies scored a negative correlation with the exception of Audio Design, while positive at .056, still reflected an absence of correlation. Overall, a moderate to high negative correlation coefficient was recorded in this analysis.

Table 7
Competencies and Objectives with Spearman's Rank Correlation Coefficient Between Mean Rate (Round Two), Mean Rank (Round Three), and Median (Round Three)

Competency	r (M rate/M rank)	r (M rank/Median)
Audio Design	.056	.765
Games and Society	-.638	.899
Game Programming	-.641	.868
Business of Gaming	-.491	.716
Usability	-.866	1.00
Visual Design	-.840	.960
Simulation Project	-.500	.500
Game Production	-.772	.942
Interactive Storytelling	-.870	.970
Critical Game Studies	-.785	.935
Game Design	-.885	.937
Indie and Do It Yourself Games	-1.00	1.00

Note. r (M rate/M rank) corresponds to the Spearman's correlation coefficient between the mean ratings from round two and the mean ranks from round three.
Note. r (M rank/Median) corresponds to the Spearman's correlation coefficient between the mean ranks from round three and their related medians.

Round Four of the Delphi Study

For the last round of the Delphi study, the survey instrument was used to determine the final consensus of the competencies and objectives kept from round three. Once the suggestions were made and approved by the review panel, the instrument was made available to the expert panelists (see Appendix F). The expert panel was instructed to either accept or reject each competency and objective, but no modifications were allowed in this instrument. Eleven panelists, or 100%, returned the instrument, though 82% (n=9) completed it fully. The data from the round four instrument was analyzed using a Chi Square nonparametric test. Each competency and objective was placed in a contingency table using the statistical software SPSS; where a probability value (p) was found for each indicator using the Chi Square test with one degree of freedom (Jayarathna, 2009). Of the ninety competencies and objectives, sixty-eight, or 75.6% were kept from round four (see Table C in Appendix F).

All competencies and objectives at a 0.05 level of significance and below (including p = 0.01 and p = 0.001) were retained for being statistically significant within this study (Jayarathna, 2009). Objectives with a p-value of greater than 0.05 did not show that consensus was achieved and were eliminated (Bax, Marwick, et.al, 2003; Jayarathna, 2009); competencies that did not achieve a p-value of 0.05 or were left with less than two objectives were discarded as well, as a competency requires at least two objectives to remain valid (NERC, 2007). Games Beyond Entertainment and Usability were eliminated because the corresponding objectives scored a low Chi Square value (X = 1.600); their scores aligned with the non-significant values.

Again, as reported in Table 8, the Accepts and Rejects from round four are displayed with the corresponding Chi Square value for each competency. Competencies scoring lower than 3.84 were discarded for non-significance; these values were not significant enough to retain (Jayarathna, 2009; Bax, Marwick, Molhoek, et.al, 2003). Those competencies with no value for the Chi Square were the highest scoring, with the most significance at the 0.001 level.

Table 8.

Round Four Accepts and Rejects with Chi Square Value (X) for Competencies

Competency List	N	Accept	% Accept	Reject	% Reject	X
Game Design	9	9	100.0	0	0.0	-
Visual Design	9	9	100.0	0	0.0	-
Interactive Storytelling	9	8	88.9	1	11.1	6.400
Game Production	9	9	100.0	0	0.0	-
Critical Game Studies	9	7	77.8	2	22.2	3.600
Games and Society	9	7	77.8	2	22.2	3.600
Game Programming	9	9	100.0	0	0.0	-
Usability	9	7	77.8	2	22.2	1.600
Audio Design	9	9	100.0	0	0.0	-
Business of Gaming	9	9	100.0	0	0.0	-
Simulation Project	9	4	44.4	5	55.6	.000
Games Beyond Entertainment	9	3	33.3	6	66.7	1.600

Note. Competencies with a '-' had no Chi-Square calculation because of a perfect score.

Table 9 fully outlines the competencies and objectives, along with the Chi Square and p-values for each. This list was pared down based on whether the objectives displayed consensus. This set of competencies and objectives in Table 9 were considered certifiable because each one remained after this fourth and final round, and lasted through the entire Delphi processes of modifications and multiple statistically-based eliminations.

Table 9.

Round Four Objectives and Competencies with Chi Square (X) and P-Values (p).

	X	P
Games Beyond Entertainment		
Offer opportunities for students to engage with games as learning systems, training systems, marketing systems, etc.	4.455	0.05
Audio Design		
Understand the impact of sound and music on the overall game experience.	4.455	0.05
Gain experience in the application of sound within a game design context.	-	0.001
Create and utilize sound effects and voice into a game.	7.364	0.01
Games and Society		
Understand how cultural values affect computer games.	-	0.001
Understand the social issues of computer games.	6.400	0.05
Understand the psychological impact of computer games.	6.400	0.05
Game Programming		
Develop appreciation of programming and issues relevant to computer games.	-	0.001
Provide a basic exposure to pragmatic game development processes.	-	0.001
Understand why certain programming methods are used.	-	0.001
Implement designs within the constraints of technical development.	6.400	0.05
Business of Gaming		
Create and present business summaries and market pitches of imagined or actual games.	-	0.001
Demonstrate understanding of the business issues behind computer games.	6.400	0.05
Write a business plan for a game including platform choice and monetization strategies.	6.400	0.05
Describe the importance of professional ethics and legal responsibilities.	6.400	0.05
Usability		
Understand the usability issues of game design.	6.400	0.05
Create and run small usability tests of game play.	-	0.001
Visual Design		
Demonstrate an understanding of the terminology, methodology, and creation process of various visual art disciplines.	-	0.001
Create drawings and illustrations in both electronic and non-electronic form.	-	0.001
Provide a basic survey of art and design practices, such that students can develop practical visual literacies.	6.400	0.05

Table 9 (continued)

	X	P
Demonstrate understanding of visual design strategies.	6.400	0.05
Recognize key art and design styles and their influence on important games.	6.400	0.05
Explain the importance of brainstorming, experimentations, and pre-visualization during the creation process.	6.400	0.05
Create screen mockups and layouts for a game's user interface.	6.400	0.05
Game Production		
Describe the importance of communication to the design process and give examples of effective communication methods.	6.400	0.05
Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.	-	0.001
Recognize the value and importance of team collaborative work.	6.400	0.05
Understand the basics of game project management.	6.400	0.05
Develop design documents along with, if possible, a real game design project.	6.400	0.05
Develop students' capacity to structure and manage their own projects.	6.400	0.05
Describe the pipeline of a video game from conception to customer support.	-	0.001
Interactive Storytelling		
Identify key storytelling techniques or structures in games.	6.400	0.05
Demonstrate understanding of narrative theory.	6.400	0.05
Design a simple participatory story.	-	0.001
Discuss the interrelationship/conflict between story & game play.	-	0.001
Critical Game Studies		
Demonstrate an understanding of the vocabulary for discussing games and play.	-	0.001
Critique significant and influential games.	6.400	0.05
Identify elements that make up a game and evaluate them as independent components.	6.400	0.05
Analyze a game's mechanics, including rules, narrative mechanics, social interactions, and physical affordances.	-	0.001
Identify important designers, games, and events in game development and adoption by society.	6.400	0.05
Discuss the history of games and identify the different game genres and important examples of each.	6.400	0.05
Identify historical innovations in game play.	6.400	0.05
Game Design		
Understand the difference between mechanics, interface, narrative, visuals - as well as the interaction between them.	6.400	0.05

Table 9 (continued)

	X	P
Understand how rule design, play mechanics, game balancing, social game interaction, and the integration of visual, audio, tactile and textual elements affect the fun or value in games.	-	0.001
Design an original non electronic game, including mechanics, objective and theme.	6.400	0.05
Identify major game design elements in a commercial digital game.	-	0.001
Analyze a game (of their own or someone else's) to determine potential improvements to the game play.	-	0.001
Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design.	-	0.001
Develop understanding of the variety of theoretical approaches to game mechanics.	6.400	0.05
Distinguish critical strengths and weaknesses of various principles and methods used in computer game design.	6.400	0.05

Table 9 (continued)

Competency List		
	X	P
Game Design	-	.001
Visual Design	-	.001
Interactive Storytelling	6.400	.05
Game Production	-	.001
Game Programming	-	.001
Audio Design	-	.001
Business of Gaming	-	.001

Note. Competencies with a '-' had no Chi-Square calculation because of a perfect score.

This study began with a list of nine core topics, which were broken down and fashioned into competencies as the research progressed. There were eight additions to the original nine: Usability, Career Readiness, Studio Practice, Computer Technologies, Indie and Do It Yourself Games, Simulation Project, Games Beyond Play and Physical Interfaces. As each round progressed, the now seventeen competencies were expanded and refined towards what exists as the final list. The competency list at the end is comprised of seven competencies – none of the eight additions were statistically significant enough to withstand the rigor of all four rounds; two of the original topics – Games and Society and Critical Game Studies, were discarded for lack of significance at the fourth round. Thus, the resulting competency list for a Game Art and Design course framework is as follows: Game Design, Visual Design, Interactive Storytelling, Game Production, Game Programming, Audio Design and Business of Gaming.

In response to the second research question examining which objectives would correspond with the competency list, a succinct and statistically sound listing of competencies and objectives now exists. This list, created solely by the expert panelists from IGDA's Game Education Special Interest Group, is comprised of seven competencies and thirty-seven objectives. Though three sets of objectives were calculated as being statistically significant, they were discarded because the overall competency was not significant. Furthermore, one competency – Games Beyond Entertainment – was discarded for a lack of objectives.

The members of the review panel and expert panel were contacted with a thank you letter for participation in this Delphi study; they were also given a copy of the final competency and objective list for a high school Game Art and Design course and were given the option to be listed in the document as a study participant (see Appendix G).

Chapter Summary

This chapter illustrated the findings from the four rounds of the Delphi method used in this study to identify a list of essential competencies and objectives for a high school

Game Art and Design course. These competencies and objectives were created based on IGDA's core topics, and experts from the organization populated the selection of panelists. The four rounds conducted in this study were explained along with each analysis technique that was utilized. The three research questions, as addressed throughout the study and data compilation, were as follows: What core competency areas can be created in addition to each Core Topic in IGDA's game-related Technology Education curriculum, what objectives will correspond with the impending competency list created from IGDA's game-related Technology Education curriculum and does the Delphi Method clearly identify curriculum competency and objective areas for a Game Art and Design curriculum at the secondary level?

Round one explained the purpose of the study and outlined the aim, which was to build upon the existing IGDA core topics for a gaming curriculum by creating objectives for the existing competencies and created additional competencies. The purpose of round two was to rate each competency and objective brought over from round one. In round three, the expert panelists ranked each competency and objective from the previous round, and a statistical comparison between the statistical ranking and the actual ranking was employed to demonstrate that consensus was being achieved. In the final round, round four, the expert panel members were allowed to accept or reject each objective and competency as a measure of creating a final consensus. The Spearman's Rank Correlation Coefficient was used in tandem with a Chi Squared analysis to verify that consensus was being met and the final list of competencies and objectives was statistically sound.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter contains summaries of the sections related to the overall research methodology used to identify essential competencies and objectives for a high school Game Art and Design course framework at the national level. Recall that the initial core topic list was created for the post secondary level, but this study gathered experts to create a course framework for the secondary level, providing an answer to a need that had not been met. This is outlined as restating the problem and purpose of the study, as well as the methodology employed to identify and achieve consensus on the competencies and objectives. The final sections of this chapter identify the overall research findings of the study, draw conclusions, state implications and promote recommendations. The three research questions were all addressed via this study: What core competency areas can be created in addition to each Core Topic in IGDA's game-related Technology Education course framework for the secondary level, what objectives will correspond with the impending competency list created from IGDA's game-related Technology Education course framework for the secondary level and does the Delphi Method clearly identify curriculum competency and objective areas for a Game Art and Design course framework at the secondary level?

The competencies and objectives answered research question number one and two as to defining essential competencies and objectives for a high school Game Art and Design curriculum based on IGDA's core topics Version 3.2 beta. Each competency and objective was identified through consensus-drawing methods, and identified through the Delphi process by using experts in the fields of Gaming, Computer Science, Engineering, and Instructional Technology. Through the four-round Delphi method, the results of the study were shown to produce seven competencies and thirty seven objectives (see Table 10). These results were important because up to this point, there was no set of IGDA-based competencies for the high school level, and there were no objectives – all of this is newly generated information. The remaining set of competencies and objectives were not only a relevant base for a high school Game Art and Design course framework, but they were also statistically sound. These were deemed appropriate via the use of experts in the aforementioned fields and through the research methods utilized in this study.

Table 10.

Final Compilation of Statistically Significant Competencies and Objectives

Audio Design
Understand the impact of sound and music on the overall game experience.
Gain experience in the application of sound within a game design context.
Create and utilize sound effects and voice into a game.
Game Programming
Develop appreciation of programming and issues relevant to computer games.
Provide a basic exposure to pragmatic game development processes.
Understand why certain programming methods are used.
Implement designs within the constraints of technical development.
Business of Gaming
Create and present business summaries and market pitches of imagined or actual games.
Demonstrate understanding of the business issues behind computer games.
Write a business plan for a game including platform choice and monetization strategies.
Describe the importance of professional ethics and legal responsibilities.
Visual Design
Demonstrate an understanding of the terminology, methodology, and creation process of various visual art disciplines.
Create drawings and illustrations in both electronic and non-electronic form.
Provide a basic survey of art and design practices, such that students can develop practical visual literacies.
Demonstrate understanding of visual design strategies.
Recognize key art and design styles and their influence on important games.
Explain the importance of brainstorming, experimentations, and pre-visualization during the creation process.

Table 10 (continued)

Create screen mockups and layouts for a game's user interface.
Game Production
Describe the importance of communication to the design process and give examples of effective communication methods.
Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
Recognize the value and importance of team collaborative work.
Understand the basics of game project management.
Develop design documents along with, if possible, a real game design project.
Develop students' capacity to structure and manage their own projects.
Describe the pipeline of a video game from conception to customer support.
Interactive Storytelling
Identify key storytelling techniques or structures in games.
Demonstrate understanding of narrative theory.
Design a simple participatory story.
Discuss the interrelationship (or conflict) between story and game play.

Table 10 (continued)

Game Design
Understand the difference between mechanics, interface, narrative, visuals - as well as the interaction between them.
Understand how rule design, play mechanics, game balancing, social game interaction, and the integration of visual, audio, tactile and textual elements affect the fun or value in games.
Design an original non electronic game, including mechanics, objective and theme.
Identify major game design elements in a commercial digital game.
Analyze a game to determine potential improvements to the game play.
Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design.
Develop understanding of the variety of theoretical approaches to game mechanics.
Distinguish critical strengths and weaknesses of various principles and methods used in computer game design.

Conclusions

Questions one and two of this study addressed creating competencies and objectives for a high school Game Art and Design curriculum at the national level, specifically: (1) what core competency areas can be created in addition to each Core Topic in IGDA's game-related Technology Education curriculum and (2) what objectives will correspond with the impending competency list created from IGDA's game-related Technology Education curriculum? These two research questions were examined via the Delphi process performed within this study. Chapter four addressed the third research question, regarding whether or not the Delphi Method clearly identified curriculum competency and objective areas for a Game Art and Design curriculum at the secondary level. The question focused on the Delphi process itself – does the Delphi Method clearly identify curriculum competency and objective areas for a Game Art and Design curriculum at the secondary level? At its conclusion, the four rounds of the Delphi study completely addressed all three research questions; the panel of experts created a list of competencies and objectives to be taught within a high school Game Art and Design course framework at the national level.

Within this study, the Delphi process was used to identify the newly created competencies and objectives for a high school Game Art and Design course framework. The necessary information was achieved within the study through the use of consensus-drawing procedures utilizing experts from the fields of Gaming, Education, Computer Science and Engineering. The statistical tests applied during the research process – Spearman's Rank Correlation Coefficient and Chi Squared – ensured that correlation concerning descriptive statistical measures were being achieved during the study. It also provided assurance that the consensus-gathering approaches used within this study were working.

Implications of the Research

Bearing examination are the implications of the findings and conclusions of this study. One major implication for the findings and conclusions of this study is what this list of competencies and objectives add to the educational gaming and technology education bodies of literature. At the time of this study, IGDA sponsored a list of core topics to be used in a post-secondary gaming classroom, yet nothing was targeted towards the high school level. This list of competencies and objectives is potentially useful. Since a panel of experts created the list of competencies and objectives, it is already appropriate and could be utilized immediately. As a second implication, take into account that the review of literature in chapter two displayed a need in the area of educational gaming curricula, particularly one based on IGDA, a collective body of experts in the gaming field. This research not only contributes to the field of educational gaming, but it is relevant to Technology Education, Career and Technical Education and Game Art and Design as well. With respect to the field of curriculum & instruction, the innovative and unique nature of educational gaming provides the atmosphere of individualized, rather than standardized curricula examples. The results of this study not only provide a set of competencies and objectives created by experts within the field, but it adds to the body of literature, thereby lending support to the gaming and education field.

Research has shown that there is intrinsic value in implementing game-based instruction into the educational setting. In 2009 the Entertainment Software Association

(ESA) reported that sixty-eight percent of households in the United States play computer or video games. It would be meaningful to not only capitalize on this trend, but to ensure that it is introduced into the learning environment as seamlessly and soundly as possible. A fifth implication takes the structure of the present-day classroom into account. Because of the immersion of video games as learning aids in the 21st century classroom, a formal list of necessary competencies and objectives, as unearthed through the results of this study, will be largely beneficial to the field of gaming education. Regarding the competency Business of Gaming, it should be noted that the confidence of the results is in question based on the modified scale within the survey instrument. This error was due in part of the researcher and the review panelists.

For a seventh implication, using the results of this study as a platform for ensuing Game Art and Design curricula is advisable. Because this study not only used experts, but utilized them in tandem with consensus-building techniques and statistical analyses, it is appropriate and fully functional. The results can be used as a stand-alone outline for a Game Art and Design course, or they can be used to bolster existing courses that may be lacking the wealth of knowledge combined within this competency and objective list. It is advisable, as an eighth implication, to consider utilizing this list to design a high school course and collect data on results when implemented with the target population. This competency and objective list may be more helpful than current curricula outlines, and that information is worth noting.

An ninth implication is to consider the structure of the competency and objective list as future Game Art and Design platforms are created. The objectives are listed as they scored, and this outline encompasses a certain flow of information. It is advisable to cover all objectives within a competency if it is taught in the classroom. Each objective was statistically significant and therefore would greatly contribute to the overall efficacy of the Game Art and Design learning experience. A tenth implication regards the panelists, where the majority was more familiar with the post secondary level teaching than the secondary level. One hundred percent of the panelists understood instructional design, though the data are comprised of high level objectives. These objectives may need tailoring when it comes to implementing them within the classroom. Additionally, a final implication would be the relevance to multiple gaming platforms. This set of competencies and objectives is not specific to one particular software or program suite; the principles and objectives are neutral, thereby providing the opportunity to be utilized among various educational gaming avenues.

Future Research

The outcome and results of this study are used to determine how the researcher would institute things differently, considering if this study or a similar one were to be conducted in the future.

1. First, the researcher suggests utilizing a larger panel of experts for this study. It would be worth examining the modifications and updates that a larger panel of experts would undoubtedly provide. A larger panel also might provide diversity in more areas of expertise, which could provide noteworthy results. Larger panel numbers may also enhance the information collected.
2. Second, the researcher suggests using two panels of experts from two different organizations. Because IGDA is combined with industry members, educators and

researchers, it would provide interesting data to compare their results with those of a more practitioner-based organization.

3. Once the study is investigated with two panels of unrelated experts, conclusions should be drawn as to the viewpoints, and how to make them functional. Literature shows that game programmers rarely, if ever, consult with educators before placing materials into the classroom. Comparing the results would emphasize the varying points of view while highlighting what is necessary to ensure both sides have a complete picture of how a Game Art and Design framework should be presented.
4. As a fourth implication, while the competencies with statistically significant Chi-squared results were kept, many objectives within lower scoring competencies were discarded and may prove to be great additions to a Game Art and Design course framework (see List 1 in Appendix F). In addition to discards due to low scoring competencies, there was also a discard due to having only one objective. All of the competencies and objectives listed below made it to round four, indicating that there was a strong correlation from round two to round three, yet there was not enough statistical significance to withstand and remain for round four; each was discarded because the competencies were discarded. This does not indicate, however, that the objectives are not relevant. It is the researchers' recommendation that if possible, the some of the remaining objectives be worked into the competencies that did withstand all four Delphi rounds and statistical analyses.
5. Now that a high school Game Art and Design framework for course design exists based on IGDA's core topics Version 3.2 beta, it would be advisable to incorporate

this list of competencies and objectives into a Game Art and Design classroom. There is definitive value in observing the usefulness of this list and whether it is fully functional at the secondary level.

Recommendations

The researcher has suggested numerous implications and has given recommendations for future research in the areas of technology education, game education and Game Art and Design. The following recommendations are to be developed for further study. Suggestions include tactics for future research, strategies for replication and ways the results can be implemented into various educational settings.

To begin with, it is advised that the review panel be more involved in the expert panel selection process via approving the demographic questions used in the demographics questionnaire. Garnering the review panel approval at this step could provide the assurance that the information and participants assembled are both relevant and necessary to the research.

A study of this type could be carried out every two to three years, as the educational gaming culture and climate changes at a rapid pace. Continually updating this competency and objective list will ensure currency in the subject matter, as well as a semblance of guaranteeing that learners will be competitive in the contemporary job market. If this study is repeated, all results are recommended to be used as a platform for formatting a high school Game Art and Design framework for course design. If implemented into a high school culture, a secondary study could be done to measure student accomplishment of the competencies. It would be permissible to resume this study by using the same research questions and using a different method, though in this study, the Delphi was successful in answering all proposed research questions. It would, however, be of value to note the differences that arise from utilizing a different method of gathering data.

Because these results were created by experts in the field, this Game Art and Design course framework can be formatted into textbook form, or at the very least, used as an aid for teaching with the current textbooks used in a high school Game Art and Design courses. Materials within used in a Game Art and Design course framework are recommended to be updated regularly in order to keep the pace with current trends. If it is not possible to overhaul existing high school Game Art and Design related courses, this competency and objective list can be used as a model for the reorganization of existing courses. Similarly, this high school Game Art and Design competency and objective list can be used as a recommended topic and outline flow. As a final recommendation, because this competency and objective list is based off of the IGDA framework, it would be worth noting how it compares to current high school Game Art and Design curricula that exist independent of IGDA.

Chapter Summary

Educational gaming is a field that changes rapidly, and students that choose to expand their knowledge in this area are entitled to an education that not only enhances their knowledge base, but prepares them for the future job market or further educational pursuits. The field of educational gaming is still relatively new, yet there are not many consistent resources related to the implementation of secondary level courses and curricula in this area.

All three research questions were answered in their entirety. As formerly stated, the purpose of this study was to use the core topics created by IGDA (2008) and generate a set of competencies and objectives for a high school Game Art and Design course framework, while utilizing the Delphi method to achieve this goal. Similarly, recall that there was no set of competencies for the high school level, and the objectives that were gathered were not in existence before this study was conducted.

The implications of this research are wide and potentially far-reaching, in addition to being the first ever high school based course framework created from the formalized core topic list from IGDA (2008). Implications include, but are not limited to: a list of competencies and objectives for the high school Game Art and Design classroom based on the IGDA core topics Version 3.2 Beta; contemporary contributions to educational gaming, game education, technology education, Game Art and Design, and vocational education; a piece of literature that has the potential to address a need in the educational gaming field and; results that can be tailored to multiple educational gaming platforms. This is the first set of objectives developed with expert input to correspond with the IGDA competencies. As more high schools add Game Art and Design as a course, this could be an important contribution in the development of the course(s).

As proposed, a list of essential competencies and objectives was created based on the IGDA core topic list via the Delphi method. This body of work will be able to serve as a guidebook for subsequent Game Art and Design course frameworks – not only now, but in future years as well.

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Appendix

Appendix A

Email to Susan Gould of the IGDA
Response from Susan Gould of the IGDA
Email from Bill Crosbie, IGDA Game Education SIG Leader
All Call for Participation
Informed Consent

1224 Afton Meadow Lane
Cary, NC 27518

September 1, 2008

Susan Gold
International Game Developers Association
19 Mantua Road
Mt. Royal, NJ 08061

RE: IGDA Curriculum Framework, Version 3.2 beta, February 2008

Dear Ms. Gold,

My name is Nayo Mack and I am a third year doctoral student in the Technology Education program at North Carolina State University. I have been following the IGDA framework on the study of games and game development, and I am very excited about the newest version that was released in February of this year.

My doctoral research has been very similar to what the special interest group has created. Your document was created with the post-secondary level institution in mind; however, I am interested in developing a gaming curriculum for the secondary level. As such, I am seeking your permission to use your core topics as a foundation to build my research on. I will use your topics as a basic frame to structure my research, but I will redefine them for a holistic secondary-level approach. My research methodology will be carried out by using a conventional Delphi study to uncover essential components of each core topic at the secondary level. I would like to implore the aid of the special interest groups or anyone else that is a member of IGDA at the appropriate time – once my topic is formally approved! I can promise the participants confidentiality throughout the process, but not anonymity since I will be analyzing each response.

Again, I am excited about the possibility of utilizing your research for further study, and I look forward to your response. I can be contacted at (919) xxx-xxxx or ncmack@ncsu.edu. Thank you for your time and consideration.

Sincerely,

Nayo C-G Mack

Nayo C-G Mack

September 2, 2008

Dear Nayo,

Thank you much for asking to use the IGDA Education SIG Curriculum Framework as a part of your doctoral research studies. You are more than welcome to use the document as the backbone to creating a secondary school version. You should note that our document was not developed by just one person, but by many, with years of experience to guide them in the choices and language provided within. I highly suggest working with members of the game industry as your project evolves. Another recommendation would be finding ways to associate STEM education into the fabric of your dissertation.

Please feel free to contact me or the listserv with questions.

Sincerely,

Susan
--
Prof. Susan Gold
Chair, IGDA Education SIG

"It is the supreme art of the teacher to awaken joy in creative expression and knowledge." - Albert Einstein

From: Bill Crosbie - bill.crosbie@gmail.com

Date: 15 October 2010 6:22:29 AM

To: "game_edu@igda.org" game_edu@igda.org

Subject: [game_edu] Call for Participation - Doctoral research for game curriculum at high school level

Reply-To: IGDA Game Education Listserv <game_edu@igda.org>
Greetings everyone,

(some things are too good to hold back on, so the steering committee decided to forward this on rather than hold back until an 'official communique' dealing with organizational structure had been released.)

An interesting opportunity has opened up to have an impact on game education at the high school level. Nayo C-G Mack had contacted Susan several years ago about requesting participation from the list as he was starting his coursework. He is now at the research phase of his degree. If you have the time to spare a few processor cycles to an excellent cause, consider contributing your knowledge to his study.

And, Nayo, welcome to the list. I think you'll appreciate the highly thoughtful nature of our community.

Bill Crosbie

Nayo C-G Mack
ncmack@ncsu.edu
CALL FOR PARTICIPATION

Dear Game Education SIG Member,
I need your assistance with a study I am currently conducting. The study seeks to define essential competencies and objectives for a high school Game Art and Design curriculum, and I have been given permission to build upon the Curriculum v3.2 from February of 2008.

This is the topic of my dissertation for the Technology, Engineering & Design Education program at North Carolina State University. For this study, I need a panel of experts and a review panel from post-secondary institutions experienced in teaching gaming-related courses and/or developing technology based courses for high schools. The information collected from the experts will be compiled into a list of essential competencies and will serve as a sample curriculum for a high school Game Art and Design course.

In order to gather the information needed in this study, a web-based Delphi will be utilized. The Delphi methodology is a survey-based process consisting of rounds of questioning; each subsequent round is developed from the responses of the previous round. Additionally, weights will be assigned to the competencies and objectives in the third round for a more complete curriculum example. This study will consist of four rounds of questioning. Each round should only take ten to fifteen minutes to complete and each participant will have one week from the date the survey is granted to complete and submit the survey. Instructions for each round will be included.

For your participation, you will be given an advanced copy of the high school Game Art and Design curriculum prior to any publications from my dissertation. You will also have the liberty of being named as an Expert Panelist in my dissertation, displaying your dedication to the continuing development of this field.

If you would like to be considered for participation in this study, please reply to me via email by typing “Agree to Participate” in the subject line. My email address is ncmack@ncsu.edu.

Thank you in advance for your willingness to participate in this study.

Best Wishes,
Nayo C-G Mack
Technology, Engineering & Design Education – Ed.D. Program
North Carolina State University

North Carolina State University
INFORMED CONSENT FORM for RESEARCH

Title of Study: A study using the Delphi method to define essential competencies for a high school Game Art and Design curriculum at the national level

Principal Investigator: Nayo C-G Mack   Faculty Sponsor: Dr. Aaron C. Clark; Dr. Jeremy Ernst

We are asking you to participate in a study. The purpose of this study is to define essential competencies and objectives for a high school Game Art and Design curriculum at the national level.

INFORMATION

If you agree to participate in this study, you will be asked to participate in a web-based Delphi study. This Delphi study will consist of four rounds of questions. These questions are posed to a group of experts in the field of Technology Education in an effort to reach consensus in defining essential competencies and objectives for a high school Game Art and Design curriculum. Although this study will span many weeks, you are only asked to complete four rounds, which will take approximately 10-15 minutes per round.

RISKS

There are no risks associated with completing this research survey.

BENEFITS

The panelists will help create a document that is potentially groundbreaking in the gaming education curriculum arena; panelists will also receive a copy of the final list they help to create.

CONFIDENTIALITY

The information in the study records will be kept confidential to the full extent allowed by law. Data will be stored securely in an off-campus location in a locked file cabinet. No reference will be made in any report, which could link your responses to the study. After all study data is collected, all identifiable information will be removed and replaced with numerical codes to further ensure confidentiality.

CONTACT

If you have any questions at any time about the study or the procedures you may contact the researcher, Nayo C-G Mack at ncmack@ncsu.edu.

PARTICIPATION

Your participation in this study is voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the study at any time without penalty. Once you agree to participate and are sent a round of the Delphi, I will send out a courtesy reminder if your responses are not received by the due date.

PARTICIPANT RIGHTS

If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Deb Paxton, Regulatory Compliance Administrator, Box 7514, NCSU Campus (919/515-4514).

CONSENT

"I have read and understand the above information and confirm that I am at least 18 years of age. You can print a copy of this form to keep for your records. I agree to participate in this study with the understanding that I may choose not to participate or to stop participating at any time without penalty or loss of benefits to which I am otherwise entitled." Please respond to this email with an acceptance or rejection. A non-response will signify a rejection of participation. A response of "Agree to Participate" will signify an acceptance to participate in this study.

SUBJECT'S SIGNATURE____ **Date** _________________

INVESTIGATOR'S SIGNATURE___________________________________ **Date** _________________

Appendix B

IRB Materials

IRB#

North Carolina State University
Institutional Review Board for the Use of Human Subjects in Research

REQUEST FOR EXEMPTION (Administrative Review)

GENERAL INFORMATION

1.	**Date Submitted:** *08/23/10*
2.	**Title of Project:** *A study using the Delphi method to define essential competencies for a high school Game Art and Design curriculum at the national level.*
3.	**Principal Investigator:** Nayo C-G Mack
4.	**Department:** *Math, Science & Technology Education*
5.	**Campus Box Number:** *Box 7801*
6.	**Email:** *ncmack@ncsu.edu*
7.	**Phone Number:** *(919) xxx-xxxx*
8.	**Fax Number:** *n/a*
9.	**Faculty Sponsor Name and Email Address if Student Submission:** *Dr. Aaron C. Clark aaron_clark@ncsu.edu and Dr. Jeremy V. Ernst Jeremy_Ernst@ncsu.edu*
10.	**Source of Funding? (required information):** *n/a*
11.	**Is this research receiving federal funding?** *No*
12.	**If Externally funded, include sponsor name and university account number:** *n/a*
13.	**RANK:** ☐ Faculty: ☐ Student: Undergraduate; ☐ Masters; or ☒ PhD ☐ Other (specify):

As the principal investigator, my signature testifies that I have read and understood the University Policy and Procedures for the Use of Human Subjects in Research. I assure the Committee that all procedures performed under this project will be conducted exactly as outlined in the Proposal Narrative and that any modification to this protocol will be submitted to the Committee in the form of an amendment for its approval prior to implementation.

Principal Investigator:

Nayo C-G Mack ________________________________* __________

(typed/printed name) (signature) (date)

As the faculty sponsor, my signature testifies that I have reviewed this application thoroughly and will oversee the research in its entirety. I hereby acknowledge my role as the ***principal investigator of record****.*

Faculty Sponsor:

Dr. Aaron C. Clark ________________________________* __________

(typed/printed name) (signature) (date)

Dr. Jeremy V. Ernst ________________________________* ________

(typed/printed name) (signature) (date)

***Electronic submissions to the IRB are considered signed via an electronic signature**

PLEASE COMPLETE AND DELIVER TO:

(carol_mickelson@ncsu.edu) or Institutional Review Board, Box 7514, NCSU Campus (Administrative Services III, Room 245)

****

For SPARCS office use only Regulatory Compliance Office

Disposition

☐ Exemption Granted ☐ Not Exempt, Submit a full protocol

Exempt Under: ☐ b.1 ☐ b.2 ☐ b.3 ☐ b.4 ☐ b.6

______________________________________ ________________________

IRB Office Representative Date

Project Description: *Describe your project by providing a summary and answering the requests for information below.*

1. Project Summary. Please make sure to include the purpose and rationale for your study as well as a brief overview of your study.

   The purpose of this survey-based study is to develop a list of essential competencies that would be taught in a Game Art and Design high school curriculum based on the IGDA Core topics by utilizing the Delphi method. This list of competencies and corresponding objectives will serve as a curriculum guide for subsequent gaming, game education and/or Game Art and Design courses at the high school level. This list of competencies and objectives will be created by content experts from the Game Education Special Interest Group (SIG) of the International Game Developers Association (IGDA).
2. Description of participant population, including age range, inclusion/exclusion criteria, and any vulnerable populations that will be targeted for enrollment.

   Participants will be randomly selected from interested respondents of the Game Education SIG of the IGDA, which are comprised of gamers, designers, University faculty, industry leaders and students; however, no students will be allowed to participate in this study to ensure that participants are practiced experts. Criteria for participation in this study include having earned a Bachelor's degree or higher, years of experience with gaming, years of experience with teaching and experience in course development.
3. Description of how potential participants will be approached about the research and how informed consent will be obtained.

   Potential participants will be approached and recruited about the study through email. This email will be an all call for participation to the IGDA Game Education SIG listserv. The information in the email will consist of the purpose, significance and rationale for the study as well as the research methodology to be utilized in collecting the data. Consent will be obtained from participant email responses with an *acceptance*, *rejection* or a *none* response about research participation. Please see attached recruitment materials.
4. Description of how identifying information will be recorded and associated with data (e.g. code numbers used that are linked via a master list to subjects' names). Alternatively, provide details on how study data will be collected and stored anonymously ("anonymously" means that there is no link whatsoever between participant identities and data).

   The researcher will have a master list of participants that will be concealed off of NCSU's campus in a locked file cabinet. The participants will remain anonymous to one another throughout the study. The demographics information collected for the master list will only be used to identify those that meet the criteria for participation in this survey-based study. The master list will not be used to identify those that have or have not completed the survey. The master list will be destroyed at the conclusion of the study once all results are finalized.

5. Provide a detailed (step-by-step) description of all study procedures, including descriptions of what the participants will experience. Include topics, materials, procedures, for use of assessments (interviews, surveys, questionnaires, testing methods, observations, etc.).

   This study will use the Delphi methodology for data collection which will consist of four rounds of questioning. After the first round, subsequent instruments developed for this study will be based on responses from the previous survey round. The topics to be included throughout the study include games and society, games and design, interactive storytelling and game production. The initial survey received by potential participants will be a demographics questionnaire consisting of questions about their educational background and experiences with gaming, developing and/or teaching gaming courses. As the rounds of questions continue, the responses will be aggregated and condensed, ultimately creating a list of competencies and objectives that would be taught in a Game Art and Design high school curriculum based on the IGDA Core topics.

6. Will minors (participants under the age of 18) be recruited for this study: No

7. Is this study funded? No If yes, please provide the grant proposal or any other supporting documents.

8. Is this study receiving federal funding? No

9. Do you have a significant financial interest or other conflict of interest in the sponsor of this project? No

10. Does your current conflicts of interest management plan include this relationship and is it being properly followed? No

11. **HUMAN SUBJECT ETHICS TRAINING**
*****Please consider taking the Collaborative Institutional Training Initiative (CITI), a free, comprehensive ethics training program for researchers conducting research with human subjects. Just click on the underlined link.

12. **ADDITIONAL INFORMATION:**
a) If a questionnaire, survey or interview instrument is to be used, attach a copy to this proposal.
Please see the Demographic Survey
b) Attach a copy of the informed consent form to this proposal.

c) Please provide any additional materials (i.e., recruitment materials, such as "flyers", recruitment scripts, etc.) that may aid the IRB in making its decision.

**If a survey instrument or other documents such as a consent form that will be used in the study are available, attach them to this request. If informed consent is not necessary, an information or fact sheet should be considered in order to provide subjects with information about the study. The informed consent form template on the IRB website could be modified into an information or fact sheet.*

The Following are categories the IRB office uses to determine if your project qualifies for exemption ***(a review of the categories below may provide guidance about what sort of information is necessary for the IRB office to verify that your research is exempt)***:

Exemption Category: *(Choose only one of the following that specifically matches the characteristics of your study that make this project exempt)*

☒ 1. Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

☐ 2. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation. ***Please Note- this exemption for research involving**

survey or interview procedures or observations of public behavior does not apply to research conducted with minors, except for research that involves observation of public behavior when the investigator(s) do not participate in the activities being observed.

☐ 3. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

☐ 4. Research, involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

5. Not applicable

☐ 6. Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration, or approved by the Environmental Protection Agency, or the Food Safety and Inspection Service of the U.S. Department of Agriculture.

Study Overview

Dissertation Title
A study using the Delphi method to define essential competencies for a high school Game Art and Design curriculum at the national level

Doctoral Researcher: Nayo C-G Mack
University: NCSU, College of Education, Department of Math, Science & Technology Education
Major: Technology, Engineering and Design Education

Introduction
According to the Federation of American Scientists, educational games could teach many things in an engaging and motivating manner, including, but not limited to, higher order thinking skills, practical skill training, provide high performance situations, unearth rarely used skills and develops expertise, all while promoting team building. Computer games and video games are primarily categorized as captivating forms of entertainment. Increasingly, however, they are becoming recognized as providing a powerful means for learning, both among educators and the game development community. It would be a natural progression for the field of education to continue society's technological trend and incorporate this mode of learning into the contemporary classroom learning environment.

Statement of the Problem
Because educational games are viewed as having instructive potential in the contemporary classroom, there need to be competencies that clearly delineate the most effective integration route. The research guiding this study is the absence of recognized and validated gaming competencies in the secondary level curriculum for gaming in the United States. As of now, the vast majority of literature pertaining to gaming courses is concerning those at the post-secondary (College/University) level. From this research, a list of competencies for a high school general gaming course will be generated at the conclusion of this study; therefore, this study seeks direction to begin to answer the research question: What are the appropriate curriculum competencies for a Game Art and Design curriculum for technical education in the United States?

Purpose of the Study
The purpose of this study is to create a list of essential competencies that would be taught in a Game Art and Design high school curriculum based on the IGDA Core topics by utilizing the Delphi method. The finished product – a list of essential competencies – will not serve as a curriculum itself, but rather can be used as a catalyst for subsequent high school gaming courses. This will be done by utilizing experts to help define what the competency areas will be via a consensus (in the form of the web-based Delphi method) based on an initial competency list created from the IGDA essential components list from 2006. Objectives will also be created to correspond with each competency.

Research Questions
The questions guiding this study are as follows:

1. What core competency areas can be created in addition to each Core Topic in IGDA's game-related Technology Education curriculum?
2. What objectives will correspond with the impending competency list created from IGDA's game-related Technology Education curriculum?
3. Does the Delphi Method clearly identify curriculum competency and objective areas for a Game Art and Design curriculum at the secondary level?

Instrument Accessibility
A web-based Delphi method will be used to generate and aggregate responses in an effort to reach consensus by creating a list of essential competencies and objectives that would be taught in a Game Art and Design high school curriculum based on the IGDA core topics. A Delphi is a series of interactive questions between the researcher and the study participants with the objective of obtaining consensus from expert panelists.

Appendix C

Demographics
Round One Review Panel Instructions
Round One Expert Panel Instructions
Panel Reminder Letter
Round One Instrument
Table A - Modifications and Combinations from Round One in the Creation of Round Two

Demographics Questionnaire for Delphi Study

"A study using the Delphi method to define essential competencies for a high school Game Art and Design curriculum at the national level"

Please check or fill in the following information:

What is your highest degree obtained as of August 1, 2010?
_____ B.S./B.A.
_____ M.S./M.Ed.
_____ Ed.D/Ph.D.

List the major area for each degree you hold:
Baccalaureate: ____
Masters: ____
Doctorate: ____
Other: ____

Which title most accurately describes your current position?
_____ Game designer
_____ Technology Instructor
_____ Technology Researcher
_____ Industry
_____ Other (please explain: ______________________________)

Which of the following grade level(s) do you currently teach?

_____ Middle School	_____ College/University
_____ High School	_____ I do not currently teach
_____ Community/Technical School	_____ I have never taught

How many years of experience do you have with gaming?
_____ 0-2
_____ 3-5
_____ 6-9
_____ more than 10

How many years of experience do you have with gaming in an educational capacity?
_____ 0-2
_____ 3-5
_____ 6-9
_____ more than 10

How many years of experience do you have teaching?

_____ 0-2
_____ 3-5
_____ 6-10
_____ 11-15
_____ 16-20
_____ 21-25
_____ over 25 years

Do you have any experience in course development, course construction or curriculum and instruction? If yes, please explain.
_____ Yes
_____ No
____
____

Current residence:
_____ USA _____ State/Territory
_____ Non-USA _____ Country

INSTRUCTIONS FOR ROUND I OF THE STUDY
Review Panel Members

Listed below are the instructions for completing the first round of questioning for the Delphi study. Again, this study is intended to define essential competencies for a high school Game Art and Design curriculum at the national level via the Delphi method.

Instructions: Instruments to be used throughout this study will be accessed via the web. Study participants will be given access to the study instruments for each round.

Instrument: The instrument outlines several core topic competencies to be considered when developing a high school Game Art and Design curriculum. This instrument is titled **ROUND I QUESTIONNAIRE**. The nine competencies listed were created by the International Game Development Association (IGDA). Also listed is an example of the type of [suggested] content covered within that particular competency. These competencies will serve as the beginning collection of competencies for the Game Art and Design curriculum, and the desire is to add to this collection in Round I, as well as creating objectives for each competency. As a participant on the review panel, you have accepted the responsibility of examining the Round I Questionnaire and providing feedback concerning format, clarity, jargon and accessibility. After you have received this instrument, please email me at ncmack@ncsu.edu within 48 hours with your feedback.

Thank you again for your time, expertise, and most of all, participation in this study. If you have any questions, please feel free to contact me by phone or email.

Sincerely,
Nayo C-G Mack
Doctoral Researcher, NC State University
(919) xxx-xxxx
ncmack@ncsu.edu

INSTRUCTIONS FOR ROUND I OF THE STUDY
Expert Panel Members

Expert Panel Members,
Listed below are the instructions for completing the first round of questioning for the Delphi study. Again, this study is intended to define essential competencies for a high school Game Art and Design curriculum at the national level via the Delphi method.
Instructions: You will only be able to take it once from any specific computer, so if you do not have 15 or so minutes to complete it, it is best to not open it. You will not be able to save your results and go back once you have started the Round One instrument. The Round One instrument can be accessed via the web at the following address:
http://www.surveymonkey.com/s/Round_One_Instrument

Instrument: The instrument outlines several core topic competencies to be considered when developing a high school Game Art and Design curriculum. This instrument is titled Round I Questionnaire. The nine competencies listed were created by the International Game Development Association (IGDA). Also listed is an example that clarifies the competency, along with a note that suggests the type of content covered within that particular competency. These competencies will serve as the beginning collection of competencies for the Game Art and Design curriculum, and the desire is to add to this collection in Round I. These examples currently listed on the Round I Questionnaire can be used if you select the Accept option located alongside the competency. You may also reject or modify the competency listed by selecting either the Reject option or the Modify option, also listed alongside the competency. If you select the modify option, please type your modified response in the textbox provided. Since one of the priorities for this study is to identify additional competencies for a well-rounded Game Art and Design curriculum, a textbox labeled Additional Responses has been included. Remember, there is no set number of competencies required for this study. Additionally, as you decide on the competencies, please create as many objectives to correspond with the competencies as you can.

Using the instructions provided, please complete the instrument to the best of your ability. Upon completion of the Round I Questionnaire, submit your responses. Please be sure to submit your responses by midnight on Saturday, November 27th, 2010. Thank you again for your time, expertise, and most of all, participation in this study. If you have any questions, please feel free to contact me by phone or email.

Sincerely,
Nayo C-G Mack
Doctoral Researcher, NC State University
(919) xxx-xxxx
ncmack@ncsu.edu

REMINDER TO EXPERT PANELISTS

An earnest ‘thank you’ to those of you that have responded to the research questionnaire made accessible on 11/20/2010. As an expert panelist, it is imperative for the success of this research that I receive your responses. If you have not yet had a chance to respond and would like to still participate, please complete the questionnaire by 11/27/2010 and submit it.

I am very grateful for your help and willingness to participate in this doctoral study. I am confident that the results will contribute to the field of gaming education and its growing body of literature.

Sincerely,
Nayo C-G Mack
Doctoral Researcher, NC State University
(919) xxx-xxxx
ncmack@ncsu.edu

IGDA'S NINE CORE TOPICS

SURVEY INSTRUMENT: ROUND ONE – *FORMING COMPETENCIES AND OBJECTIVES*

INSTRUCTIONS: Please review the following core topics (CT) as created by the International Game Designer's Association. You may accept, reject or modify the examples found in this data collection instrument. Please check ACCEPT to keep the competency, REJECT if you do not think the competency is appropriate, or MODIFY to re-word the competency. You may modify it by typing in the text box provided underneath each stated competency. Your main objective is to ADD more NEW competencies and objectives by typing inside the provided textbox. You may type as many NEW competencies and objectives as needed.

CT1 – Critical Game Studies

Example: Criticism, Analysis, & History of electronic and non-electronic games.

Definition: *Critical game studies offer insight into the textual analysis of game play. Also included here are: the history of computers and digital games and toys; the construction and critique of cannon of significant and influential games; and game criticism and journalism.*

_____ Accept _____ Reject _____ Modify (*write, edit or state in box below*)

____

Objective: ____
Objective: ____
Objective: ____

CT2 – Games and Society

Example: Understanding how games reflect and construct individuals and groups, as well as well as how games reflect and are constructed by individuals and groups.

Definition: *This topic offers insight into worldwide gaming culture; psychological facets of games including studies of media effects and the ongoing debate about the psychological impact of games on individuals and groups; examines how individuals and groups construct games; explores how values, identities, and cultural images shape game production.*

_____ Accept _____ Reject _____ Modify (*write, edit or state in box below*)

____

Objective: ____
Objective: ____
Objective: ____

CT3 – Game Design

Example: Principles and methodologies behind the rules and play of games.

Definition: *This topic addresses the fundamental ideas behind the design of electronic and nonelectronic games. Includes game play, storytelling, challenges and basic interactive design, including interface design, information design and world interaction. Perhaps most important is a detailed study of how games function to construct experiences, including rule design, play mechanics, game balancing, social game interaction, and the integration of visual, audio, tactile and textual elements into the total game experience.*

_____ Accept _____ Reject _____ Modify (*write, edit or state in box below*)

____
Objective: ____
Objective: ____
Objective: ____

CT4 – Game Programming
Example: Aspects of traditional computer science and software engineering – modified to address the technical aspects of gaming.
Definition: *This topic includes physics, mathematics, programming techniques, algorithm design, game-specific programming and the technical aspects of game testing.*
_____ Accept _____ Reject _____ Modify (*write, edit or state in box below*)

____
Objective: ____
Objective: ____
Objective: ____

CT5 – Visual Design
Example: Designing, creating and analyzing the visual components of games.
Definition: *This topic includes visual design fundamentals, both on and off the computer, across a broad range of media. Content areas include: history, analysis and production in traditional art media such as painting, drawing and sculpture; communication fields like illustration, typography and graphic design; other design disciplines such as architecture and industrial design; and time-based media like animation and filmmaking.*
_____ Accept _____ Reject _____ Modify (*write, edit or state in box below*)

____
Objective: ____
Objective: ____
Objective: ____

CG6 – Audio Design
Example: Designing and creating sound and sound environments.
Definition: *This topic includes a range of theoretical and practical audio-related areas, such as: music theory and history; music composition; aesthetic analysis of music; recording studio skills; and electronic sound generation. Audio relating specifically to digital game technologies, such as 3D sound processing and generative audio structures, is also included.*
_____ Accept _____ Reject _____ Modify (*write, edit or state in box below*)

____
Objective: ____
Objective: ____
Objective: ____

CT7 – Interactive Storytelling
Example: Traditional storytelling and the challenges of interactive narrative.
Definition: *Writers and designers of interactive works need a solid understanding of traditional narrative theory, character development, plot, dialogue, back-story, and world creation, as well as experimental approaches to storytelling in literature, theatre, and film with relevance to games.*
_____ Accept _____ Reject _____ Modify (*write, edit or state in box below*)
____
Objective: ____
Objective: ____
Objective: ____

CT8 – Game Production
Example: Practical challenges of managing the development of games.
Definition: *Games are among of the most complex forms of software to create, and game development and publishing are complex, collaborative efforts. Along with all the technical challenges of software development, issues of design documentation, content creation, team roles, group dynamics, risk analysis, people management, and process management are addressed in this competency.*
_____ Accept _____ Reject _____ Modify (*write, edit or state in box below*)
____
Objective: ____
Objective: ____
Objective: ____

CT9 – Business of Gaming
Example: Economic, legal and policy aspects of games.
Definition: *The economics of the game industry – how games are funded, marketed and sold, and the relationships among publishers, developers, distributors, marketers, retailers, and other kinds of companies are addressed here. Market and industry trends, licensing management, the dynamics of company and product value, and business differences between major game platforms are all important aspects within this competency.*
_____ Accept _____ Reject _____ Modify (*write, edit or state in box below*)
____
Objective: ____
Objective: ____
Objective: ____

Additional Competency: ____
Example: ____
____
Objective: ____
Objective: ____
Objective: ____

Additional Competency: ____
Example: ____
____
Objective: ____
Objective: ____
Objective: ____

Additional Competency: ____
Example: ____
____
Objective: ____
Objective: ____
Objective: ____

Additional Competency: ____
Example: ____
____
Objective: ____
Objective: ____
Objective: ____

Additional Competency: ____
Example: ____
____
Objective: ____
Objective: ____
Objective: ____

Table A

Modifications and Combinations from Round One in the Creation of Round Two

Competency	
Visual Design	
Original	This topic includes visual design fundamentals, both on and off the computer, across a broad range of media. Content areas include: history, analysis and production in traditional art media such as painting, drawing and sculpture; communication fields like illustration, typography and graphic design; other design disciplines such as architecture and industrial design; and time-based media like animation and filmmaking.
Modification	This topic includes visual design fundamentals, both on and off the computer, across a broad range of media. Content areas include: analysis and production in traditional art media such as painting and drawing; communication fields like illustration, typography and graphic design; and time-based media like animation and filmmaking.
Objectives	
Combined	Modeling and Animation.
	To be able to create the graphics for a game.

Competency	
Games and Society	
Original	This topic offers insight into worldwide gaming culture; psychological facets of games including studies of media effects and the ongoing debate about the psychological impact of games on individuals and groups; examines how individuals and groups construct games; explores how values, identities, and cultural images shape game production.
Modification	Worldwide gaming culture; psychological facets of games including studies of media effects and theories, and the ongoing debate about the psychological impact of games on individuals and groups; examines how individuals and groups construct games; anthropological methods; explores how values, identities, and cultural images shape game production.
Competency	
Game Programming	
Original	This topic includes physics, mathematics, programming techniques, algorithm design, game-specific programming and the technical aspects of game testing.

Modification	Physics, mathematics, programming techniques, algorithm design, game-specific programming and the technical aspects of game testing; introduction to game engines such as Unity, Darkbasic, GameMaker, etc.; generation of problem definitions and developing code 'sketches' to explore possible solutions.
Competency	
Audio Design	
Original	This topic includes a range of theoretical and practical audio-related areas, such as: music theory and history; music composition; aesthetic analysis of music; recording studio skills; and electronic sound generation. Audio relating specifically to digital game technologies, such as 3D sound processing and generative audio structures, is also included.
Modification	Designing and creating sound and sound environments; music theory and history; music composition, sound effects editing/generation, voice over direction; recording studio skills; sound as an aspect of gameplay mechanics.
Competency	
Game Design	
Original	This topic addresses the fundamental ideas behind the design of electronic and non-electronic games. Includes game play, storytelling, challenges and basic interactive design, including interface design, information design and world interaction. Perhaps most important is a detailed study of how games function to construct experiences, including rule design, play mechanics, game balancing, social game interaction, and the integration of visual, audio, tactile and textual elements into the total game experience.
Modification	Fundamental principles and methods behind the design of traditional and digital games. Includes game play and mechanics, systems/rule design, asset creation/management, player interaction, storytelling, interface design, and testing/balancing, with the focus being on how all these elements are implemented in order to construct the total game experience.

Table 5 continued.

Competency	
Business of Gaming	
Original	The economics of the game industry – how games are funded, marketed and sold, and the relationships among publishers, developers, distributors, marketers, retailers, and other kinds of companies are addressed here. Market and industry trends, licensing management, the dynamics of company and product value, and business differences between major game platforms are all important

	aspects within this competency.
Modification	Economic, legal and policy aspects of games.
Competency	
Game Production	
Original	Games are among of the most complex forms of software to create, and game development and publishing are complex, collaborative efforts. Along with all the technical challenges of software development, issues of design documentation, content creation, team roles, group dynamics, risk analysis, people management, and process management are addressed in this competency.
Modification	Specific focus on developmental models (Agile, SCrum, Valve Cabal, etc.), issues in game productions including project management, design documentation, team roles, group dynamics, people management and process management.
Competency	
Interactive Storytelling	
Original	Writers and designers of interactive works need a solid understanding of traditional narrative theory, character development, plot, dialogue, back-story, and world creation, as well as experimental approaches to storytelling in literature, theatre, and film with relevance to games.
Modification	Understanding of traditional narrative theory, character development, plot, dialogue, back-story, and world creation; experimental approaches to storytelling in literature, theatre and film with relevance to games; difference between participatory and interactive narratives emphasized.
Competency	
Critical Game Studies	
Original	Critical game studies offer insight into the textual analysis of game play. Also included here are: the history of computers and digital games and toys; the construction and critique of cannon of significant and influential games; and game criticism and journalism.
Modification	Offers insight into the analysis of game play; the history of traditional and digital games and toys; the construction and critique of cannon of significant and influential games; and game criticism and journalism

Note. Business of Gaming was the lowest scoring competency, receiving 60% accepts and 40% rejects.

Appendix D

Round Two Review Panel Instructions
Round Two Expert Panel Instructions
Panel Reminder Letter
Round Two Instrument
Table B – Rating of Competencies and Objectives

Hello Review Panel,

I hope all is well. The results from Round One of the Delphi have been compiled and Round Two is ready for your perusal. As a reminder, all that you have to do is review the survey instrument of each round for clarity, consistency and jargon. The Round Two survey is attached in a pdf document for your perusal; the link that I will send to the Expert Panel is available here: http://www.surveymonkey.com/s/Round_Two_Instrument

Please do not be daunted by the length. I am sure that once the expert panel gets the gist after the first competency and set of objectives, it will go quickly! If you have any modifications to suggest, you have 48 hours from now (until 1pm on 12/5) to email them to me. The instructions are more detailed below:

Instructions for Round I of the Study
Review Panel Members,
Listed below are the instructions for completing the second round of questioning for the Delphi study. Again, this study is intended to define essential competencies for a high school Game Art and Design curriculum at the national level via the Delphi method.
In Round Two, the Expert Panel is asked to RATE the competencies and objectives.
The competencies are rated on a 5-point Likert scale; the objectives are rated in the same manner:

1 - **Strongly Disagree**/This competency or objective should not be taught in a high school Game Art and Design course
2 - **Disagree**/ This competency or objective may not be beneficial if taught in a high school Game Art and Design course
3 - **Neither Agree nor Disagree**/ This competency or objective could or could not be taught in a high school Game Art and Design course
4 - **Agree**/ This competency or objective could be beneficial if taught in a high school Game Art and Design course
5 - **Strongly Agree**/ This competency or objective should be taught in a high school Game Art and Design course

If I do not receive any feedback after 48 hours, I will send the Round to the Expert Panel as is. Thank you in advance for your input. If you have any questions, please feel free to contact me by phone or email.

Sincerely,

Nayo C-G Mack
Doctoral Researcher, NC State University
(919) xxx-xxxx
ncmack@ncsu.edu

Hello Expert Panel,

I hope all is well with you. First, I'd like to commend you for your responses on Round One. We had a 100% response rate, which is very rare in Delphi studies, so kudos to you all! Secondly, the instructions for Round Two are listed below.
Instructions for Round Two:

In Round Two, your objective is to RATE each of the competencies and objectives that were accepted and/or modified from Round One. Please do not be undeterred by the length; it should go quickly once you are used to the format. You will rate the items from 1 - 5 on the following scale, where '1' represents the lowest degree of importance and '5' represents the highest degree of importance:

1 **- Strongly Disagree**/This competency or objective should not be taught in a high school Game Art and Design course
2 - **Disagree**/ This competency or objective may not be beneficial if taught in a high school Game Art and Design course
3 - **Neither Disagree nor Agree**/ This competency or objective could or could not be taught in a high school Game Art and Design course
4 - **Agree**/ This competency or objective could be beneficial if taught in a high school Game Art and Design course
5 - **Strongly Agree**/ This competency or objective should be taught in a high school Game Art and Design course

Please note that the newly created competencies have space for you to type in more objectives if you'd like to. I received a few comments that the content may be too complex or inappropriate for high school aged learners. You are welcomed to modify the language and/or content of the competencies, or simply reject if you feel the subject is best left for college aged learners; I simply summarize what the majority votes for. The link is available here: http://www.surveymonkey.com/s/Round_Two_Instrument

Upon completion of the Round Two Instrument, submit your responses. Please be sure to submit your responses by midnight on Sunday, December 12th, 2010. Once you complete this round, we will be halfway through the study. How exciting! If you have any questions, please feel free to contact me by phone or email. Thank you in advance, and have a great week,

Sincerely,

Nayo C-G Mack
Doctoral Researcher, NC State University
(919) xxx-xxxx
ncmack@ncsu.edu

Hello Expert Panel,

This is the second notice for Round Two of the study. The instructions are included below. If you have already completed Round Two, please disregard this message, and thank you!

I realize that we are in the holiday season and the semester is ending; if you can spare a bit of time, please complete this round. Round Three will be shorter, I promise! The completion date has been extended until Thursday, December 16th, at midnight. If we are diligent, we may be able to finish three of the four rounds by the end of the year.

Thank you in advance,

Nayo

ROUND TWO – RATING OF COMPETENCIES AND OBJECTIVES

Instructions

In Round Two, we will now RATE each of the objectives and competencies that were accepted and/or modified from Round One. You will rate the items from 1 - 5 on the following scale, where '1' represents the lowest degree of importance and '5' represents the highest degree of importance, as such:

1* - Strongly Disagree/This competency or objective should not be taught in a high school Game Art and Design course

2* - Disagree/ This competency or objective may not be beneficial if taught in a high school Game Art and Design course

3* - Neither Agree nor Disagree/ This competency or objective could or could not be taught in a high school Game Art and Design course

4* - Agree/ This competency or objective could be beneficial if taught in a high school Game Art and Design course

5* - Strongly Agree/ This competency or objective should be taught in a high school Game Art and Design course

***SCALE:** SD, D, NA/D, A, SA

Some competencies will have explanations of what content they encompass (depending on the feedback).

There will also be a MODIFY box under each competency and objective in case you'd like to do additional modifications. This will be the last chance to do any modifications.

Topic Overview

Listed are the topics you will be rating (in no particular order):

- Game Design
- Game Production
- Audio Design
- Games and Society
- Usability
- Physical Interfaces
- Indie and DIY (Do It Yourself) Games
- Games beyond play
- Simulation Project
- Business of Gaming
- Career Readiness
- Visual Design
- Studio Practice
- Game Programming
- Interactive Storytelling
- Computer Technologies
- Critical Game Studies

Visual Design

**Remember, you are rating each competency and objective on a scale of 1-5, where '1' is lowest and '5' is highest. You may also modify the competencies and objectives if you'd like.

Encompasses: Visual design fundamentals, designing and creating, analysis and production in traditional art media, communication fields like illustration, typography and graphic design; and time-based media like animation and film making; all relative practical components.

1 - Strongly Disagree/This competency or objective should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency or objective may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency or objective could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency or objective could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency or objective should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box):
____

Please rate the following objectives for **Visual Design**.

Objective	SD	D	NA/D	A	SA
Demonstrate an understanding of the terminology, methodology, and creation process of various visual art disciplines.					
Create screen mockups and layouts for a game's user interface.					
Recognize key art and design styles and their influence on important games.					
Demonstrate understanding of visual design strategies.					
Demonstrate language arts knowledge and skills.					
Provide a basic survey of art and design practices, such that students can develop practical visual literacies.					
Describe the process (pipeline) by which visual assets are created for games.					
Create the graphics for games; modeling and animation.					
Create drawings and illustrations in both electronic and non-electronic form.					
Understand how visual design decisions impact the overall game experience.					
Develop critical reflections on the interrelation of aesthetics and the audience.					
Understand the significance of historical and cultural heritage of art and artistic styles as it relates to 3D game graphics.					
Enable students to develop skills in applying theoretical and practical knowledge from related areas.					
Explain the importance of brainstorming, experimentations, and pre-visualization during the creation process.					
Design and implement the interface for a game; interface theory and design.					
Use computer tools to create two-dimensional drawings and three-dimensional models.					

Games and Society

Encompasses: Worldwide gaming culture; psychological facets of games including studies of media effects and theories, and the ongoing debate about the psychological impact of games on individuals and groups; examines how individuals and groups construct games; anthropological methods; explores how values, identities, and cultural images shape game production.

1 - Strongly Disagree/This competency or objective should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency or objective may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency or objective could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency or objective could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency or objective should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box): ________________________________

Please rate the following objectives for **Games and Society**.

Objective	SD	D	NA/D	A	SA
Understand how cultural values affect computer games.					
Understand how individuals and groups construct games as well as how their values/culture shape them.					
Analyze important games in terms of their social and cultural contexts.					
Understand the social issues of computer games.					
Understand legal issues that affect games, developers and players.					
Provide students with exposure to tools which assist in developing social engagements in gameplay.					
Demonstrate understanding of the role games play at various stages of human development.					
Identify psychological predispositions of human beings that influence their reception and use of games.					
Understand worldwide gaming culture.					
Recognize key signs and symbols (semiotics) in terms of racial and cultural depictions and how they affect the interpretation of a game.					
Understand the psychological impact of computer games.					
Describe the impact of the video game industry on the economy.					
Enable an understanding of the impacts of cultural expectations and structures on what is considered "good" gameplay.					
Provide examples of how various cultures differ in the assumptions, expectations and taboos of games.					
Identify at least five ways in which gamers may differ from each other (age, gender, race, culture, language, religion, socio-economic status, etc.) and be able to analyze the impact of those factors on the play experience.					

Computer Technology

This is a new competency that was created.
1 - Strongly Disagree/This competency should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box):
____

Please rate the following objectives for **Computer Technology**:

Objective	**SD**	**D**	**NA/D**	**A**	**SA**
Describe the essential parts of a computer and how they function.					
Demonstrate the ability to perform standard maintenance and performance related tasks on common operating systems.					

Type any additional objectives below:
____

Game Programming

Encompasses: Physics, mathematics, programming techniques, algorithm design, game-specific programming and the technical aspects of game testing; introduction to game engines such as Unity, Darkbasic, GameMaker, etc.; generation of problem definitions and developing code 'sketches' to explore possible solutions.
1 - Strongly Disagree/This competency or objective should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency or objective may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency or objective could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency or objective could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency or objective should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box):
____

Please rate the following objectives for **Game Programming**.

Objective	SD	D	NA/D	A	SA
Troubleshoot a game.					
Demonstrate grade-level appropriate skills in creating flowcharts and solving equations.					
Implement designs within the constraints of technical development.					
Understand basic game logic and framework structure.					
Understand the programming of 3D and Artificial Intelligence.					
Identify key components of a game engine and how they interrelate.					
Develop appreciation of programming and issues relevant to computer games.					
Become familiar with popular game tools such as DirectX, 3DMax, and different gaming engines.					
Understand why certain programming methods are used.					
Provide a basic exposure to pragmatic game development processes.					
Identify the various branches of mathematics used in programming (which portions of the game use which branch).					
Write a design document for a simple digital game.					
Identify an ill-defined problem in the game implementation.					
Demonstrate the effective use of 3D hardware (scanners, tablets, motion capture).					
Gain experience in development, leading to competencies in scripting.					
Demonstrate skills in listing the logical steps of everyday complex processes (such as answering a phone, making a sandwich, etc.).					
Be able to define a small subset of the problem that may be tested with a minimal digital prototype.					
Construct a simple digital game.					

Audio Design

Encompasses: Designing and creating sound and sound environments; music theory and history; music composition, sound effects editing/generation, voice over direction; recording studio skills; sound as an aspect of gameplay mechanics.

1 - Strongly Disagree/This competency or objective should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency or objective may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency or objective could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency or objective could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency or objective should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box): ________________________________

Please rate the following objectives for **Audio Design**.

Objective	**SD**	**D**	**NA/D**	**A**	**SA**
Identify the roles music and sound play in a game.					
Understand the impact of sound and music on the overall game experience.					
Understand the specific audio issues of video games.					
Expose to relevant practical and theoretical material.					
Recognize how sound and music can be used to enhance gameplay.					
Create and utilize sound effects and voice into a game.					
Gain experience in the application of sound within a game design context.					

Game Design

Encompasses: Fundamental principles and methods behind the design of traditional and digital games. Includes gameplay and mechanics, systems/rule design, asset creation/management, player interaction, storytelling, interface design, and testing/balancing, with the focus being on how all these elements are implemented in order to construct the total game experience.

1 - Strongly Disagree/This competency or objective should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency or objective may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency or objective could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency or objective could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency or objective should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box):
____

Please rate the following objectives for **Game Design**.

Objective	SD	D	NA/D	A	SA
Conceive of ideas for small-scale electronic games and work alone or in a team to implement and playtest them.					
Distinguish critical strengths and weaknesses of various principles and methods used in computer game design.					
Identify major game design elements in a commercial digital game.					
Discuss how genres of games vary in how they utilize elements such as storytelling, mechanics, art, etc.					
Analyze a game (of their own or someone else's) to determine potential improvements to the game play.					
Understand how rule design, play mechanics, game balancing, social game interaction, and the integration of visual, audio, tactile and textual elements affect the fun or value in games.					
Analyze the key components of the game experience of important games.					
Discuss the interrelationship of different game elements and their impact on the game experience.					
Understand how computer games are designed using appropriate methods and principles.					
Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design.					
Demonstrate how games are developed as experiential tools and environments.					
Describe the complex interaction between video games and players and the role it plays in the popularity of a game.					
Provide opportunities to reflect upon the relation of game mechanics and design process.					
Develop understanding of the variety of theoretical approaches to game mechanics.					
Identify elements that make games "fun".					
Construct a simple non-digital game.					
Explain the importance of challenge within game play.					
Understand the difference between mechanics, interface, narrative, visuals - as well as the interaction between them.					
Understand how game play, storytelling, and design affect the fun or value in games.					
Design an original non electronic game, including mechanics, objective and theme.					

Studio Practice

This is a new competency that was created.
Should Studio Practice be a competency taught in a high school Game Art and Design course?
1 - Strongly Disagree/This competency should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box): ________________________________

Please rate the following objectives for **Studio Practice**.

Objective	**SD**	**D**	**NA/D**	**A**	**SA**
Specific interactive subject.					
Pragmatic application of theory; design of playable outcomes.					

Type any additional objectives below: ________________________________

Career Readiness

This is a new competency that was created.
Should Career Readiness be a competency taught in a high school Game Art and Design course?
1 - Strongly Disagree/This competency should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box): ___________________________________

Please rate the following objectives for **Career Readiness**.

Objective	SD	D	NA/D	A	SA
Investigate career opportunities in the game industry.					
Internship or job shadow within the industry.					
Collaboration within the industry.					

Business of Gaming

Encompasses: Economic, legal and policy aspects of games.

Should Business of Gaming be a competency taught in a high school Game Art and Design course?

1 - Strongly Disagree/This competency should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box):

____

Please rate the following objectives for **Career Readiness**.

Objective	SD	D	NA/D	A	SA
Write a business plan for a game including platform choice and monetization strategies.					
Identify games beyond the marketing mainstream (i.e. Indie games).					
Engage with the relevant issues in market structure.					
Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.					
Create and present business summaries and market pitches of imagined or actual games.					
Understand the economic and legal side of game development.					
Identify the impact of current industry practices on games that are created.					
Engage with the relevant issues in legal compliance.					
Describe the importance of professional ethics and legal responsibilities.					
Demonstrate understanding of the business issues behind computer games.					

Usability

This is a new competency that was created.

Should Usability be a competency in a high school Game Art and Design course?
1 - Strongly Disagree/This competency should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box):
____

Please rate the following objectives for **Usability**.

Objective	SD	D	NA/D	A	SA
Understand the usability issues of game design.					
Create and run small usability tests of gameplay.					
Explain the functionality of game related components of a computer/console such as Save systems, Input/Outpus devices, processors, network cards, etc.					

Please type any additional objectives below: ______________________________________

Simulation Project

This is a new competency that was created.

Should Simulation Project be a competency in a high school Game Art and Design course?
1 - Strongly Disagree/This competency should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box):
____

Please rate the following objectives for **Simulation Project**.

Objective	SD	D	NA/D	A	SA
Participate in large scale or individual real world design projects.					
Create a working game or simulation individually or as part of a team.					

Please type any additional objectives below: ____

Game Production

Encompasses: Specific focus on developmental models (Agile, SCrum, Valve Cabal, etc.), issues in game productions including project management, design documentation, team roles, group dynamics, people management and process management.

Should Game Production be a competency in a high school Game Art and Design course?

1 - Strongly Disagree/This competency should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box): ______________________________________

Please rate the following objectives for **Game Production**.

Objective	SD	D	NA/D	A	SA
Describe the importance of communication to the design process and give examples of effective communication methods.					
Understand the basics of game project management.					
Show understanding of the game production process.					
Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.					
Exposure to a range of possible project management techniques.					
Demonstrate skills in team-work and leadership as used in the game industry.					
Write a design document for their game.					
Lead the production process of a game or level.					
Recognize the value and importance of team collaborative work.					
Develop design documents along with, if possible, a real game design project.					
Demonstrate personal money-management concepts, procedures, and strategies.					
Develop students' capacity to structure and manage their own projects.					
Describe the pipeline of a video game from conception to customer support.					
Understand the impact of current industry practices on the games that are created.					

Interactive Storytelling

Encompasses: Understanding of traditional narrative theory, character development, plot, dialogue, back-story, and world creation; experimental approaches to storytelling in literature, theatre and film with relevance to games; difference between participatory and Interactive narratives emphasized..

Should Interactive Storytelling be a competency in a high school Game Art and Design course?

1 - Strongly Disagree/This competency should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box): ___________________________________

Please rate the following objectives for **Interactive Storytelling**.

Objective	SD	D	NA/D	A	SA
Design a simple participatory story.					
Identify the components of traditional narrative structures and devices, comparing/contrasting them with the structures and devices as they are used in video games.					
Identify key storytelling techniques or structures in games.					
Demonstrate understanding of narrative theory.					
Demonstrate language arts knowledge and skills.					
Provide experience in developing, analyzing and implementing narrative in games.					
Discuss how and when narrative is used in games and for what purpose.					
Understand the trade-offs between player participation and authorial control.					
Write a script for a level.					
Write traditional linear stories that can be integrated with a linear game.					
Discuss the interrelationship (or conflict) between story and gameplay.					
Extend the examples and potential of interactive narrative.					
Determine and document the graphical and animation needs of a game using design documents including art direction and reference material.					
Provide exposure to a range of appropriate theoretical tools that allow for the construction and analysis of effective non-linear narratives.					
Discuss the role of the writer in an interactive environment and how it varies from novels, film and television.					
Understand at least three ways to deliver narrative content (ambient, dialogue, cut-scene, emergent) and can identify them in existing digital games.					
Write non-linear stories for games that involve choices on the part of the player, leading to multiple outcomes.					

Games Beyond Play

This is a new competency that was created.

Should Games Beyond Play be a competency in a high school Game Art and Design course?
1 - Strongly Disagree/This competency should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box): ________________________________

Please rate the following objectives for **Games Beyond Play**:

Objective	**SD**	**D**	**NA/D**	**A**	**SA**
Assist in developing students' understanding of games as a medium, rather than simply as systems of play.					
Offer opportunities for students to engage with games as learning systems, training systems, marketing systems, etc.					

Please type any additional objectives below: _____________________________________

Critical Game Studies

Encompasses: Offers insight into the analysis of game play; the history of traditional and digital games and toys; the construction and critique of cannon of significant and influential games; and game criticism and journalism.

Should Critical Game Studies be a competency in a high school Game Art and Design course?

1 - Strongly Disagree/This competency should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box): ______________________________________

Please rate the following objectives for **Critical Game Studies**:

Objective	SD	D	NA/D	A	SA
Offer insight into the textual analysis of gameplay.					
Tell the difference between a game's design and its execution.					
Identify important designers, games, and events in game development and adoption by society.					
Provide exposure to a range of cultural issues, in order to broaden and deepen their engagement with practices.					
Provide insights into the development and use of computer games.					
Understand the history of computers and digital games and toys.					
Identify historical innovations in gameplay.					
Discuss the roles games play within a society and how specific games fulfill their roles.					
Develop critical literacies in novice game designers.					
Understand the historical significance of electronic and non-electronic games.					
Understand history of games and related issues.					
Discuss the history of games and identify the different game genres and important examples of each.					
Critique significant and influential games.					
Analyze a game's mechanics, including rules, narrative mechanics, social interactions, and physical affordances.					
Identify elements that make up a game and evaluate them as independent components.					
Enable novices to develop skills when applying critical practices.					
Demonstrate an understanding of the vocabulary for discussing games and play.					
Develop appropriate critical tools to the study of games.					
Understand the difference between game reviews, critiques, and reporting.					

Indie and DIY* Games

This is a new competency that was created.

*Do It Yourself

Should Indie and DIY Games be a competency in a high school Game Art and Design course?

1 - Strongly Disagree/This competency should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box):
____

Please rate the following objectives for **Indie and DIY Games**:

Objective	SD	D	NA/D	A	SA
Identify tools for rapid game prototyping and development, and understand what they can do with each after the course ends.					
Students are familiar with at least three art/expressive/unusual games.					

Physical Interfaces

This is a new competency that was created.

Should Physical Interfaces be a competency in a high school Game Art and Design course?

1 - Strongly Disagree/This competency should not be taught in a high school Game Art and Design course

2 - Disagree/ This competency may not be beneficial if taught in a high school Game Art and Design course

3 - Neither Agree nor Disagree/ This competency could or could not be taught in a high school Game Art and Design course

4 - Agree/ This competency could be beneficial if taught in a high school Game Art and Design course

5 - Strongly Agree/ This competency should be taught in a high school Game Art and Design course

Modify (please write, edit or state in the text box): ______________________________________

Please rate the following objectives for **Physical Interfaces**:

Objective	SD	D	NA/D	A	SA
Identify at least five types of interface with a game and describe the affordances for design that each provides.					
Students can build a controller of their own using pre-existing kits.					

If you have any comments, questions or additional objectives, feel free to leave them in the box below.

Additional comments and/or questions: ______________________________________

Optional:
Please type your initials in the text box below. This is not to keep track of your personal responses. It will be used to keep track of which panelists have or have not completed the survey.

Initials: ____

End of Round Two
Thank you for completing the second round of the Delphi study. We are halfway there! There are two more rounds to come in the near future, though not as intensive as this one.

Thank you again. Good bye!

Table B - Rating of Competencies and Objectives

Competency	SD	D	ND/A	A	SA	M	N
Visual Design	0	0	0	8	2	4.2	10
Objectives	SD	D	ND/A	A	SA	M	N
Demonstrate an understanding of the terminology, methodology, and creation process of various visual art disciplines.	0	0	1	4	4	4.33	9
Create screen mockups and layouts for a game's user interface.	0	1	2	3	3	3.89	9
Recognize key art and design styles and their influence on important games.	0	0	1	5	3	4.22	9
Demonstrate understanding of visual design strategies.	0	0	3	3	2	3.88	8
Demonstrate language arts knowledge and skills.	0	1	3	2	2	3.63	8
Provide a basic survey of art and design practices, such that students can develop practical visual literacies.	0	0	1	4	3	4.25	8
Describe the process (pipeline) by which visual assets are created for games.	0	0	2	3	3	4.13	8
Create the graphics for games; modeling and animation.	0	2	2	3	1	3.38	8
Create drawings and illustrations in both electronic and non-electronic form.	0	0	0	6	2	4.25	8
Understand how visual design decisions impact the overall game experience.	0	0	3	3	2	3.88	8
Develop critical reflections on the interrelation of aesthetics and the audience.	0	1	3	3	1	3.50	8
Understand the significance of historical and cultural heritage of art and artistic styles as it relates to 3D game graphics.	1	3	0	4	0	2.88	8
Enable students to develop skills in applying theoretical and practical knowledge from related areas.	0	2	3	2	1	3.25	8
Explain the importance of brainstorming, experimentations, and pre-visualization during the creation process.	0	0	2	2	4	4.25	8
Design and implement the interface for a game; interface theory and design.	1	0	1	4	2	3.75	8
Use computer tools to create two-dimensional drawings and three-dimensional models.	0	2	3	2	1	3.25	8

Note. Visual Design was an original core topic.

Competency	SD	D	ND/A	A	SA	M	N
Games and Society	0	1	0	6	1	3.88	8
Objective	SD	D	ND/A	A	SA	M	N
Understand how cultural values affect computer games.	0	1	1	3	3	4.00	8
Understand how individuals and groups construct games as well as how their values/culture shape them.	0	0	2	5	1	3.88	8
Analyze important games in terms of their social and cultural contexts.	0	0	2	3	3	4.13	8
Understand the social issues of computer games.	0	0	2	3	3	4.13	8
Understand legal issues that affect games, developers and players.	0	0	3	3	2	3.88	8
Provide students with exposure to tools which assist in developing social engagements in game play.	0	3	1	3	0	3.00	7
Demonstrate understanding of the role games play at various stages of human development.	1	1	1	4	1	3.38	8
Identify psychological predispositions of human beings that influence their reception and use of games.	0	1	1	4	2	3.88	8
Understand worldwide gaming culture.	0	0	2	4	2	4.00	8
Recognize key signs and symbols (semiotics) in terms of racial and cultural depictions and how they affect the interpretation of a game.	0	2	1	4	1	3.50	8
Understand the psychological impact of computer games.	0	1	3	3	1	3.50	8
Describe the impact of the video game industry on the economy.	1	0	3	2	2	3.50	8
Enable an understanding of the impacts of cultural expectations and structures on what is considered "good" game play.	0	1	1	4	2	3.88	8
Provide examples of how various cultures differ in the assumptions, expectations and taboos of games.	0	2	1	2	3	3.75	8
Identify at least five ways in which gamers may differ from each other (age, gender, race, culture, language, religion, socio-economic status, etc.) and be able to analyze the impact of those factors on the play experience.	0	0	1	4	3	4.25	8

Note. Games and Society was an original core topic.

Competency	SD	D	ND/A	A	SA	M	N
Computer Technologies	0	1	4	1	2	3.5	8
Objective	SD	D	ND/A	A	SA	M	N
Describe the essential parts of a computer and how they function.	0	1	4	1	2	3.50	8
Demonstrate the ability to perform standard maintenance and performance related tasks on common operating systems.	1	1	5	0	1	2.88	8
Demonstrate the ability to perform updates, firmware to gaming systems	-	-	-	-	-	-	-
Perhaps of value if hooked into work developing customized gaming appliances i.e. physical interfaces	-	-	-	-	-	-	-

Note. Computer Technologies was a newly created competency. The objectives with no Likert scale responses were ones that were created in this round.

Competency	SD	D	ND/A	A	SA	M	N
Game Programming	0	0	1	4	3	4.25	8
Objective	SD	D	ND/A	A	SA	M	N
Troubleshoot a game.	1	0	2	3	2	3.63	8
Demonstrate grade-level appropriate skills in creating flowcharts and solving equations.	0	0	1	4	3	4.25	8
Implement designs within the constraints of technical development.	0	1	1	5	1	3.75	8
Understand basic game logic and framework structure.	0	0	0	4	4	4.50	8
Understand the programming of 3D and Artificial Intelligence.	2	1	2	3	0	2.75	8
Identify key components of a game engine and how they interrelate.	0	0	2	4	2	4.00	8
Develop appreciation of programming and issues relevant to computer games.	0	0	0	5	3	4.38	8
Become familiar with popular game tools such as DirectX, 3DMax, and different gaming engines.	0	2	2	4	0	3.25	8
Understand why certain programming methods are used.	0	0	2	6	0	3.75	8
Provide a basic exposure to pragmatic	0	0	0	5	3	4.38	8

game development processes.							
Identify the various branches of mathematics used in programming (which portions of the game use which branch).	0	0	4	2	2	3.75	8
Write a design document for a simple digital game.	0	1	2	3	2	3.75	8
Identify an ill-defined problem in the game implementation.	0	1	1	2	4	4.13	8
Demonstrate the effective use of 3D hardware (scanners, tablets, motion capture).	0	4	2	2	0	2.75	8
Gain experience in development, leading to competencies in scripting.	0	1	2	4	1	3.63	8
Demonstrate skills in listing the logical steps of everyday complex processes (such as answering a phone, making a sandwich, etc.).	0	0	1	3	4	4.38	8
Be able to define a small subset of the problem that may be tested with a minimal digital prototype.	0	0	2	2	4	4.25	8
Construct a simple digital game.	0	0	2	3	3	4.13	8

Note. Game Programming was an original core topic.

Competency	SD	D	ND/A	A	SA	M	N
Audio Design	0	0	2	6	0	3.75	8
Objective	SD	D	ND/A	A	SA	M	N
Identify the roles music and sound play in a game.	0	0	2	3	3	4.13	8
Understand the impact of sound and music on the overall game experience.	0	0	0	5	3	4.38	8
Understand the specific audio issues of video games.	0	0	0	7	1	4.13	8
Expose to relevant practical and theoretical material.	0	0	4	4	0	3.50	8
Recognize how sound and music can be used to enhance game play.	0	0	1	5	2	4.13	8
Create and utilize sound effects and voice into a game.	0	0	3	4	1	3.75	8
Gain experience in the application of sound within a game design context.	0	0	3	3	2	3.88	8

Note. Audio Design was an original core topic.

Competency	SD	D	ND/A	A	SA	M	N
Game Design	0	0	0	4	4	4.5	8
Objective	SD	D	ND/A	A	SA	M	N
Conceive of ideas for small-scale electronic games and work alone or in a team to implement and playtest them.	0	2	1	2	3	3.75	8
Distinguish critical strengths and weaknesses of various principles and methods used in computer game design.	0	0	1	5	2	4.13	8
Identify major game design elements in a commercial digital game.	0	0	0	4	4	4.50	8
Discuss how genres of games vary in how they utilize elements such as storytelling, mechanics, art, etc.	0	0	1	6	1	4.00	8
Analyze a game (of their own or someone else's) to determine potential improvements to the game play.	0	0	3	1	4	4.13	8
Understand how rule design, play mechanics, game balancing, social game interaction, and the integration of visual, audio, tactile and textual elements affect the fun or value in games.	0	0	0	5	3	4.38	8
Analyze the key components of the game experience of important games.	0	0	2	2	4	4.25	8
Discuss the interrelationship of different game elements and their impact on the game experience.	0	0	2	5	1	3.88	8
Understand how computer games are designed using appropriate methods and principles.	0	0	2	3	3	4.13	8
Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design.	0	0	0	6	2	4.25	8
Demonstrate how games are developed as experiential tools and environments.	0	1	3	4	0	3.38	8
Describe the complex interaction between video games and players and the role it plays in the popularity of a game.	0	0	5	3	0	3.38	8
Provide opportunities to reflect upon the relation of game mechanics and design process.	0	0	1	5	2	4.13	8
Develop understanding of the variety of	0	0	1	5	2	4.13	8

theoretical approaches to game mechanics.							
Identify elements that make games "fun".	0	0	2	3	3	4.13	8
Construct a simple non-digital game.	0	0	0	3	5	4.63	8
Explain the importance of challenge within game play.	0	0	0	6	2	4.25	8
Understand the difference between mechanics, interface, narrative, visuals - as well as the interaction between them.	0	0	0	4	4	4.50	8
Understand how game play, storytelling, and design affect the fun or value in games.	0	0	0	7	1	4.13	8
Design an original non electronic game, including mechanics, objective and theme.	0	0	0	4	4	4.50	8

Note. Game Design was an original core topic.

Competency	SD	D	ND/A	A	SA	M	N
Studio Practice	0	1	5	2	0	4.5	8
Objective	SD	D	ND/A	A	SA	M	N
Specific interactive subject.	1	0	5	2	0	3.00	8
Pragmatic application of theory; design of playable outcomes.	0	1	5	1	1	3.25	8

Note. Studio Practice was a newly created competency.

Competency	SD	D	ND/A	A	SA	M	N
Career Readiness	0	0	3	4	1	3.75	8
Objective	SD	D	ND/A	A	SA	M	N
Investigate career opportunities in the game industry.	0	0	0	5	3	4.38	8
Internship or job shadow within the industry.	1	2	3	1	1	2.88	8
Collaboration within the industry.	0	4	1	2	1	3.00	8
Skill set analysis per discipline; overall relevant skill sets/knowledges	-	-	-	-	-	-	-
Join Indie Team or Mod developer	-	-	-	-	-	-	-
Demonstrate job seeking skills (resumes, interviews, portfolio building, etc.) with an emphasis on those related to the video game industry	-	-	-	-	-	-	-

Note. Career Readiness was a newly created competency. The objectives with no Likert scale responses were ones that were created in this round.

Competency	SD	D	ND/A	A	SA	M	N
Business of Gaming	0	2	1	5	0	3.38	8
Objective	**SD**	**D**	**ND/A**	**A**	**SA**	**M**	**N**
Write a business plan for a game including platform choice and monetization strategies.	2	1	2	3	0	2.75	8
Identify games beyond the marketing mainstream (i.e. Indie games).	1	0	5	2	0	3.00	8
Engage with the relevant issues in market structure.	2	3	2	0	0	2.00	7
Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.	4	2	2	0	0	1.75	8
Create and present business summaries and market pitches of imagined or actual games.	1	1	4	2	0	2.88	8
Understand the economic and legal side of game development.	0	1	5	2	0	3.13	8
Identify the impact of current industry practices on games that are created.	1	1	5	1	0	2.75	8
Engage with the relevant issues in legal compliance.	3	2	3	0	0	2.00	8
Describe the importance of professional ethics and legal responsibilities.	0	0	7	1	0	3.13	8
Demonstrate understanding of the business issues behind computer games.	0	2	3	3	0	3.13	8

Note. Business of Gaming was an original core topic. The mean ratings for Business of Gaming objectives are less than the 3.01 cutoff due to a discrepancy in the chart. The scale for this competency was out of 4.0 rather than 5.0; therefore, the cutoff is 2.01.

Competency	SD	D	ND/A	A	SA	M	N
Usability	0	0	2	5	1	3.88	8
Objective	**SD**	**D**	**ND/A**	**A**	**SA**	**M**	**N**
Understand the usability issues of game design.	0	0	2	4	2	4.00	8
Create and run small usability tests of game play.	0	0	2	4	2	4.00	8

Explain the functionality of game related components of a computer/console such as Save systems, Input/Outputs devices, processors, network cards, etc.	0	1	3	3	1	3.50	8
Connecting consoles to various televisions standards	-	-	-	-	-	-	-
This area very under-defined	-	-	-	-	-	-	-
Competent in play-testing.	-	-	-	-	-	-	-

Note. Usability was a newly created competency. The objectives with no Likert scale responses were ones that were created in this round.

Competency	SD	D	ND/A	A	SA	M	N
Simulation Project	0	4	0	3	1	3.13	8
Objective	SD	D	ND/A	A	SA	M	N
Participate in large scale or individual real world design projects.	0	3	0	4	1	3.38	8
Create a working game or simulation individually or as part of a team.	0	2	0	4	2	3.75	8
Created a simple, non-digital simulation game. Analyze existing simulation game subjects, themes, and executions.	-	-	-	-	-	-	-

Note. Simulation Project was a newly created competency. The objectives with no Likert scale responses were ones that were created in this round.

Competency	SD	D	ND/A	A	SA	M	N
Game Production	1	0	2	5	0	3.38	8
Objective	SD	D	ND/A	A	SA	M	N
Describe the importance of communication to the design process and give examples of effective communication methods.	0	0	0	5	2	4.29	7
Understand the basics of game project management.	0	0	1	4	2	4.14	7
Show understanding of the game production process.	0	0	2	3	2	4.00	7
Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.	0	0	1	2	4	4.43	7
Exposure to a range of possible project	0	2	1	3	1	3.43	7

management techniques.							
Demonstrate skills in team-work and leadership as used in the game industry.	0	1	0	6	0	3.71	7
Write a design document for their game.	0	0	2	2	3	4.14	7
Lead the production process of a game or level.	0	1	0	4	2	4.00	7
Recognize the value and importance of team collaborative work.	0	0	0	4	3	4.43	7
Develop design documents along with, if possible, a real game design project.	0	1	0	3	3	4.14	7
Demonstrate personal money-management concepts, procedures, and strategies.	0	2	3	2	0	3.00	7
Develop students' capacity to structure and manage their own projects.	0	0	2	2	3	4.14	7
Describe the pipeline of a video game from conception to customer support.	0	0	2	3	2	4.00	7
Understand the impact of current industry practices on the games that are created.	0	1	3	2	1	3.43	7

Note. Game Production was an original core topic.

Competency	SD	D	ND/A	A	SA	M	N
Interactive Storytelling	0	0	1	6	1	4.00	8
Objective	SD	D	ND/A	A	SA	M	N
Design a simple participatory story.	0	0	2	1	5	4.38	8
Identify the components of traditional narrative structures and devices, comparing/contrasting them with the structures and devices as they are used in video games.	0	0	1	5	2	4.13	8
Identify key storytelling techniques or structures in games.	0	0	2	2	4	4.25	8
Demonstrate understanding of narrative theory.	0	0	1	5	2	4.13	8
Demonstrate language arts knowledge and skills.	0	0	1	4	3	4.25	8
Provide experience in developing, analyzing and implementing narrative in games.	0	0	3	4	1	3.75	8
Discuss how and when narrative is used in games and for what purpose.	0	0	1	6	1	4.00	8
Understand the trade-offs between player	0	0	1	4	3	4.25	8

participation and authorial control.							
Write a script for a level.	0	0	2	3	3	4.13	8
Write traditional linear stories that can be integrated with a linear game.	1	2	2	2	1	3.00	8
Discuss the interrelationship (or conflict) between story and game play.	0	0	1	5	2	4.13	8
Extend the examples and potential of interactive narrative.	1	3	1	2	1	2.88	8
Determine and document the graphical and animation needs of a game using design documents including art direction and reference material.	1	1	1	4	1	3.38	8
Provide exposure to a range of appropriate theoretical tools that allow for the construction and analysis of effective non-linear narratives.	0	2	3	3	0	3.13	8
Discuss the role of the writer in an interactive environment and how it varies from novels, film and television.	0	1	1	4	2	3.88	8
Understand at least three ways to deliver narrative content (ambient, dialogue, cut-scene, emergent) and can identify them in existing digital games.	0	0	2	5	1	3.88	8
Write non-linear stories for games that involve choices on the part of the player, leading to multiple outcomes.	0	0	2	4	2	4.00	8

Note. Interactive Storytelling was an original core topic.

Competency	SD	D	ND/A	A	SA	M	N
Games Beyond Play	0	3	3	2	0	2.88	8
Objective	SD	D	ND/A	A	SA	M	N
Assist in developing students' understanding of games as a medium, rather than simply as systems of play.	0	1	1	5	0	3.57	7
Offer opportunities for students to engage with games as learning systems, training systems, marketing systems, etc.	0	1	1	5	0	3.57	7
Create prototype of a serious game and its applications	-	-	-	-	-	-	-

Note. Games Beyond Play was a newly created competency. The objectives with no Likert scale responses were ones that were created in this round.

Competency	SD	D	ND/A	A	SA	M	N
Critical Game Studies	0	0	1	6	1	4.00	8
Objective	SD	D	ND/A	A	SA	M	N
Offer insight into the textual analysis of game play.	0	1	2	5	0	3.50	8
Tell the difference between a game's design and its execution.	0	0	1	4	3	4.25	8
Identify important designers, games, and events in game development and adoption by society.	0	0	1	5	2	4.13	8
Provide exposure to a range of cultural issues, in order to broaden and deepen their engagement with practices.	0	0	6	1	1	3.38	8
Provide insights into the development and use of computer games.	0	1	3	3	1	3.50	8
Understand the history of computers and digital games and toys.	0	0	1	4	3	4.25	8
Identify historical innovations in game play.	0	1	0	5	2	4.00	8
Discuss the roles games play within a society and how specific games fulfill their roles.	0	0	2	4	2	4.00	8
Develop critical literacies in novice game designers.	0	1	3	2	2	3.63	8
Understand the historical significance of electronic and non-electronic games.	0	0	2	5	1	3.88	8
Understand history of games and related issues.	0	0	1	6	1	4.00	8
Discuss the history of games and identify the different game genres and important examples of each.	0	0	1	6	1	4.00	8
Critique significant and influential games.	0	0	1	5	2	4.13	8
Analyze a game's mechanics, including rules, narrative mechanics, social interactions, and physical affordances.	0	0	1	4	3	4.25	8
Identify elements that make up a game and evaluate them as independent components.	0	0	2	4	2	4.00	8

Enable novices to develop skills when applying critical practices.	0	1	4	2	1	3.38	8
Demonstrate an understanding of the vocabulary for discussing games and play.	0	0	1	3	4	4.38	8
Develop appropriate critical tools to the study of games.	0	0	3	2	3	4.00	8
Understand the difference between game reviews, critiques, and reporting.	0	0	2	4	2	4.00	8

Note. Critical Game Studies was an original core topic.

Competency	SD	D	ND/A	A	SA	M	N
Indie and Do It Yourself Games	0	2	0	6	0	3.50	8
Objective	SD	D	ND/A	A	SA	M	N
Identify tools for rapid game prototyping and development, and understand what they can do with each after the course ends.	0	0	1	4	2	4.14	7
Students are familiar with at least three art/expressive/unusual games.	0	0	1	5	1	4.00	7

Note. Indie and Do It Yourself Games was a newly created competency.

Competency	SD	D	ND/A	A	SA	M	N
Physical Interfaces	1	3	2	2	0	2.38	8
Objective	SD	D	ND/A	A	SA	M	N
Identify at least five types of interface with a game and describe the affordances for design that each provides.	1	1	1	4	0	3.14	7
Students can build a controller of their own using pre-existing kits.	1	1	3	2	0	2.86	7

Note. Physical Interfaces was a newly created competency.

Appendix E

Round Three Review and Expert Panel Instructions
Panel Reminder Letter
Round Three Instrument

Hello Review Panel,

Happy Holidays! I hope you are enjoying the holiday as the year draws to a close. We are now ready to launch Round Three of the study. The instructions for the Expert Panel are included below. As usual, you have 48 hours to give any feedback, comments and/or suggestions about the clarity and consistency of the survey instrument. Please respond by midnight on Thursday, December 30th. The link is available here:
http://www.surveymonkey.com/s/Round_Three_Instrument

I could not do this without you! Thanks,
Nayo

--Expert Panel Instructions---------------------------------------
Hello Expert Panel,

Happy Holidays! It is now time to complete Round Three of our study. In Round Three, your objective is to RANK each of the objectives that were rated in Round Two. (Those that had low mean ratings were discarded.) At the end of the survey instrument, you will rank and assign percentages to the competencies. They will be ranked from "1 to n", with "1" being the best, "2" being the next best, and so forth. The Group Mean (GM) is included for each objective carried over from Round Two. The GM is included to let you know the Means, not to influence your ranking in any way. Our aim is to create a more definitive list of items, so please choose the ranking with that in mind.

You may also edit any objective or competency, but only if you strongly feel it is necessary. Keep in mind that this will be the last chance to edit any competency and objective listed. If you feel that a particular competency/objective can be combined with another competency/objective, please report that in the comment section. Only the upper 50% of objectives (within each competency) will be kept for Round Four.

This survey will not take long to complete, as the rankings should go quickly. Upon completion of the Round Three Instrument, submit your responses. Please be sure to submit your responses by midnight on Wednesday, January 5th. The survey is available here:
http://www.surveymonkey.com/s/Round_Three_Instrument

Happy Holidays, Happy New Year and thank you!

Sincerely,

Nayo C-G Mack
Doctoral Researcher, NC State University
(919) xxx-xxxx
ncmack@ncsu.edu

Hello Expert Panel,

** *As a friendly last request, please complete Round Three if you would be so kind. You have valuable input and I would love for it to be counted towards this round!* **

Happy New Year! It is now time to complete Round Three of our study. In Round Three, your objective is to RANK each of the objectives that were rated in Round Two. (Those that had low mean ratings were discarded.) They will be ranked from "1 to n", with "1" being the best, "2" being the next best, and so forth. The Group Mean (GM) is included for each objective carried over from Round Two. The GM is included to let you know the Means, not to influence your ranking in any way. Our aim is to create a more definitive list of items, so please choose the ranking with that in mind.

You may also edit any objective or competency, but only if you strongly feel it is necessary. Keep in mind that this will be the last chance to edit any competency and objective listed. If you feel that a particular competency/objective can be combined with another competency/objective, please report that in the comment section. Only the upper 50% of objectives (within each competency) will be kept for Round Four.

After ranking the objectives, you will rank the competencies and assign percentages to them. The details are on the survey page.

This survey will not take long to complete, as the rankings should go quickly. Upon completion of the Round Three Instrument, submit your responses. Please be sure to submit your responses by midnight on Wednesday, January 12th. The survey is available here: http://www.surveymonkey.com/s/Round_Three_Instrument

Happy Holidays, Happy New Year and thank you!

Sincerely,

Nayo C-G Mack
Doctoral Researcher, NC State University
(919) xxx-xxxx
ncmack@ncsu.edu

ROUND THREE – RANKING THE COMPETENCIES AND OBJECTIVES

In Round Three, we will now RANK each of the objectives and competencies from Round Two. The ranking scale is based on the most important to least important competencies and objectives. You will first rank the objectives; the competencies will be ranked last.

You will rank the items from 1 - n on the following scale, where '1' represents the HIGHEST rank and 'n' represents the LOWEST rank (1 = Best, 2 = next best, 3,4,5,6,7...).

You may edit any objective, but only if you feel strongly about it. This will be the last time that you may edit the competencies and objectives.

OPTIONAL For the new competencies that were created, feel free to give a definition, though this is optional. They do not have definitions yet (as related to a Game Art and Design curriculum). Please RANK all items, whether you supply a new definition or not.

Topic Overview
Listed are the topics you will be ranking (in no particular order):

- Game Programming
- Game Production
- Visual Design
- Games and Society
- Usability
- Indie and DIY (Do It Yourself) Games
- Games Beyond Entertainment
- Simulation Project
- Business of Gaming
- Career Readiness
- Audio Design
- Game Design
- Interactive Storytelling
- Critical Game Studies

Before you begin…
**Remember, you are RANKING each objective on a scale of 1-n, where '1' is HIGHEST and 'n' is LOWEST.

Games Beyond Entertainment

This is a new competency that was created.
OPTIONAL Please give a sample definition for Games Beyond Entertainment as related to a Game Art and Design curriculum.
Definition: ____
Final comments or modifications on this competency: ____________________________
Please rank the following objectives for Games Beyond Entertainment:

Objective	**1**	**2**	**3**
Assist in developing students' understanding of games as a medium, rather than simply as systems of play. *GM = 3.57			
Offer opportunities for students to engage with games as learning systems, training systems, marketing systems, etc. *GM = 3.57			
Create a prototype of a serious game and its applications. *GM = none			

Please type any additional modifications below: __________________________________

Audio Design

Final comments or modifications on this competency:
____

Please rank the following objectives for Audio Design:

Objectives	1	2	3	4	5	6	7
Identify the roles music and sound play in a game. *GM = 4.13							
Understand the impact of sound and music on the overall game experience. *GM = 4.38							
Understand the specific audio issues of video games. *GM = 4.13							
Expose to relevant practical and theoretical material. *GM = 3.50							
Recognize how sound and music can be used to enhance gameplay. *GM = 4.13							
Create and utilize sound effects and voice into a game. *GM = 3.75							
Gain experience in the application of sound within a game design context. *GM = 3.88							

Games and Society

Final comments or modifications on this competency: ___________________________

Please rank the following objectives for Games and Society:

Objectives	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Understand how cultural values affect computer games. *GM = 4.00														
Understand how individuals and groups construct games as well as how their values/culture shape them. *GM = 3.88														
Analyze important games in terms of their social and cultural contexts. *GM = 4.13														
Understand the social issues of computer games. *GM = 4.13														
Understand legal issues that affect games, developers and players. *GM = 3.88														
Demonstrate understanding of the role games play at various stages of human development. *GM = 3.38														
Identify psychological predispositions of human beings that influence their reception and use of games. *GM = 3.88														
Understand worldwide gaming culture. *GM = 4.0														
Recognize key signs and symbols (semiotics) in terms of racial and cultural depictions and how they affect the interpretation of a game. *GM = 3.50														
Understand the psychological impact of computer games. *GM = 3.50														
Describe the impact of the video game industry on the economy. *GM = 3.50														
Enable an understanding of the impacts of cultural expectations and structures on what is														

considered "good" gameplay. *GM = 3.88														
Provide examples of how various cultures differ in the assumptions, expectations and taboos of games. *GM = 3.75														
Identify at least five ways in which gamers may differ from each other (age, gender, race, culture, language, religion, socio-economic status, etc.) and be able to analyze the impact of those factors on the play experience. *GM = 4.25														

Game Programming

Final comments or modifications on this competency: ___________________________

Please rank the following objectives for Game Programming:

Objectives	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**…**	**15**	**16**
Troubleshoot a game. *GM = 3.63														
Demonstrate grade-level appropriate skills in creating flowcharts and solving equations. *GM = 4.25														
Implement designs within the constraints of technical development. *GM = 3.75														
Understand basic game logic and framework structure. *GM = 4.50														
Identify key components of a game engine and how they interrelate. *GM = 4.00														
Develop appreciation of programming and issues relevant to computer games. *GM = 4.38														

Become familiar with popular game tools such as DirectX, 3DMax, and different gaming engines. *GM = 3.25														
Understand why certain programming methods are used. *GM = 3.75														
Provide a basic exposure to pragmatic game development processes. *GM = 4.38														
Identify the various branches of mathematics used in programming (which portions of the game use which branch). *GM = 3.75														
Write a design document for a simple digital game. *GM = 3.75														
Identify an ill-defined problem in the game implementation. *GM = 4.13														
Gain experience in development, leading to competencies in scripting. *GM = 3.63														
Demonstrate skills in listing the logical steps of everyday complex processes (such as answering a phone, making a sandwich, etc.). *GM = 4.38														
Be able to define a small subset of the problem that may be tested with a minimal digital prototype. *GM = 4.25														
Construct a simple digital game. *GM = 4.13														

Business of Gaming

Final comments or modifications on this competency: ________________________________

Please rank the following objectives for Business of Gaming:

Objectives	1	2	3	4	5	6	7
Write a business plan for a game including platform choice and monetization strategies. *GM = 2.75							
Identify games beyond the marketing mainstream (i.e. Indie games). *GM = 3.00							
Create and present business summaries and market pitches of imagined or actual games. *GM = 2.88							
Understand the economic and legal side of game development. *GM = 3.13							
Identify the impact of current industry practices on games that are created. *GM = 2.75							
Describe the importance of professional ethics and legal responsibilities. *GM = 3.13							
Demonstrate understanding of the business issues behind computer games. *GM = 3.13							

Usability

This is a new competency that was created.

OPTIONAL Please give a sample definition for Usability as related to a Game Art and Design curriculum.

Definition: ____

Final comments or modifications on this competency: ______________________________

Please rank the following objectives for Usability:

Objective	1	2	3	4	5
Understand the usability issues of game design. *GM = 4.00					
Create and run small usability tests of gameplay. *GM = 4.00					
Explain the functionality of game related components of a computer/console such as Save systems, Input/Outputs devices, processors, network cards, etc. *GM = 3.50					
Connecting consoles to various television standards. *GM = none					
Competency in play-testing. *GM = none					

Please type any additional modifications below: ____________________________________

Visual Design

Final comments or modifications on this competency:

____

Please rank the following objectives for Visual Design:

Objectives	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**…**	**15**
Demonstrate an understanding of the terminology, methodology, and creation process of various visual art disciplines. *GM = 4.33													
Create screen mockups and layouts for a game's user interface. *GM = 3.89													
Recognize key art and design styles and their influence on important games. *GM = 4.22													
Demonstrate understanding of visual design strategies. *GM = 3.88													
Demonstrate language arts knowledge and skills. *GM = 3.63													
Provide a basic survey of art and design practices, such that students can develop practical visual literacies. *GM = 4.25													
Describe the process (pipeline) by which visual assets are created for games. *GM = 4.13													
Create the graphics for games; modeling and animation. *GM = 3.38													
Create drawings and illustrations in both electronic and nonelectronic form. *GM = 4.25													
Understand how visual design decisions impact the overall game experience. *GM = 3.88													
Develop critical reflections on the interrelation of aesthetics and the audience. *GM = 3.50													

Enable students to develop skills in applying theoretical and practical knowledge from related areas. *GM = 3.25													
Explain the importance of brainstorming, experimentations, and previsualization during the creation process. *GM = 4.25													
Design and implement the interface for a game; interface theory and design. *GM = 3.75													
Use computer tools to create two-dimensional drawings and three-dimensional models. *GM = 3.25													

Simulation Project

This is a new competency that was created.

OPTIONAL Please give a sample definition for Simulation Project as related to a Game Art and Design curriculum.
Definition: ____
Final comments or modifications on this competency: ___________________________

Please rank the following objectives for Simulation Project:

Objective	1	2	3
Participate in large scale or individual real world design projects. *GM = 3.38			
Create a working game or simulation individually or as part of a team. *GM = 3.75			
Classroom should mirror studio settings (departments, managers). *GM = none			

Please type any additional modifications below: ________________________________

Game Production

Final comments or modifications on this competency: ___________________________

Please rank the following objectives for Game Production:

Objectives	1	2	3	4	5	6	7	8	9	10	…	13
Describe the importance of communication to the design process and give examples of effective communication methods. *GM = 4.29												
Understand the basics of game project management. *GM = 4.14												
Show understanding of the game production process. *GM = 4.00												
Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. *GM = 4.43												
Exposure to a range of possible project management techniques. *GM = 3.43												
Demonstrate skills in team-work and leadership as used in the game industry. *GM = 3.71												
Write a design document for their game. *GM = 4.14												
Lead the production process of a game or level. *GM = 4.00												
Recognize the value and importance of team collaborative work. *GM = 4.43												
Develop design documents along with, if possible, a real game design project. *GM = 4.14												
Develop students' capacity to structure and manage their own projects. *GM = 4.14												
Describe the pipeline of a video game from conception to customer support. *GM = 4.00												
Understand the impact of current industry practices on the games that are created. *GM = 3.43												

Interactive Storytelling

Final comments or modifications on this competency:

____

Please rank the following objectives for Interactive Storytelling:

Objectives	1	2	3	4	5	6	7	8	9	10	11	…	15
Design a simple participatory story. *GM = 4.38													
Identify the components of traditional narrative structures and devices, comparing/contrasting them with the structures and devices as they are used in video games. *GM = 4.13													
Identify key storytelling techniques or structures in games. *GM = 4.25													
Demonstrate understanding of narrative theory. *GM = 4.13													
Demonstrate language arts knowledge and skills. *GM = 4.25													
Provide experience in developing, analyzing and implementing narrative in games. *GM = 3.75													
Discuss how and when narrative is used in games and for what purpose. *GM = 4.00													
Understand the trade-offs between player participation and authorial control. *GM = 4.25													
Write a script for a level. *GM = 4.13													
Discuss the interrelationship (or conflict) between story and gameplay. *GM = 4.13													
Determine and document the graphical and animation needs of a game using design documents including art direction and reference													

material. *GM = 3.38													
Provide exposure to a range of appropriate theoretical tools that allow for the construction and analysis of effective non-linear narratives. *GM = 3.13													
Discuss the role of the writer in an interactive environment and how it varies from novels, film and television. *GM = 3.88													
Understand at least three ways to deliver narrative content (ambient, dialogue, cut-scene, emergent) and can identify them in existing digital games. *GM = 3.88													
Write non-linear stories for games that involve choices on the part of the player, leading to multiple outcomes. *GM = 4.00													

Critical Game Studies

Final comments or modifications to this competency:

Please rank the following objectives for Critical Game Studies:

Objectives	1	2	3	4	5	6	7	8	9	10	11	…	20
Offer insight into the textual analysis of gameplay. *GM = 3.50													
Tell the difference between a game's design and its execution. *GM = 4.25													
Identify important designers, games, and events in game development and adoption by society. *GM = 4.13													

Provide exposure to a range of cultural issues, in order to broaden and deepen their engagement with practices. *GM = 3.38													
Provide insights into the development and use of computer games. *GM = 3.50													
Understand the history of computers and digital games and toys. *GM = 4.25													
Identify historical innovations in gameplay. *GM = 4.00													
Discuss the roles games play within a society and how specific games fulfill their roles. *GM = 4.00													
Develop critical literacies in novice game designers. *GM = 3.63													
Understand the historical significance of electronic and non-electronic games. *GM = 3.88													
Understand history of games and related issues. *GM = 4.00													
Discuss the history of games and identify the different game genres and important examples of each. *GM = 4.00													
Critique significant and influential games. *GM = 4.13													
Analyze a game's mechanics, including rules, narrative mechanics, social interactions, and physical affordances. *GM = 4.25													
Identify elements that make up a game and evaluate them as independent components. *GM = 4.00													
Enable novices to develop													

skills when applying critical practices. *GM = 3.38													
Demonstrate an understanding of the vocabulary for discussing games and play. *GM = 4.38													
Develop appropriate critical tools to the study of games. *GM = 4.00													
Understand the difference between game reviews, critiques, and reporting. *GM = 4.00													

Game Design

Final comments or modifications to this competency: ______________________________

Please rank the following objectives for Game Design:

Objectives	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**…**	**19**	**20**
Conceive of ideas for small-scale electronic games and work alone or in a team to implement and playtest them. *GM = 3.75														
Distinguish critical strengths and weaknesses of various principles and methods used in computer game design. *GM = 4.13														
Identify major game design														

elements in a commercial digital game. *GM = 4.50														
Discuss how genres of games vary in how they utilize elements such as storytelling, mechanics, art, etc. *GM = 4.00														
Analyze a game (of their own or someone else's) to determine potential improvements to the game play. *GM = 4.13														
Understand how rule design, play mechanics, game balancing, social game interaction, and the integration of visual, audio, tactile and textual elements affect the fun or value in games. *GM = 4.38														
Analyze the key components of the game experience of important games. *GM = 4.25														
Discuss the interrelationship of different game elements and their impact on the game experience. *GM = 3.88														
Understand how computer games are designed using appropriate methods and principles. *GM = 4.13														
Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design. *GM = 4.25														
Demonstrate how games are developed as experiential tools and environments. *GM = 3.38														
Describe the complex interaction between video games and players and the role														

it plays in the popularity of a game. *GM = 3.38														
Provide opportunities to reflect upon the relation of game mechanics and design process. *GM = 4.13														
Develop understanding of the variety of theoretical approaches to game mechanics. *GM = 4.13														
Identify elements that make games "fun". *GM = 4.13														
Construct a simple non-digital game. *GM = 4.63														
Explain the importance of challenge within game play. *GM = 4.25														
Understand the difference between mechanics, interface, narrative, visuals - as well as the interaction between them. *GM = 4.50														
Understand how game play, storytelling, and design affect the fun or value in games. *GM = 4.13														
Design an original non electronic game, including mechanics, objective and theme. *GM = 4.50														

Indie and DIY* Games

This is a new competency that was created.
*Do It Yourself

OPTIONAL Please give a sample definition for Simulation Project as related to a Game Art and Design curriculum.
Definition: ____
Final comments or modifications on this competency: _____________________________

Please rank the following objectives for Indie and DIY Games:

Objective	1	2	3
Identify tools for rapid game prototyping and development, and understand what they can do with each after the course ends. *GM = 4.14			
Students are familiar with at least three art/expressive/unusual games. *GM = 4.00			

Please type any additional modifications below: _______________________________
If you have any questions or comments, feel free to leave them in the box below.

Additional comments and/or questions: ______________________________________

Optional

Please type your initials in the text box below. This is not to keep track of your personal responses. It will be used to keep track of which panelists have or have not completed the survey.

Initials: ____

End of Round Three

Thank you for completing Round Three of the Delphi study. There is one final round with an Exit Demographic Survey* to end this research study. Your input has been invaluable.

Thank you again. Happy Holidays, Happy New Year and Good bye!

* The Exit Demographic Survey is just to update the demographic files in case anyone has earned an additional degree, changed job titles/occupation, gained another year of experience, etc.

Appendix F

Round Four Review and Expert Panel Instructions
Panel Reminder Letter
Round Four Instrument
Table C - Round Four Accepts and Rejects with Chi Square value (X) for Objectives
List 1. Discarded Competencies and Objectives from Round Four

Hello Review Panelists,

The time has arrived! We are now at the fourth and final round for this study. In this round, all the participants are asked to do is to Accept or Reject the remaining objectives and competencies. As a reminder, if you have any suggestions or modifications, I will gladly take them and incorporate them into the instrument. Please send any suggestions by 12noon on Monday, January 17th. The survey is available here:
http://www.surveymonkey.com/s/Round_Four_Instrument

I have also attached the survey in a pdf version. The instructions that the Expert Panelists are included below:
-- Instructions --
Hello Expert Panel,

The time is here! We are now at the fourth and final round of this study. This is the culminating round where you will ACCEPT or REJECT the remaining objectives and competencies.

Round Four was created by calculating the mean ranks of each competency and objective from Round Three. Once the means were in place, the bottom half was discarded, and those with high ranks were kept (this applies to the objectives; no competency has been discarded). You will now ACCEPT or REJECT the remaining objectives and competencies. The means (M) are included next to each objective and competency for your perusal, though it is not intended to influence your acceptance or rejection.

As a final measure, I will also send out an Exit Demographics Survey just as a way to update the demographics for this study (in case anyone has received a promotion, earned another degree, gained another year of experience, etc.) In the Exit Survey you will have the option to state your name and/or School/Business affiliation to be published as a contributing panelist in this study. As an additional 'thank you' for your participation, you will be able to receive a copy of the study results before anyone else in the field does! It is yours as much as it is mine. The survey is available here:
http://www.surveymonkey.com/s/Round_Four_Instrument

Please respond by *date*. Thank you for your participation thus far. I look forward to compiling the final results!

Sincerely,

Nayo C-G Mack
Doctoral Researcher, NC State University
(919) xxx-xxxx
ncmack@ncsu.edu

Hello Expert Panel,

If you have already completed Round Four, please disregard this notice, and thank you!

Thank you all for completing Round Three of the study. I realize that there were tedious sections in the last study, but for this round, they were cut in half based on the rankings. The time is here! We are now at the fourth and final round of this study. This is the culminating round where you will ACCEPT or REJECT the remaining objectives and competencies.

Round Four was created by calculating the mean ranks of each competency and objective from Round Three; the half with the highest rank was kept. You will now ACCEPT or REJECT the remaining objectives and competencies. The means (M) are included next to each objective and competency for your perusal, though it is not intended to influence your acceptance or rejection.

As a final measure, I will also send out an Exit Demographics Survey just as a way to update the demographics for this study (in case anyone has received a promotion, earned another degree, gained another year of experience, etc.) In the Exit Survey you will have the option to state your name and/or School/Business affiliation to be published as a contributing panelist in this study. As an additional 'thank you' for your participation, you will be able to receive a copy of the study results before anyone else in the field does! It is yours as much as it is mine. The survey is available here:
http://www.surveymonkey.com/s/Round_Four_Instrument

Please respond by midnight on Thursday, January 27th. Thank you for your participation thus far. I look forward to compiling the final results!

Sincerely,

Nayo C-G Mack
Doctoral Researcher, NC State University
(919) xxx-xxxx
ncmack@ncsu.edu

ROUND FOUR – ACCEPT OR REJECT

In Round Four, we will ACCEPT or REJECT the objectives remaining from those ranked in the top half of Round Three.

The objectives are numbered as they were ranked from highest to lowest, and the Means (M) are included for your knowledge.

Once you complete your Accepts or Rejects and the results are analyzed, what remains will be compiled. The final group of compiled competencies and objectives will be suitable to recommend as a high school Game Art and Design curriculum (or platform to expand upon).

Topic Overview:
You will be Accepting or Rejecting objectives within the following competencies:

- Game Programming
- Game Production
- Visual Design
- Games and Society
- Usability
- Games Beyond Entertainment
- Simulation Project
- Business of Gaming
- Audio Design
- Game Design
- Interactive Storytelling
- Critical Game Studies

Games Beyond Entertainment

Please Accept or Reject each objective:

Objective	Accept	Reject
#1 - Assist in developing students' understanding of games as a medium, rather than simply as systems of play. M = 1.5		
#2 - Offer opportunities for students to engage with games as learning systems, training systems, marketing systems, etc. M = 2.1		
#3 - Create a prototype of a serious game and its applications. M = 2.4		

Audio Design

Please Accept or Reject each objective:

Objective	Accept	Reject
#1 - Understand the impact of sound and music on the overall game experience. M = 3.3		
#2 - Gain experience in the application of sound within a game design context. M = 3.7		
#3 - Create and utilize sound effects and voice into a game. M = 3.9		
#4 - Expose to relevant practical and theoretical material. M = 3.9		

Games and Society

Please Accept or Reject each objective:

Objective	Accept	Reject
#1 - Understand how individuals and groups construct games as well as how their values/culture shape them. M = 3.2		
#2 - Analyze important games in terms of their social and cultural contexts. M = 4.1		
#3 - Understand how cultural values affect computer games. M = 5.0		
#4 - Understand the social issues of computer games. M = 6.8		
#5 - Identify at least five ways in which gamers may differ from each other (age, gender, race, culture, language, religion, socio-economic status, etc.) and be able to analyze the impact of those factors on the play experience. M = 7.2		
#6 - Understand the psychological impact of computer games. M = 7.5		
#7 - Understand worldwide gaming culture. M = 7.7		

Game Programming

Please Accept or Reject each objective:

Objective	Accept	Reject
#1 - Understand basic game logic and framework structure. M = 1.8		
#2 - Develop appreciation of programming and issues relevant to computer games. M = 4.4		
#3 - Provide a basic exposure to pragmatic game development processes. M - 5.5		
#4 - Understand why certain programming methods are used. M = 6.7		
#5 - Identify an ill-defined problem in the game implementation. M = 7.4		
#6 - Demonstrate grade-level appropriate skills in creating flowcharts and solving equations. M = 7.6		
#7 - Implement designs within the constraints of technical development. M = 8.5		
#8 - Identify the various branches of mathematics used in programming (which portions of the game use which branch). M = 9.0		

Business of Gaming

Please Accept or Reject each objective:

Objective	Accept	Reject
#1 - Understand the economic and legal side of game development. M = 3.3		
#2 - Create and present business summaries and market pitches of imagined or actual games. M = 3.4		
#3 - Demonstrate understanding of the business issues behind computer games. M = 3.4		
#4 - Write a business plan for a game including platform choice and monetization strategies. M = 3.7		
#5 - Describe the importance of professional ethics and legal responsibilities. M = 3.9		

Usability

Please Accept or Reject each objective:

Objective	Accept	Reject
#1 - Understand the usability issues of game design. M = 1.4		
#2 - Create and run small usability tests of gameplay. M = 2.1		
#3 - Competency in play-testing. M = 3.1		

Visual Design

Please Accept or Reject each objective:

Objective	Accept	Reject
#1 - Demonstrate an understanding of the terminology, methodology, and creation process of various visual art disciplines. M = 4.2		
#2 - Create drawings and illustrations in both electronic and non-electronic form. M = 4.6		
#3 - Provide a basic survey of art and design practices, such that students can develop practical visual literacies. M = 5.9		
#4 - Demonstrate understanding of visual design strategies. M = 6.2		
#5 - Recognize key art and design styles and their influence on important games. M = 6.3		
#6 - Understand how visual design decisions impact the overall game experience. M = 6.6		
#7 - Explain the importance of brainstorming, experimentations, and pre-visualization during the creation process. M = 6.9		
#8 - Create screen mockups and layouts for a game's user interface. M = 8.4		

Simulation Project

Please Accept or Reject each objective:

Objective	Accept	Reject
#1 - Create a working game or simulation individually or as part of a team. M = 1.9		
#2 - Participation within a classroom environment that mirrors studio settings. M = 2.2		
#3 - Participate in large scale or individual real world design projects. M = 2.3		

Game Production

Please Accept or Reject each objective:

Objective	Accept	Reject
#1 - Describe the importance of communication to the design process and give examples of effective communication methods. M = 3.4		
#2 - Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. M = 4.5		
#3 - Recognize the value and importance of team collaborative work. M = 4.8		
#4 - Understand the basics of game project management. M = 5.4		
#5 - Show understanding of the game production process. M = 6.3		
#6 - Develop design documents along with, if possible, a real game design project. M = 7.3		
#7 - Develop students' capacity to structure and manage their own projects. M = 7.3		
#8 - Describe the pipeline of a video game from conception to customer support. M = 7.3		

Interactive Storytelling

Please Accept or Reject each objective:

Objective	Accept	Reject
#1 - Identify key storytelling techniques or structures in games. M = 2.9		
#2 - Understand the trade-offs between player participation and authorial control. M = 5.1		
#3 - Demonstrate language arts knowledge and skills. M = 5.6		
#4 - Demonstrate understanding of narrative theory. M = 5.9		
#5 - Design a simple participatory story. M = 5.9		
#6 - Identify the components of traditional narrative structures and devices, comparing/contrasting them with the structures and devices as they are used in video games. M = 6.0		
#7 - Discuss the interrelationship (or conflict) between story and gameplay. M = 7.0		
#8 - Write non-linear stories for games that involve choices on the part of the player, leading to multiple outcomes. M = 8.7		

Critical Game Studies

Please Accept or Reject each objective:

Objective	Accept	Reject
#1 - Demonstrate an understanding of the vocabulary for discussing games and play. M = 4.5		
#2 - Understand the history of computers and digital games and toys. M = 5.5		
#3 - Critique significant and influential games. M = 6.8		
#4 - Develop appropriate critical tools to the study of games. M = 7.6		
#5 - Identify elements that make up a game and evaluate them as independent components. M = 7.8		
#6 - Understand history of games and related issues. M = 7.9		
#7 - Analyze a game's mechanics, including rules, narrative mechanics, social interactions, and physical affordances. M = 8.8		
#8 - Identify important designers, games, and events in game development and adoption by society. M = 9.0		
#9 - Discuss the history of games and identify the different game genres and important examples of each. M = 9.3		
#10 - Identify historical innovations in gameplay. M = 9.6		

Game Design

Please Accept or Reject each objective:

Objective	Accept	Reject
#1 - Construct a simple non-digital game. M = 3.4		
#2 - Understand the difference between mechanics, interface, narrative, visuals - as well as the interaction between them. M = 4.1		
#3 - Understand how rule design, play mechanics, game balancing, social game interaction, and the integration of visual, audio, tactile and textual elements affect the fun or value in games. M = 4.8		
#4 - Design an original non electronic game, including mechanics, objective and theme. M = 5.6		
#5 - Identify major game design elements in a commercial digital game. M = 5.8		
#6 - Analyze a game (of their own or someone else's) to determine potential improvements to the game play. M = 8.6		
#7 - Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design. M - 8.6		
#8 - Understand how game play, storytelling, and design affect the fun or value in games. M = 8.6		
#9 - Develop understanding of the variety of theoretical approaches to game mechanics. M = 9.6		
#10 - Explain the importance of challenge within game play. M = 9.7		
#11 - Distinguish critical strengths and weaknesses of various principles and methods used in computer game design. M = 9.8		

Competencies

* No Competency will be discarded unless:
1 - Is chosen as a REJECT by a majority of the panelists
and/or
2 - On average, there are less than two objectives left under the competency.

Please Accept or Reject each competency:

Objective	Accept	Reject
#1 - Game Design, M = 1.44		
#2 - Visual Design, M = 3.22		
#3 - Interactive Storytelling, M = 5.44		
#4 - Game Production, M = 5.56		
#5 - Critical Game Studies, M = 6.11		
#6 - Games and Society, M = 6.13		
#7 - Game Programming, M = 6.22		
#8 - Usability, M = 6.5		
#9 - Audio Design, M = 8.88		
#10 - Business of Gaming, 9.38		
#11 - Simulation Project, M = 10.13		
#12 - Games Beyond Entertainment, M = 10.34		

Optional

Please type your initials in the text box below. This is not to keep track of your personal responses. It will be used to keep track of which panelists have or have not completed the survey.

Initials: ____

End of Round Four

Thank you for completing Round Four of the Delphi study. Congrats to us all!

I will send the Exit Demographics survey soon. Please complete it, as you will have the option to be listed as a participant in this study. As an added bonus, you will also have the option to receive a completed version of the high school Game Art and Design curriculum based off of the IGDA Framework - The Study of Games and Game Development version 3.2 beta.

Thank you again. This research study would not have been a success without you!

Table C.

Round Four Accepts and Rejects with Chi Square value (X) for Objectives

Audio Design	N	Accept	% Accept	Reject	% Reject	X
Understand the impact of sound and music on the overall game experience.	10	9	90.0	1	10.0	4.455
Gain experience in the application of sound within a game design context.	10	10	100.0	0	0.0	-
Create and utilize sound effects and voice into a game.	10	9	90.0	1	10.0	7.634
Expose to relevant practical and theoretical material.	10	7	70.0	3	30.0	-

Note. Objectives with a '-' had no Chi-Square calculation because of a perfect score.

Games and Society	N	Accept	% Accept	Reject	% Reject	X
Understand how individuals and groups construct games as well as how their values/culture shapes them.	9	7	77.8	2	22.2	1.600
Analyze important games in terms of their social and cultural context.	9	7	77.8	2	22.2	1.600
Understand how cultural values affect computer games.	9	9	100	0	0.0	-
Understand the social issues of computer games.	9	8	88.9	1	11.1	6.400
Identify at least five ways in which gamers may differ from each other (age, gender, race, culture, language, religion, socio-economic status, etc.) and be able to analyze the impact of those factors on the play experience.	9	7	77.8	2	22.2	3.600
Understand the psychological impact of computer games.	9	8	88.9	1	11.1	6.400
Understand worldwide gaming culture.	9	5	55.6	4	44.4	.400

Note. Objectives with a '-' had no Chi-Square calculation because of a perfect score.

Game Programming	N	Accept	% Accept	Reject	% Reject	X
Understand basic game logic and framework structure.	9	8	88.9	1	11.1	3.600
Develop appreciation of programming and issues relevant to computer games.	9	9	100	0	0.0	-
Provide a basic exposure to pragmatic game development processes.	9	9	100	0	0.0	-
Understand why certain programming methods are used.	9	9	100	0	0.0	-
Identify an ill-defined problem in the game implementation.	9	6	66.7	3	33.3	1.600
Demonstrate grade-level appropriate skills in creating flowcharts and solving equations.	9	7	77.8	2	22.2	3.600
Implement designs within the constraints of technical development.	9	8	88.9	1	11.1	6.400
Identify the various branches of mathematics used in programming (which portions of the game use which branch).	9	6	66.7	3	33.3	1.600

Note. Objectives with a '-' had no Chi-Square calculation because of a perfect score.

Business of Gaming	N	Accept	% Accept	Reject	% Reject	X
Understand the economic and legal side of game development.	9	7	77.8	2	22.2	3.600
Create and present business summaries and market pitches of imagined or actual games.	9	9	100.0	0	0.0	-
Demonstrate understanding of the business issues behind computer games.	9	8	88.9	1	11.1	6.400
Write a business plan for a game including platform choice and monetization strategies.	9	8	88.9	1	11.1	6.400
Describe the importance of professional ethics and legal responsibilities.	9	8	88.9	1	11.1	6.400

Note. Objectives with a '-' had no Chi-Square calculation because of a perfect score.

Usability	N	Accept	% Accept	Reject	% Reject	X
Understand the usability issues of game design.	9	9	100.0	0	0.0	6.400
Create and run small usability tests of game play.	9	9	100.0	0	0.0	-
Competency in play-testing.	9	7	77.8	2	22.2	3.600

Note. Objectives with a '-' had no Chi-Square calculation because of a perfect score.

Visual Design	N	Accept	% Accept	Reject	% Reject	X
Demonstrate an understanding of the terminology, methodology, and creation process of various visual art disciplines.	9	9	100.0	0	0.0	-
Create drawings and illustrations in both electronic and non-electronic form.	9	9	100.0	0	0.0	-
Provide a basic survey of art and design practices, such that students can develop practical visual literacies.	9	9	100.0	0	0.0	6.400
Demonstrate understanding of visual design strategies.	9	8	88.9	1	11.1	6.400
Recognize key art and design styles and their influence on important games.	9	8	88.9	1	11.1	6.400
Understand how visual design decisions impact the overall game experience.	9	9	100.0	0	0.0	-
Explain the importance of brainstorming, experimentations, and pre-visualization during the creation process.	9	8	88.9	1	11.1	6.400
Create screen mockups and layouts for a game's user interface.	9	8	88.9	1	11.1	6.400

Note. Objectives with a '-' had no Chi-Square calculation because of a perfect score.

Simulation Project	N	Accept	% Accept	Reject	% Reject	X
Create a working game or simulation individually or as part of a team.	9	7	77.8	2	22.2	3.600

Participation within a classroom environment that mirrors studio settings.	9	6	66.7	3	33.3	1.600
Participate in large scale or individual real world design projects.	9	7	77.8	2	22.2	3.600

Note. All objectives received a Chi-Square value.

Game Production	N	Accept	% Accept	Reject	% Reject	X
Describe the importance of communication to the design process and give examples of effective communication methods.	9	9	100.0	0	0.0	6.400
Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.	9	9	100.0	0	0.0	-
Recognize the value and importance of team collaborative work.	9	8	88.9	1	11.1	6.400
Understand the basics of game project management.	9	8	88.9	1	11.1	6.400
Show understanding of the game production process.	9	6	66.7	3	33.3	1.600
Develop design documents along with (if possible) a real game design project.	9	8	88.9	1	11.1	6.400
Develop students' capacity to structure and manage their own projects.	9	8	88.9	1	11.1	6.400
Describe the pipeline of a video game from conception to customer support.	9	9	100.0	0	0.0	-

Note. Objectives with a '-' had no Chi-Square calculation because of a perfect score.

Interactive Storytelling	N	Accept	% Accept	Reject	% Reject	X
Identify key storytelling techniques of structures in games.	9	8	89.8	1	11.1	6.400
Understand the trade-offs between player participation and authorial control.	9	8	89.8	1	11.1	3.600
Demonstrate language arts knowledge and skills.	9	7	77.8	2	22.2	3.600
Demonstrate understanding of narrative theory.	9	8	89.8	1	11.1	6.400
Design a simple participatory story.	9	9	100.0	0	0.0	-
Identify the components of traditional narrative structures and devices, comparing/contrasting them with the structures and devices as they are used in	9	7	77.8	2	22.2	3.600

video games.						
Discuss the interrelationship (or conflict) between story and game play.	9	9	100.0	0	0.0	-
Write non-linear stories for games that involve choices on the part of the player, leading to multiple outcomes.	9	6	66.7	3	33.3	1.600

Note. Objectives with a '-' had no Chi-Square calculation because of a perfect score.

Critical Game Studies	N	Accept	% Accept	Reject	% Reject	X
Demonstrate an understanding of the vocabulary for discussing games and play.	9	9	100.0	0	0.0	-
Understand the history of computers and digital games and toys.	9	7	77.8	2	22.2	3.600
Critique significant and influential games.	9	8	88.9	1	11.1	6.400
Develop appropriate critical tools to the study of games.	9	7	77.8	2	22.2	3.600
Identify elements that make up a game and evaluate them as independent components.	9	8	88.9	1	11.1	6.400
Understand history of games and related issues.	9	6	66.7	3	33.3	1.600
Analyze a game's mechanics, including rules, narrative mechanics, social interactions, and physical affordances.	9	9	100.0	0	0.0	-
Identify important designers, games, and events in game development and adoption by society.	9	8	88.9	1	11.1	6.400
Discuss the history of games and identify the different game genres and important examples of each.	9	8	88.9	1	11.1	6.400
Identify historical innovations in game play.	9	8	88.9	1	11.1	6.400

Note. Objectives with a '-' had no Chi-Square calculation because of a perfect score.

Game Design	N	Accept	% Accept	Reject	% Reject	X
Construct a simple non-digital game.	9	8	88.9	1	11.1	3.600
Understand the difference between mechanics, interface, narrative, visuals – as well as the interaction between them.	9	9	100.0	0	0.0	6.400
Understand how rule design, play mechanics, game balancing, social game interaction, and the integration of visual, audio or tactile and textual elements affect the fun or value in games.	9	9	100.0	0	0.0	-
Design an original non-electronic game, including mechanics, objective and theme.	9	8	88.9	1	11.1	6.400
Identify major game design elements in a commercial digital game.	9	9	100.0	0	0.0	-
Analyze a game to determine the potential improvements to the game play.	9	9	100.0	0	0.0	-
Demonstrate an understanding of the techniques used to evaluate game mechanics, game play, flow, and game design.	9	9	100.0	0	0.0	-
Understand how game play, storytelling, and design affect the fun or value in games.	9	7	77.8	2	22.2	3.600
Develop understanding to the variety of theoretical approaches to game mechanics.	9	8	88.9	1	11.1	6.400
Explain the importance of challenge within game play.	9	6	66.7	3	33.3	1.600
Distinguish critical strengths and weaknesses of various principles and methods used in computer game design.	9	8	88.9	1	11.1	6.400

Note. Objectives with a '-' had no Chi-Square calculation because of a perfect score.

List 1. Discarded Competencies and Objectives from Round Four.

1. Critical Game Studies
    - Demonstrate an understanding of the vocabulary for discussing games and play.
    - Critique significant and influential games.
    - Identify elements that make up a game and evaluate them as independent components.
    - Analyze a game's mechanics, including rules, narrative mechanics, social interactions, and physical affordances.
    - Identify important designers, games, and events in game development and adoption by society.
    - Discuss the history of games and identify the different game genres and important examples of each.
    - Identify historical innovations in game play.
2. Games and Society
    - Understand how cultural values affect computer games.
    - Understand the social issues of computer games.
    - Understand the psychological impact of computer games.
3. Usability
    - Understand the usability issues of game design.
    - Create and run small usability tests of game play.
4. Games Beyond Entertainment
    - Offer opportunities for students to engage with games as learning systems, training systems, marketing systems, etc.

Appendix G

Thank You letter
Exit Demographic Survey
List of Study Panelists

Hello Panelists,

I cannot thank you enough for your contributions to my study over the past few months. I would like to offer you the opportunity to have your name listed as a panelist within the document to accompany the findings. In the Exit Demographics Survey, you can list your name and association (whether it be a school, corporation, organization, etc.), or you can just list your name if you like. Conversely, if you'd like to remain anonymous, that is also perfectly fine!

The Exit Demographic Survey is available here:
http://www.surveymonkey.com/s/Exit_Demographic_Survey

Secondly, I have attached the final list of competencies and objectives as created by you, the panelists. This will serve as a recommended high school Game Art and Design curriculum in my dissertation. What remained was statistically significant and highly correlated. Do not worry if your preferences were discarded; I am including that information in the appendix as I feel it has merit as well. I hope you are as proud of the results as I am! :)

You have made this monstrous task much easier than I could have ever imagined. You have my gratitude. Thank you again, and best of luck to you all,

Sincerely,

Nayo C-G Mack
Doctoral Researcher, NC State University
(919) xxx-xxxx
ncmack@ncsu.edu

Exit Demographics Questionnaire for Delphi Study

"A study using the Delphi method to define essential competencies for a high school Game Art and Design course framework at the national level"

The Exit Demographic Survey will be used strictly to update the demographic files in case anyone has earned an additional degree, changed job titles/occupation, gained another year of experience, etc. This will enable me to have a complete profile of the panelists.

Please check or fill in the following information:

Have you either attended a high school in the United States for at least one year OR taught at a high school in the United States for at least one year?

_____ Yes
_____ No

What is your highest degree obtained as of December 30, 2010?
_____ B.S./B.A.
_____ M.S./M.Ed.
_____ Ed.D/Ph.D.

List the major area for each degree you hold:
Baccalaureate: ____
Masters: ____
Doctorate: ____
Other: ____

Which title most accurately describes your current position?
_____ Game designer
_____ Technology Instructor
_____ Technology Researcher
_____ Industry
_____ Other (please explain: ______________________________________)

Which of the following grade level(s) do you currently teach?

_____ Middle School
_____ High School
_____ Community/Technical School
_____ College/University
_____ I do not currently teach
_____ I have never taught

How many years of teaching experience do you have?
_____ 0-2
_____ 3-5
_____ 6-10

_____ 11-15
_____ 16-20
_____ 21-25
_____ over 25 years

How many years of experience do you have with gaming?
_____ 0-2
_____ 3-5
_____ 6-9
_____ more than 10
_____ Other (please specify)

How many years of experience do you have with gaming in an educational capacity?
_____ 0-2
_____ 3-5
_____ 6-9
_____ more than 10
_____ I do not have experience with gaming in an educational capacity

Do you have any experience in course development, course construction or curriculum and instruction? If yes, please explain.
_____ Yes
_____ No
____
____

Current residence:
_____ USA _____ State/Territory
_____ Non-USA _____ Country

If you would like your name published along with the results of this research study, please list it below (exactly as you would like it published). You can also list any affiliation (college, university, organization, employer, etc) to be printed with your name.
Name: ____
Affiliation: ____

Final Remarks…
Thank you for your support of this research study. You have contributed to the educational gaming field in an invaluable way. Best wishes to you all.

Many thanks!

Study Panelists and Their Affiliations

Name: Dan Carreker
Affiliation: *Mt. Sierra College*

Name: Erik Champion
Affiliation: *none*

Name: William Crosbie
Affiliation: *none*

Name: Leonard A. Moreno
Affiliation: *Antelope Valley Union High School District / ROP*

Name: Adam Parker
Senior Lecturer, Games Design
Affiliation: *Qantm College*
Melbourne, Australia

Name: Walter Rotenberry
Affiliation: *Wake Technical Community College*

Name: Ian Schreiber
Affiliation: *Independent*