

Prototype of an Educational Video Game for Knowledge Retention in Youth Health Education

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PROTOTYPE OF AN EDUCATIONAL VIDEO GAME FOR KNOWLEDGE
RETENTION IN YOUTH HEALTH EDUCATION

by

JENNIFER L. VOGEL

A thesis submitted in partial fulfillment of the requirements
for the Honors in the Major Program in Information Technology
in the College of Engineering and Computer Science
and in The Burnett Honors College
at the University of Central Florida
Orlando, Florida

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Thesis Chair: Euripides Montagne

ABSTRACT

There is some debate about the most effective and least controversial means of sex education in schools. In several states, state law does not require education about Sexually Transmitted Diseases and Human Immunodeficiency Virus Infection/Acquired Immunodeficiency Syndrome (STDs and HIV/AIDS.) There is also debate about the effect and pervasiveness of sexual situations in video games and its effect on the healthy sexual development of adolescents. This research therefore aims to try to solve these two problems and answer the following question: Is it possible to represent sex in a more realistic and educational way through a video game while teaching more medically accurate and necessary information? The completion of this study will be able to provide some insights on the feasibility and benefits of widespread implementation of serious video games for health education in the United States and also point to the necessity of future research into this topic.

ACKNOWLEDGMENTS

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DEDICATIONS

For my all my family and friends, thank you for your unending support and love throughout my academic and professional pursuits and throughout my life.

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For my mom, Debbie Vogel, thank you for always being as thrilled about my success as I am (or more).

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LIST OF ACRONYMS

STDs Sexually Transmitted Diseases

HIV/AIDS Human Immunodeficiency Virus infection / Acquired ImmunoDeficiency Syndrome

ADDIE Analyze, Design, Develop, Integrate, Evaluate (Method)

RSE Relationship-Sex and health Education

STI Sexually Transmitted Infection

OCPS Orange County Public Schools

NPC Non-Player Character

SME Subject Matter Expert

CHAPTER 1: INTRODUCTION

The continual advance of technology and the increasing demand for cheaper, more effective, widespread education offers an interesting opportunity for the intersection of these two areas. The success of educational video games has begun to capture the attention of both the entertainment industry and academic institutions. Although the development of educational games for health and education is certainly on the rise and the impact of such games cannot be understated, there is still much that is unknown and remains to be researched in this area. There are several conferences each year throughout the world where professional game developers and designers, as well as educators, psychologists, and other scientists share and discuss their research. In the United States alone there are many conferences, including Games for Change, the Serious Play Conference, Serious Games Summit and more. Some advocates have even gone so far as to state that serious games have the ability to revolutionize the education system if we can harness their potential.

There is some debate about the most effective and least controversial means of sex education in schools. In Florida, state law does not require education about Sexually Transmitted Diseases (STDs) including, but not limited to Human immunodeficiency virus infection / acquired immunodeficiency syndrome (HIV/AIDS). Even worse, when HIV/AIDS education is provided, it is only mandated to be age appropriate, but not medically accurate. Education about contraceptives is not required either. In fact, the only state-required sexuality education is characterized as “abstinence-only-until-marriage” (Guttmacher Institute, 2013).

The Florida statute on health education in public school states the following things must happen when health education is provided:

“Throughout instruction in acquired immune deficiency syndrome, sexually transmitted diseases, or health education, when such instruction and course material contains instruction in human sexuality, a school shall:

- (a) Teach abstinence from sexual activity outside of marriage as the expected standard for all school-age students while teaching the benefits of monogamous heterosexual marriage.
- (b) Emphasize that abstinence from sexual activity is a certain way to avoid out-of-wedlock pregnancy, sexually transmitted diseases, including acquired immune deficiency syndrome, and other associated health problems.
- (c) Teach that each student has the power to control personal behavior and encourage students to base actions on reasoning, self-esteem, and respect for others.
- (d) Provide instruction and material that is appropriate for the grade and age of the student.”

Aside from the omission of specifically requiring HIV/AIDs, the standards are generally lax. Consequences of inadequate health education can be dangerous. Florida consistently ranks as one of the top states in the nation in number of people diagnosed with HIV/AIDs in all age groups (CDC, 2011).

There is also debate about the effect and pervasiveness of sexual situations in video games and its effect on the healthy sexual development of adolescents. This research therefore aims to try to solve these two problems and answer the following question: Is it possible mitigate the misleading representation of sex in video games by representing sex in a more factual and educational way while teaching more medically accurate and necessary information?

In order to effectively evaluate the research questions, the “Adaptive-ADDIE Method” will be used. The ADDIE method is one of the most commonly used Instructional Design models. The steps of the traditional ADDIE model are followed in order: Analyze, Design, Development, Integration, and Evaluation. Despite its popularity and long term use, many opponents argue that it is too linear in nature. For this reason, an iterative twist on the traditional ADDIE, the Adaptive-ADDIE model was chosen. Adaptive-ADDIE was proposed by Ranvir Singh Bahl in 2012 as an improvement on ADDIE because it “forces realistic expectations, embraces change and allows a team to deliver value at consistent intervals without doing extensive planning, getting into analysis paralysis and developing mounds of project documentation,” (Bahl, 2012). The Adaptive-ADDIE includes the same analyze, design, develop, integrate, and evaluate phases, but each phase is expected to be revisited, particularly the design, integrate and evaluate steps, which should be iterative in nature based on user and stakeholder feedback throughout the process. In more detail, the steps of the ADDIE process are:

- a) Analyze: the audience characteristics, task to be learned, etc.
- b) Design: learning objectives, choose an instructional approach.
- c) Develop: instructional or training materials (prototype.)
- d) Implement: and deliver or distribute the instructional materials.
- e) Evaluate: to make sure the materials achieved the desired goals.
 - Formative Evaluation (qualitative feedback.)
 - Summative Evaluation (quantitative feedback.)

Figure 1 shows a model of the Adaptive-ADDIE processes.

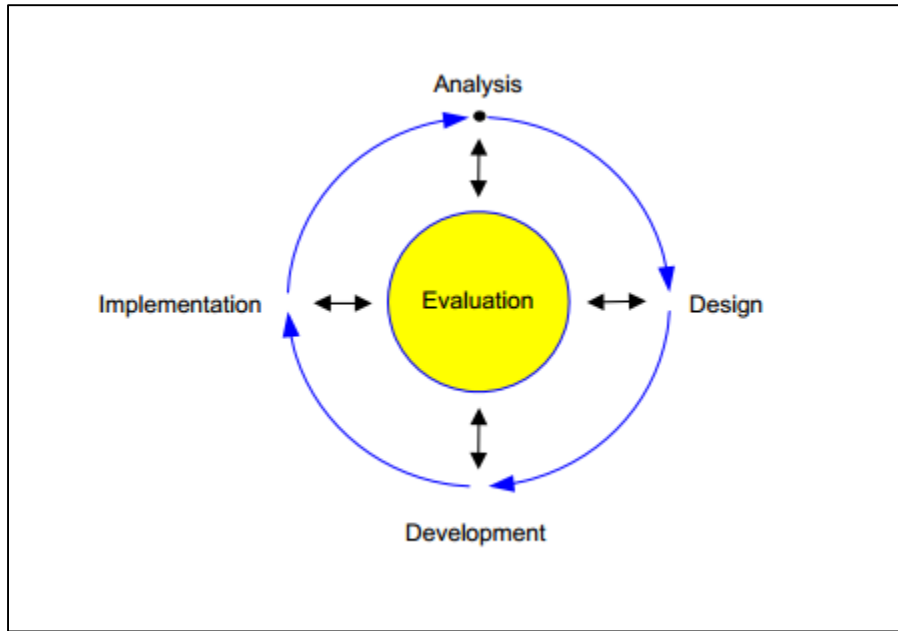


Figure 1. The ADDIE Method. Note: Reprinted from “Best Practices in Instructional Design for Web-based Training”. Copyright 2011 by U.S. Department of Labor.

The analyze phase of the project begins with a literature review including history of educational video games and support of the need for such an instructional method in youth health education. Following will be a description of the design and development phases of the learning game, #CONTRACEPT. Finally the next steps of integration and evaluation will be discussed, as well as challenges and obstacles experienced during development and suggestions for educators and instructional designers based on the lessons of this project.

CHAPTER 2: LITERATURE REVIEW

Development of Serious Games for the Classroom

Bonus (Bonus, 2012) defines an instructional game as one that “offers constant feedback on in-game activity with little concern for failure, is specifically designed for instruction by aligning game mechanics with instructional goals, aligns game narrative with instructional goals, and allows players to choose and customize their characters.” The most important facet of an educational game is that it is designed to teach something. One can think of an educational video game as a way of adding video game elements to traditional instructional material for the purpose of engaging the user.

Engagement has been shown to be a key factor in learning and retention. Engagement theory was originally outlined by Kearsley and Schneiderman, who stated “The fundamental idea underlying engagement theory is that students must be meaningfully engaged in learning activities through interaction with others and worthwhile tasks. While in principle, such engagement could occur without the use of technology, we believe that technology can facilitate engagement in ways which are difficult to achieve otherwise.” (Kearsley & Schneiderman, 1999).

Commercial video game companies continuously strive through user studies and academic research to find new ways to make their games more addictive, enjoyable, and enticing. Many academic studies also address these topics, but from a social-sciences point of view. Within the academic community, “engagement” is often one of the key measures of enjoyment in games, and within educational games, the knowledge retention of the subject. For example, a study at the Missouri University of Science and Technology defines characteristics of engagement as “feelings

of enjoyment, wanting to play non-stop, losing awareness of the environment and time distortion.” The study found that a key factor in all categories of engagement was a sense of curiosity (Fui-Hoon Nah, et al., 2012).

Despite the obstacles facing widespread implementation of educational games featuring a game world, or “virtual world” environment, many studies have shown that this type of exploration is very beneficial for learning and can enable enjoyable learning experiences. Through a study involving Quest Atlantis, a game in which a virtual world is explored, it was found that students liked learning through digital worlds. In Quest Atlantis, learning takes place within the context of a National Park in which participants were asked to solve water quality problems in an ecosystem, a topic about which they were previously uneducated. An overwhelming majority of participants reported that they enjoyed the game, that they learned a lot, and that they thought they would not have learnt more through any other traditional instruction method (Iqbal, 2012).

Further support for utilizing adventure elements in an educational game comes from the assertion that learning in games takes place when a player gains insight from solving a puzzle. By nature, the design of the game itself supports and encourages the learning (Fernandez-Vera & Osterweil, 2010). Fernandez-Vera & Osterweil explain that through adventure games, the player finds themselves in an environment in which they are confronted with challenges that they must solve through a variety of strategies and exercising several different types of cognitive skills.

Benefits of Educational Games as a Teaching Medium

Even entertainment games serve as important teaching mediums. A study by Hense & Mandl in 2012 supported that when people play video games, they do so with immense

motivational and emotional involvement-- for example, that racing games promote complex problem-solving skills. It is also important to note that players acquire these skills without feeling the typical boredom and obligation associated to typical school tasks, but through positive reinforcement and conditioning. Problem solving skills are learned most effectively when the player is provided information through the narrative which they need to use to solve the problems at hand (Hense & Mandl, 2012).

We have all likely observed the effects of learning through conventional entertainment video games. Even “Asteroids” offers insight into basic astrophysics, though highly conceptual. PacMan offers spatial knowledge and puzzle solving skills. Video games for entertainment are able to intensively motivate the player through emotional engagement with the game and often experience learning processes without feeling burdened, uncomfortable, or overly challenged (Hense & Mandl, 2012).

Through an analysis of educational, emotion and motivation theories of learning in computer games, Hense and Mandl have developed a list of quality criteria for digital learning games, which also serves to display the far-reaching and flexible opportunities within games to integrate learning principles. Their list of quality criteria is shown in Figure 2.

1. Clearly define the learning goals of the game without neglecting the playful elements
2. Make use of the full spectrum of learning principles used in digital games
 - a. Behaviorist principles
 - provide direct feedback (particularly reinforcement) on learners' actions
 - give opportunities for exercise and practice
 - b. Cognitivist principles
 - embed complex problems within the game context
 - embed information needed to solve the problems within the game context and narrative
 - c. Constructivist principles
 - create realistic problems which are authentic and personally relevant to the players
 - offer different perspectives and contexts for a given content
 - create a social context for learning
 - provide instructional support
 - offer opportunities for learners' own construction processes
3. Evoke positive emotions
 - a. Guarantee that learners have fun, e.g.
 - provide an attractive game design
 - maximize usability
 - avoid frustration and disappointment
 - b. Provoke learners' curiosity, e.g.
 - offer different choices
 - offer opportunities for exploration
 - c. Allow for satisfaction and pride
 - provide positive feedback for learners' accomplishments
 - create opportunities for presentation of learners' accomplishments
 - don't let learners fail (too often)
4. Evoke and keep up motivation
 - a. Foster intrinsic motivation
 - make learning and playing intrinsically attractive
 - avoid too much focus on extrinsic rewards (score, awards etc.)
 - b. Allow for feelings of competence
 - set goals which are challenging yet realistic given the learners' ability
 - give learners complete control over their success (reduce influence of chance)
 - ensure frequent and constant opportunities for feeling competent
 - c. Provide autonomy
 - provide freedom choice, but avoid too much uncertainty about possible negative consequences
 - provide freedom of action
 - d. Enable social relatedness
 - provide in-game cooperation with real and/or virtual partners
 - create game-related communities of learners
 - e. Meet learners' interests
 - tailor game subject, narrative, and genre to learners' interests
 - offer choices for the different interests of different learners
 - f. Enable flow
 - clearly state learners' goals at each stage of the game
 - adapt difficulty level to learners' ability and skills
 - provide constant, immediate and informative feedback

Figure 2. Characteristics of effective digital learning games. Note: Reprinted from "Learning with or in games? Quality criteria for digital learning games from the perspectives of learning, emotion, and motivation theory." Copyright 2012 by IADIS international conference on cognition and exploratory learning in digital age. Reprinted with Permission.

Challenges of Developing Educational Games for the Classroom

When designing instruction, just as designing a game for entertainment, it is crucial to analyze the needs and qualities of the audience. In traditional instruction, care is often taken to address the 3 learning “modalities”: visual, auditory, and kinesthetic. When it comes to educational video games, Lehmann and Ifenthaler (Lehmann & Ifenthaler, 2012) found that learners who identified in the more verbal groups do not differ significantly from those in the more visual groups in accuracy of solutions or declarative knowledge. This means that while learning modalities should be considered, the medium of a digital learning game already supports opportunities for learning through visual, auditory, and tactile methods. Graphical interface style and genre preferences are of bigger consequence when designing a game for a diverse audience.

Different genres of entertainment games often have specific audiences that are small and self-selected. Conversely, serious and educational video games are often played by students who are forced by their teacher as part of the curriculum. This leads to a much more diverse audience as far as the personality and the preferences of the player. Even more challenging is that many players may be resistant to playing the game at all. Heeter, et al. (Heeter, et al., 2010) found that gender was significantly related to lack of commitment in certain genres of games. Specifically, females tended to show more enjoyment of and commitment to knowledge-based or puzzle-based games, whereas males tended to enjoy first person shooter games. The research suggests that dislike of the game itself is one of the most important factors that may diminish the effectiveness of the educational game due to less commitment, less positive affect and less focused attention. These research conclusions show that it is important to create a game that people of varying levels of

video game experience can enjoy, and, if possible, to deliver the educational information through many different styles of games in order to reach the widest audience and have the most positive impact on learning.

Implementing Learning Games in Health Education

Serious games have long been used as a tool for simulating healthcare techniques from surgery to psychotherapy, and even as a means of teaching a proper medication regimen. For example, Re-Mission is a game for children with cancer that was developed by HopeLab at Stanford University. Re-Mission is a highly interactive video game in which players control a character and navigate through the body of a patient with cancer, destroying the cancer cells along the way. HopeLab found through functional Magnetic Resonance Imaging scans (more commonly known as fMRI scans) that playing the video game stimulated the parts of the brain associated with positive motivation, and in this way, helped boost players' adherence to chemotherapy and antibiotic treatment. (Cole, et al., 2012).

A need to expand Relationship-Sex and health Education (RSE) in the school system has been identified but faces many challenges, including the stigma of sex education amongst parents and the cost of expanding any programs within the school system.

Wagner (Wagner, 2011) states that there is often a distinct separation of sex education from other curriculum and that teenagers have trouble integrating this knowledge into real life. Further, he posits that not only is there imbalance between the presentation of sexual situations in real life and in class, but also that students are continuously bombarded with romantic messages through

advertising and entertainment, though the transferable skills taught in school are not adequate to process and think critically about the messages in the overwhelming media presence.

This separation of relationship and sexual education from the broader curriculum, and moreover, actual real-life social situations, demonstrates the need for an environment which can simulate what students might expect to encounter outside of class.

Benefits of Implementing Serious Games in Health Education

The benefits of gamifying relationship sex education are far reaching. The benefits to the student include increased comfort level with the material, a safe space to feel free to make and learn from mistakes without serious consequences, and enjoyment of the game play, which will further enhance engagement in the material, leading to more meaningful and permanent learning. Additionally, sex education is commonly a sensitive subject. Many parents are apprehensive about the type of information that is being disseminated to students. Not only would a game with inoffensive scenarios and “family-friendly” graphics be more acceptable to parents, but the availability of the game for parental preview would be helpful in fostering approval. Parents could easily access the same game that their children were playing and educate themselves on the material being presented. This could even stimulate discussion within the household on related topics.

Another challenge facing the expansion of RSE programs is the production cost. Luckily, once a video game is designed and produced, little cost is incurred by distributing the game, whether it is distributed to 10 schools or 1000 schools.

History of Sex Education in Video Games

The results of a survey conducted by Kearney & Maja (Kearney & Maja, 2007) suggest that many people involved in the gaming industry of all ages, including developers, players, and publishers, agree that sex is used to market products by appealing to human nature, using human sexual psychology as an advantage. M. Scott Gross in the American Journal of Sexuality Education (Gross, 2005) proved that dopamine levels in the brain are raised during game play. This plays an important role in reinforcing attitudes and values portrayed in games, which can be especially confusing to teenagers who do not have access to medically accurate information about sex.

There is no argument that “sex sells” video games. One of the earliest examples of this was a game called Leisure Suit Larry in which, if you failed to use a condom, you could not advance to the next level. Kearney & Maja (2007) assert that this might be one of the earliest examples of game-based learning about sex. Even in more recent times, with the popularity of technology integration in education and the prevalence of sex in video games, little academic research or development of educational games to teach sexual education to teenagers has been done.

One successful sex education video game is called PR:EPARe (Positive Relationships: Eliminating Coercion and Pressure in Adolescent Relationships). It was designed by the Applied Research Centre for Health & Lifestyle Interventions in Coventry University, UK (Arnab et al., 2013). It was created and studied to help adolescents gain knowledge about reproduction and proper birth control and Sexually Transmitted Infection (STI) prevention. It was found that after playing the game, students felt more confident in their knowledge about how to respond to sexual coercion and the negative consequences of coercion in relationships. (Brown, et al., 2012)

Some serious games are beginning to stray from strictly desktop computer based platforms and branch out from the dictate-and-test format. Safe Sex with Friends is a game that is currently in development by Kaho Abe from the New York University Game Center and Sarah Schoemann from New York University Polytechnic (Abe, 2013). It is an award winning tile based scrabble-like game design that is a parody of the popular mobile game, “Words with Friends.” It was designed by to teach young adults about the correct use of barrier protection methods. The game is even more appealing to young people because it will be widely available on mobile devices. The panel that awarded the funding for the game design, Matt Parker, from the Games for Change Organization, has stated that the organization hopes that the game will be fun enough that teenagers will play it and learn from it willingly (Games for Change, 2013).

CHAPTER 3: GAME DESIGN AND DEVELOPMENT

The purpose of the game design research is to help integrate an educational video game into a preexisting sexual education program to create a safe space for youth to explore a range of topics relating to sexual health in a casual, inviting, private, and educational environment - and have as much fun as possible! Following the adaptive ADDIE method of instructional design, an educational game was developed. The game is called #CONTRACEPT.

The purpose of the content of the game itself is to teach students the health education standards identified by the National Health Education Standards shown in Table 1.

Table 1: *National Health Education Standards*

Standard 1	Students will comprehend concepts related to health promotion and disease prevention to enhance health.
Standard 2	Students will analyze the influence of family, peers, culture, media, technology, and other factors on health behaviors.
Standard 3	Students will demonstrate the ability to access valid information, products, and services to enhance health.
Standard 4	Students will demonstrate the ability to use interpersonal communication skills to enhance health and avoid or reduce health risks.
Standard 5	Students will demonstrate the ability to use decision-making skills to enhance health.
Standard 6	Students will demonstrate the ability to use goal-setting skills to enhance health.
Standard 7	Students will demonstrate the ability to practice health-enhancing behaviors and avoid or reduce health risks.
Standard 8	Students will demonstrate the ability to advocate for personal, family, and community health.

Note: Reprinted from “National Health Education Standards – Achieving Excellence”. Copyright 2004 by Center for Disease Control and Prevention.

The first step in the ADDIE approach to instructional design is analyze. The intended audience for the game #CONTRACEPT is teens and pre-teens. Due to accessibility constraints (limited access to tablets and mobile technology within the public school system) the target platform for the game is a personal computer. The audience is expected to have basic computer skills and a basic existing knowledge of sexual health topics.

The tasks to be learned are the learning objectives shown in Table 1. The learning material within the game has been designed based on existing health education curriculum that was provided by the Orange County Public School (OCPS) Health Education Coordinator. The main focus of the game is to “myth bust” based on commonly held misconceptions among teens. The material for these commonly held misconceptions was also provided by the OCPS Education Coordinator.

Full Gameplay Design

When the player enters the “game world,” which is a top-down quest based environment modeled after a school, they will encounter different “situations” presented by Non-Player Characters (NPCs) that are based on material provided by the subject matter experts (SME) to present the desired sexual education information. The SMEs are partners from Planned Parenthood of Central Florida’s Youth Education Program (Planned Parenthood of Greater Orlando, 2014).

By allowing students to encounter virtual situations which require sexual education knowledge, they may feel safer to explore and experiment – leading to the ability to learn from their mistakes in a safe environment (within the game world.) By practicing these cognitive decision making skills that are focused on sexual education topics, students will be better equipped

to apply these skills when they face the situations in real life. Figure 4 shows a screenshot of the game world.

At all times during the game, there will be a help icon at the top of the screen that has an image of a smart phone. When the player accesses the smartphone, an overlay will pop up and display Planned Parenthood's website on the phone's browser, and the player will navigate the site in search of helpful information. Once found, the player will "solve" the riddle by giving the "correct answer" to the NPC that presented the task. Before it is revealed if they have chosen the correct answer, they will play a related mini-game to earn bonus points. When the final score is tallied, the player will be presented with a message that is either affirmative or reframe the question. This will serve as the feedback mechanism and together with the minigame, will function as strong reinforcement of the gained knowledge.

The mini-games will be the most engaging part of the learning intervention. All of the mini-games will be in the style of old arcade games. During the module about sexually transmitted diseases, the mini-game required for completion would be a Galaga style fixed shooter wherein the player will shoot different STDs with antibiotics, and destroying more serious STDs will result in more points. This mini-game is illustrated in Figure 5. For the topic of birth control, there will be a Pacman-style game in which the player will move around the maze collecting birth control pills. (It is important to note that relevant information about the proper use of birth control will be discussed in the module prior to the mini-game to prevent confusion.) The "ghosts" that are chasing the "Pacman" would be sperm, and when the player picks up a condom packet (the large dots in actual pacman that allow you to kill the ghosts) a barrier shield will form around the player and

they will be able to “kill” the sperm. A screen shot of this mini-game is shown in Figure 6. Of course, it will be reinforced that some of the concepts in the mini-games should not be taken literally.

The final proposed mini-game was inspired by youth feedback. During the design of the game a brief interview was conducted with students in the target age range, and they shared that they would enjoy a game that dispelled “sex myths” and added that a car racing element would be ideal. To combine these ideas, we conceptualized a racing game similar to Mario Kart in which the player would be presented with different sex myths that would pop up on the screen. A couple seconds later, the player can choose to speed through a “true” or “false” powerup zone. If the player answers correctly, their car will receive a boost.

Drawing on the conclusions of Heeter, et al., it is a good idea to have varying styles of mini-games contained within one over-arching quest-based roleplaying game (RPG). The quests will provide lessons while the mini-games will enhance the engagement of players in the game and the desired knowledge retention. An example of lesson design within the game is shown in Figure 3.

Development Tools

The simplicity of development through game-making software allows for future scalability. Anyone with access to the software could add to the game or modify the instructional contents to be tailored to their audience. It is not outside the realm of possibility that a teacher could tailor the game for their class and instructional goals.

Quests and Game World. The main game world was developed in RPG Maker VX Ace (Enterbrain, 2012), which is software made for the development and playing of role playing games. It includes an extensive mapping system, which allows the user to create complex maps through a simple drag-and-drop tile interface. An expansive suite of features allows for quick game development through character and object tiles, ruby game scripting, a battle system, and more.

Mini-Games. The mini-games were adapted from existing open-source scripts for RPG Maker VX Ace. Within RPG Maker the user is able to write ruby scripts to launch within their game. In combination with native quick event creation, scripts are easily launched on an event specified by the user, such as a character approaching an NPC or performing an action on an object.

Graphics. Many of the graphics within the game were included in the RPG Maker VX Ace resource pack. Some graphics were adapted from royalty free images on the internet or open source tiles made for RPG Maker. The open source images from the internet were adapted in Adobe Photoshop CS5.

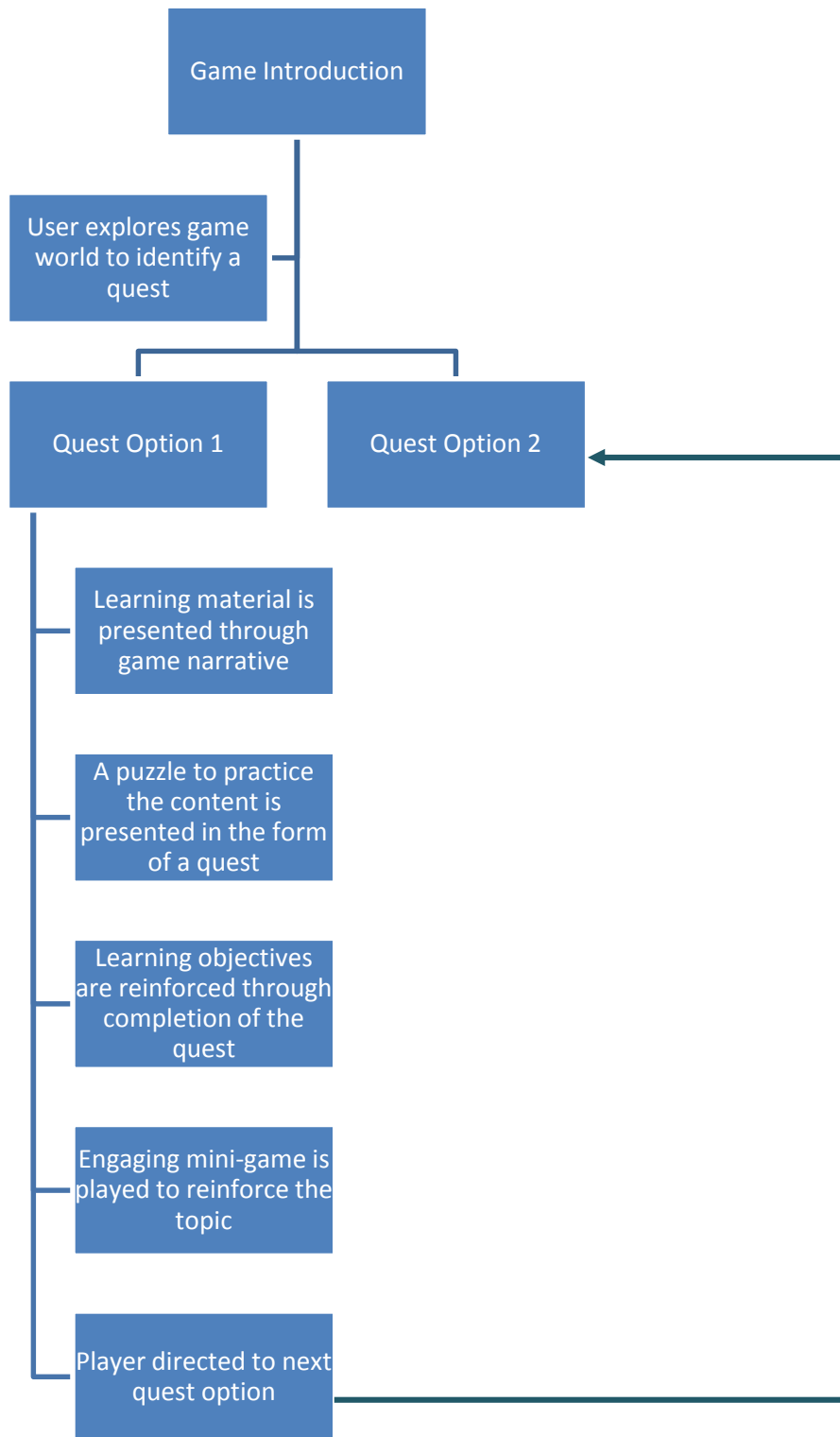


Figure 3. Lesson flow within gameplay.

Stages of Game Implementation

The first prototype of the game has been developed over the past year. Stakeholder feedback has been collected through the formative assessment process, which was meant to gather feedback from future user groups. Educators and SME feedback was collected through think-aloud brainstorming and short interviews. The preliminary results have been integrated into the prototype through iterative development. Partnership with subject matter experts has allowed the simultaneous design and development with the inclusion of their expert advice.

Prototype. The initial prototype of the game serves as proof of concept. It is relatively “bare-bones” compared to the full game design. The prototype consists of 2 quests that present proper birth control usage and information about STDs. They are both accompanied by mini-games. Examples of the gameplay are shown in Figures 4, 5, and 6.



Figure 4. Screen shot of a classroom in the game world.

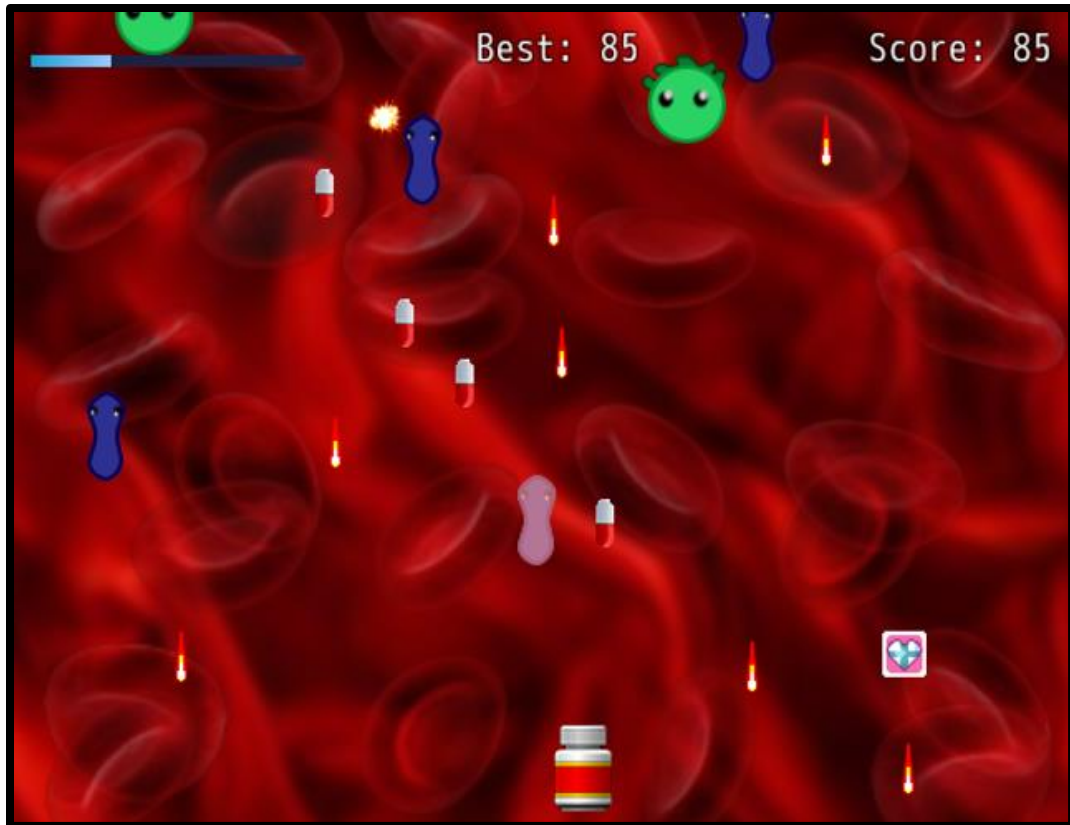


Figure 5. Screen shot of the minigame at the end of the module on STDs.

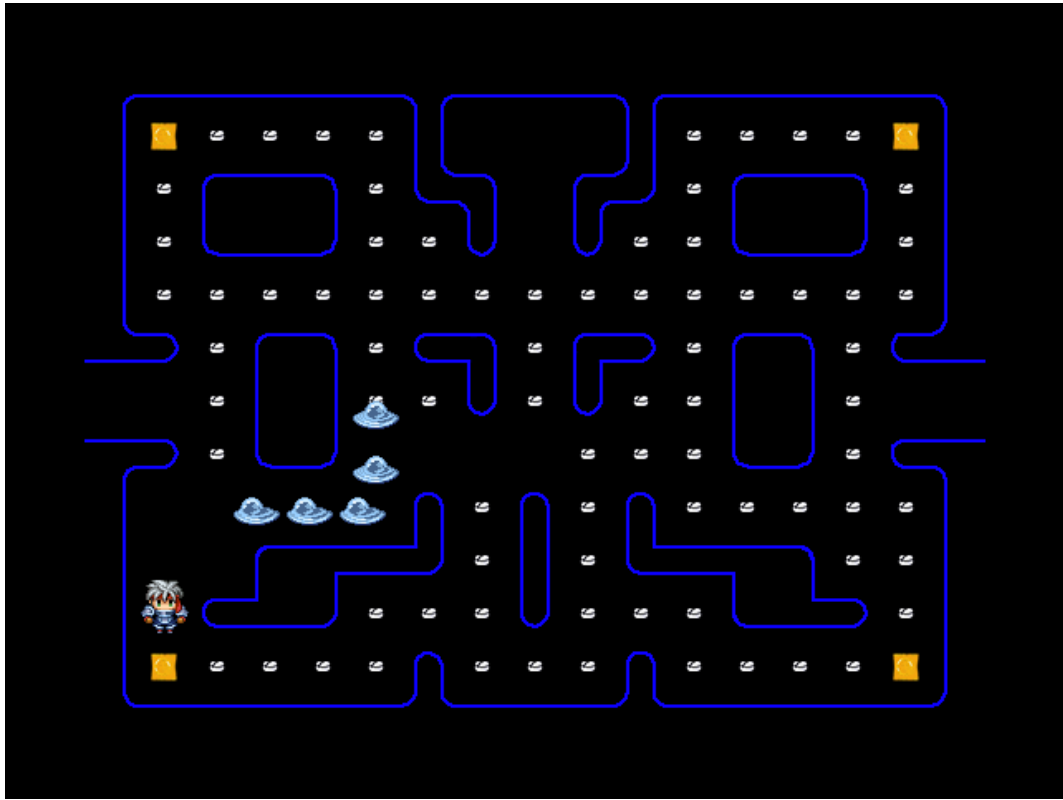


Figure 6. Screen shot of the minigame at the end of the birth control module.

Usability Review and Summative Assessments. Upon completion of prototype 1, it is planned that there will be a usability review conducted on the interface of the game. Additionally, a summative assessment has been designed which includes the following items:

- Diagnostic Assessments: brief surveys about basic demographics and a pre-test on content and self-efficacy
- Post-Gameplay Evaluations: of self-efficacy and content
- Comparison with other teaching methods: Control group reads the same content presented in the game, but from a PowerPoint. Their scores are compared to gameplay only group and compared for differences.

The results of the summative evaluation and comparison with control groups will show whether the learning intervention is effectively teaching the content. The data gathered from the usability review and summative assessments will be used to make improvements upon the final game.

Full Game Implementation. The final iteration of game development will integrate feedback from all sources and will be completed before implementation of the game within the health education curriculum. The final game will consist of the two quests and mini games from the prototype, as well as a third mini game (the racing game) and expanded quests. It will possibly include the “smartphone” overlay that was mentioned in the game design section, but was not implemented in the prototype. The implementation of the “smartphone” overlay will depend on student performance in the prototype.

The following table (Table 2) presents the work log of stages, including both completed and future stages. The ultimate objective is to implement successfully the educational game into the existing curriculum of youth health education.

Table 2. Work log of project stages

Stage	Work Log	Description	Output
Completed Stages			
Stage 1	Preliminary game design brainstorming	Interviews with SME, open-ended questions	Game Design Draft
Stage 2	Storyboard Creation	drafts of game design	Draft game artwork
Stage 3	Game Proposal Creation	solidify game design and artwork style	Formal Game Proposal Document
Stage 4	Preliminary Formative Evaluation on Game Design	Collect feedback from 3 youth health education SMEs and several peers	Feedback from SME
Stage 5	Design of Game Scenarios	Content analysis of common sexual health misconceptions	Game Script
Stage 6	Development of Mini-Games	Script creation within RPG Maker VX Ace	Prototype of MiniGames
Stage 7	Development of Game Scenarios	Drag-and-drop game design with RPG Maker VX Ace	Prototype of game scenarios
Stage 8	Development of summative evaluation for future use	Creation of surveys for future assessments	Surveys and research protocols
Stage 9	Post-development formative evaluation	Open-ended questions to Education SMEs and lecturers	SME and peer feedback
Stage 10	Revision and finalization of Prototype	Integration of SME feedback into game and summative evaluation	Functioning Prototype
Stage 11	Analysis of development outcomes	Critical analysis on development and design procedures challenges and successes	Suggestions for educators and instructional designers
Future Stages			
Stage 11	Usability Review	Analysis of interface design	Improvement on game interface
Stage 12	Learner Self efficacy and knowledge gain assessment	Analysis of user self efficacy and knowledge gain	Conclusions on effectiveness of game
Stage 13	Revised game and final product	Integration of conclusions from self efficacy and knowledge gain assessments	Finalized game
Stage 14	Implementation	Integration of game into existing curriculum	

CHAPTER 4: DISCUSSION

This paper has described an effort to design and develop a prototype educational video game for “myth busting” commonly held misconceptions about sexual health education using the Adaptive ADDIE method of instructional design. Some preliminary evaluation has taken place, and more extensive assessment and the final stage of ADDIE, integrate, will be discussed in a future paper. The outcome of this project will hopefully be to enhance the youth sexual education curriculum at several institutions. The research hopes to serve as a case study to guide future instructional designers on best practices in designing educational video games through for sensitive or controversial learning topics.

Challenges and Limitations

The Adaptive ADDIE is a good method for iteratively developing educational game prototypes while allowing for the flexibility needed in small-scale instructional design. Although the Adaptive ADDIE served as a good design and development framework, few development efforts are without challenges. Some of the challenges faced through the design, development, and evaluation phases of #CONTRACEPT are listed below:

- a) While the software used for development, RPG Maker VX Ace, is highly flexible and customizable, there is a fairly steep learning curve for development on this platform. It is a good alternative to development of instructional learning interventions from scratch, but for an educator or developer without a strong programming background, some training may be required.

- b) The platform used for development is also required for distribution. This means that it is impractical to distribute the prototype online, which may limit the accessibility of this game to classroom environment only.
- c) Human sexual education is a controversial topic. The implications for this research are two-fold. On one hand, #CONTRACEPT served as a good case study for understanding the challenges faced while developing an educational game for a sensitive subject. On the other hand, it was difficult to obtain access to the local public school system for user testing on the target audience.
- d) This study was specifically designed to address common misconceptions about basic human sexuality education. Though the platform offers for relatively simple scalability, the current version of the game without any modifications would not be suitable for those with a higher level of education about the subject.

Suggestions for Instructional Designers Using Video Games to Teach Sensitive Topics

The challenges of creating a game containing lessons on a sensitive topic such as sex education, indicate a few possible improvements to increase the feasibility of testing a video game within the public school system. Because some school districts are cautious of allowing a video game with material about sex education, a research wishing to evaluate such a game should consider any of the following pieces of advice:

- a) Work directly with a specific teacher who can serve as a liaison to the school district to perform an evaluation of the game.

- b) Work with an outside organization who could facilitate the study without the need for approval from the public school system.
- c) Carry out a usability evaluation as well as a summative evaluation and present these preliminary results to the school board when proposing the research within the school system so they can clearly see the benefits of the study when deciding to approve or reject.

Best Practices for Educators and Learning Intervention Designers

- a) Educational institutions that offer human sexual health education should consider a learning game as a practical teaching method for students of any age. Benefits include: possibility for self-instruction, availability for parental review, and content customization based on the education and comfort level of the learner.
- b) While RPG Maker VX Ace may require training, it is a highly flexible solution for development of customizable learning games. RPG Maker VX Ace and other similar game making platforms are good solutions for educational video games, especially those with controversial topics.
- c) Educators should be aware of technological competition for teaching about sexual health in the classroom. Students are constantly bombarded by messages about sex in the media-especially entertainment video games. Educational institutions should be prepared to combat this bombardment with serious learning interventions with medically accurate information.

- d) Due to financial constraints, the graphics of #CONTRACEPT are very low quality. To compete with the high-quality of entertainment games, an educational video game with higher production value could be developed.
- e) Parents, teachers, and school faculty should be in better communication regarding the teaching of sexual health education in public schools and the usage of interactive media for instruction in the classroom and in a home setting.

The successful development of the prototype of this game and positive feedback from SMEs and future user-groups points to further research needed in instructional methods for sensitive topics. Is it more effective to approach a subject with which students usually feel uncomfortable in a self-guided learning matter as opposed to the traditional classroom lecture method?

The statistics clearly show that current reproductive health education is inadequate and ineffective. Education that is provided is not only often misleading, but the lack of information is having dangerous results for the reproductive health of America's young people. Researchers and educators in the field have been calling for reform and new strategies. Research indicates that technology, and possibly learning video games, can provide a method for improvement. Hopefully the results of this development effort can provide guidance and suggestions for future educators and instructional designers.

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