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Worcester Public Library Outreach: Game Design Curriculum

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An Interactive Qualifying Project Report: submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
In partial fulfillment of the
Degree of Bachelor of Science
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Abstract

This Interactive Qualifying Project at the Worcester Public Library involved the incorporation of an educational experience in computer programming with a personalized and fun curriculum. Surveys of the target group, teenagers between the ages of 12 and 18, provided insight necessary to create and tailor lesson plans to their interests and needs. Members of the library staff were interviewed about advertising methods for library programs to ensure event attendance. The group designed a curriculum to teach teenagers Scratch™, a computer program that introduces users to basic game programming, while encouraging creativity and self-expression. The lessons and program structure developed will constitute a major part of future Scratch™ workshops at the Worcester Public Library.

Acknowledgements

We would like to take this opportunity to thank our faculty advisors Chickery Kasouf and Robert Krueger, our sponsor Anne Hrobsky, and the entire staff at the Worcester Public Library.

Authorship

The members of this Interactive Qualifying Project, Andrew Camire, John Francis and Joan Keyes, claim equal authorship of the project and of this report.

Executive Summary

Video games have become a major component of this generation. While the games are wildly popular, there exists controversy to how worthwhile their use is for youth. While some argue that playing video games can lead to violence and bad behavior, there are education professionals who believe that the popularity of video games can be harnessed to a constructive end. Teachers have integrated the use of computer games into their classroom environment, and found them to be a valuable educational tool. Public libraries can also benefit from this use of technology to attract teenage patrons, and broaden the range of programs offered.

The Worcester Public Library provides a number of learning opportunities for teenagers based in technology. Designing a lesson plan to teach video game creation at the library would provide teenagers with an experience in computer programming, and allow them to express their creativity. The curriculum should be developed around the teens' interests in order to teach them in a manner that is both educational and engaging. It is important to be knowledgeable in lesson planning in order to develop this type of curriculum. Different libraries and schools have effectively integrated technology and video games into their programs for teenagers. The computer program that the curriculum would be centered around is Scratch™, developed by the Lifelong Kindergarten Group at the MIT Media Lab. Scratch™ is designed for youths ages 8 to 18 to develop their skills in programming, mathematics and problem solving, all while allowing their creativity to flourish. In order to ensure the success of the program, it was necessary to understand effective methods for targeting advertising toward teenagers in order to stimulate their interest in, and excitement for the program.

The purpose of this Interactive Qualifying Project (IQP) was to create a game design curriculum for the Worcester Public Library that built upon a curriculum created by an IQP

group that did a project there in 2011. The first step in the process of creating a successful program was learning about the interests of teenage library patrons. Surveys were distributed to teenagers in the 'Teen Zone' of the library, and to members of one of the teen groups that meets there, in order to determine our target age group and their general interests. An interview of the previous IQP group was conducted to determine the strengths and weaknesses of the program they ran, and to decide how we should build our curriculum upon their legacy. Interviews with various librarians provided us with information on how to advertise and promote our program to teenagers at the library. Archival research was performed to examine the success of other learning programs that incorporated technology, to give us ideas for building our curriculum. In order to test the effectiveness of our curriculum, we planned to host a pilot session for our curriculum at the library. The participants were asked to fill out a feedback form at the end of each session to evaluate the lesson. A pilot session was also held for the librarians to teach them our curriculum so that they could hold future programs for teenagers like the sessions we held.

A Scratch™ curriculum was created that was intended for teenagers between the ages of 12 and 18. The curriculum consisted of three lessons, each teaching how to make a different video game. The curriculum was used in five sessions, three for teenagers at the library and two for members of the library staff. The sessions for teenagers were each an hour and a half long, and each member of our group performed a different task. One member taught the lesson using a step-by-step PowerPoint presentation, another followed along with the lesson in Scratch™ using a separate projector, and the third walked around to help answer any questions that arose. The consensus received from the feedback forms was that we constructed the sessions very well, but the speed at which they were taught could be slower to make following along easier.

The sessions conducted with the librarians were also successful. While the pace of the lesson had to be changed to match their needs, they still were able to complete each of the game tutorials in the time allotted. The feedback received from participants was consistent in saying that the class was conducted very well, and the only piece of criticism was that each piece of the lesson deserved more explanation.

We judged that the sessions were successful when the participants were able to take the lesson we gave them and create their own unique version. All of our lessons and Scratch™ projects will be posted on the teen page of the Worcester Public Library website for any teenagers interested to access them.

Upon the conclusion of this project, we have compiled a list of recommendations for the Worcester Public Library in regards to further Scratch™ programs. First, a librarian should be appointed to a position in charge of Scratch™-related activities in the future. Second, the library staff should be educated in the program, so that they might be equipped to answer any related questions raised by library patrons. Third, we are leaving behind a proposed structure for Scratch™ workshops, which include both the basics of Scratch™ taught by the previous IQP group, and the game creation lessons taught during this project. These workshops should become a permanent fixture at the library for patrons to enjoy in the years to come. Finally, we suggest that advertising for the programs start further ahead of time than the advertising for ours, to optimize attendance at these events. These recommendations will provide library staff with the tools needed to ensure the continuity of the program.

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I. Introduction

I. I. Societal Issues

Since video games came into their own in the early 1970s, they have become fully ingrained into the lives of a majority of adolescents in the United States. With this popularity has come controversy as well. A number of studies conducted have linked students with poor grades and scholarly inaptitude with the playing of video games. (It's All Fun and Games Until Someome Gets Hurt, 2007). Contrary to these potential ties between computer games and their negative influences, some researchers support the idea of using video games in education. For example, Schaffer (2005) invites people to "look at video games because they create new social and cultural worlds: worlds that help people learn by integrating thinking, social interaction, and technology, all in service of doing things they care about." Computers have been adopted for use in today's educational field as well. While traditional teaching methods still hold strong, increasingly schools are including some sort of technology-based education in their curriculum. Whether this is in the form of educational games on the computer, digital art classes, or the more traditional typing class, modern education has incorporated computers in a significant way.

I. II. Practical Issues

Technology has become wildly popular among young adults because of the broad spectrum of applications, which include social networking, gaming and education. Most public libraries today have updated their technology by adding computer labs and other forms of media in order to facilitate and support this trend. One such example of this expansion of educational technology can be seen at the Worcester Public Library in Worcester, Massachusetts. However, the problem the library faces is that the children and young adults who access this technology only use it as a means to play games and go on websites that lack educational value. (Flynn,

Pearsall, Pettiglio, & Wu, 2010). Last year a group of students from Worcester Polytechnic Institute devised a curriculum that provided an effective way to combine education with technology and a fun and interesting way for teenagers to learn about game programming. In order to promote educational use of the computers and facilitate the library in incorporating education with technology, a game programming curriculum was designed that adds to the work done by the previous year's project.

The purpose of our curriculum centered on an educational use of computers for young adults. The programming curriculum allowed them to create games of their own that they can share with their friends, and taught mathematical and computational concepts as well. By using video games, something members of the target age group enjoy, the curriculum held their interest and encouraged their creativity to come to life in their projects. This curriculum also provided them with a taste of knowledge in programming and technology that may inspire them later in life as well, such as in college or in a career.

I. III. Key Issues

The biggest issue faced in designing the curriculum was holding the interest of the students. Two main issues that had the potential to cause the class to lose interest were the curriculum perhaps being too difficult for them to follow, or them understanding it too easily and thus becoming bored with the material. By ensuring the material covered could be understood, and allowing room for them to expand their knowledge, these issues could be overcome. Each learning session concluded with asking the class for any comments or input on how the course was run.

To better address our task we conducted background research on how to educate participants and how to plan a curriculum that incorporated topics of interest for students

between the ages of 12-18. It is common knowledge that all teachers have their preferred style of teaching and that students have different methods of learning; retaining information in different ways and at different rates from their fellow classmates. In order to account for these factors, the curriculum accommodated a number of different learning styles to provide the optimal experience for participants.

The Worcester Public Library staff had to understand the curriculum and program so as to allow for future sessions to be held. The hope is that the program will be continued in future sessions taught by the library staff, and that the children will pass on the knowledge they learned through the curriculum and become teachers themselves.

I. IV. Research

In this section we discuss key research areas that will be developed in our background chapter.

I. IV. I. Lesson Planning

There was a need for a lesson plan that was both educational and held the interest of the students. This was important to the success of the project because our project was mainly based on teaching the Scratch™ program to teenagers at the library. Scratch™ is the perfect tool to keep them engaged in the lesson, as it was created with a similar target age group in mind.

I. IV. II. Teenage Interests

Discovering the interests of the target age group was a key component in creating a curriculum. What do they do for hobbies? What shows do they like? What is their favorite subject in school? If we found out what participants were involved in, we would have a better

chance of making successful lesson plans that would appeal to the target age group, and would get them interested in learning the game design capabilities of the Scratch™ computer program.

I. IV. III. Promotion

Marketing our Scratch™ program to the local residents of Worcester was a key step in ensuring its success. Part of this process involved looking at how library programs for youth were promoted in other urban areas. We looked at strategies used, and how they caught the attention of teenagers. Seeing how other libraries promote programs presented ideas of how to accomplish this at the Worcester Public Library. The group also considered interviewing teenagers who participated in the Scratch™ program last year to find where they learned about it.

I. IV. IV. Community

We investigated the role that the library plays in the community and in the lives of the target age group. Why do kids between the ages of 12 and 18 go to the library? What do they use it for? Another area researched was how to take information gathered about teaching and promotion, and apply it to this project at the Worcester Public Library. Correct and successful promotion of the project at the library was essential in ensuring the maximum interest possible. In order to keep the interest of the group members, it was necessary to make our lesson plan as appealing to them as possible. Through this they would want to learn more about the Scratch™ program, and perhaps even spread the word about what they are learning at the library.

I. V. Goal

Our group is the Worcester Public Library Outreach program. The goal for our Interactive Qualifying Project is to learn the Scratch™ computer program and to teach it to young teenagers at the library using a lesson plan we create. We must make sure our lesson plan appeals to the target age group, and that we are able to promote our program in order to ensure the maximum involvement.

II. Background

Our literature review consists of the psychological concepts involved in the creation of a lesson plan and using technology in the classroom as an educational tool. This research ties into creating an educational and intuitive lesson plan. Basic features of the Scratch™ computer program are reviewed. In addition, methods of advertising our learning program are discussed.

II. I. Psychology

Developmental psychology is defined as the study of the psychological and emotional changes, and the changes in perception, that humans experience over the course of their lives (Wood, Wood, & Boyd, 2006). This field of psychology examines changes in motor skills and other psycho-physiological processes, development of cognitive skills, acquisition of language, emotional, personality and social development, the formation of identity, and self-actualization. Developmental psychology divides life into five main stages: infancy, childhood, adolescence, adulthood, and old age (Wood, Wood, & Boyd, 2006).

The stage of life that will be focused on for this project is adolescence. Adolescence is the period of life between the beginning of puberty and the commitment to an adult social role. During this period personal and social identity are formed, and moral purpose is discovered (Huitt & Hummel, 1998). Adolescence is split into three parts: early adolescence (ages 10-12), mid-adolescence (ages 13-15), and late adolescence (ages 16-19). In order for the adolescent individual to "find themselves" they must learn through experience, test limits, explore autonomy, and commit to an identity (Huitt & Hummel, 1998)

A branch of developmental psychology that will be useful in designing a curriculum is educational psychology. This branch studies how human beings learn in educational settings, the

effectiveness of educational practices, the psychology of teaching, and the social psychology of a school setting (Lucas, Blazek, & Riley, 2005). It has a specific focus on the different ways students learn and develop. Educational psychology is a major component of teaching practices, including curriculum development, organizational learning, and classroom management (Lucas, Blazek, & Riley, 2005).

II. II. Lesson Planning

In order to have a successful lesson plan we made sure that it appealed to the target age group, while remaining educational. Our group learned of ways to teach teenagers in order to educate them about Scratch™. To begin, we needed a precise goal and objectives for what we were trying to teach. Organization was another key feature of teaching; the more organized we were in our approach, the more interesting and effective our teaching would be. One of the most important steps in helping the teenagers learn was getting to know them in some sense. Making an appealing lesson plan that relates to the teenagers would engage their interest in the lesson. (How do I make a lesson plan?, 2011).

According to the Madeline Hunter Lesson Design, there are specific steps that one should take in conducting a lesson. These steps are (Formatting Lesson Plans: The Madeline Hunter Lesson Design Model, 2011):

- Get the attention of the students.
- Tell the students what they will be learning and how it will be useful to them, followed by a quick visual example.
- Walk through another example, but include the students this time and let them follow along.

- Make sure students understand what they were taught; then the students will be able to practice these concepts on their own.

- Wrap up the lesson by asking the students what they have learned, and to show that they have learned it.

There is another perspective on learning that is geared specifically towards creating lesson plans about technology. Stephen Petrina from the Journal of Technology Education developed a five-part course design. The five parts are as follows (Petrina, 1992):

1.) Participation: the students can share their ideas and take responsibility of their education.

2.) Integration: the students interact with others and share their ideas and feelings.

3.) Relevance: the interests and needs of the students are incorporated into the lesson.

4.) Self: the students must want to further their own knowledge to benefit themselves.

5.) Goal: there must be a specific goal for the lesson being taught in order for it to be successful.

In order to meet the standards of a successful lesson plan, the group had to determine how teenagers learn. There are three types of learning according to Gault (2011). They are visual, auditory, and kinesthetic. Members of each type learn best in different ways and teenagers are no exception. A way to get the students involved in a lesson is to figure out what motivates them and gets them engaged. According to Strong, Silver and Robinson (1995), students are motivated when they have four goals: success, curiosity, originality, and satisfying relationships. In order to tell if a child is engaged in their learning is to watch for three specific signs; they are: interest in work, continued learning despite problems and difficulties, and taking pleasure in completion of work (adapted from Strong, Silver, and Robinson). One way to get students engaged is to peak their curiosity. According to Strong, Silver, and Robinson (1995):

> Students want and need work that stimulates their curiosity and awakens their desire for deep understanding. People are naturally curious about a variety of things… How can we ensure that our curriculum arouses intense curiosity? By making sure it features two defining characteristics: the information about a topic is fragmentary or contradictory, and the topic relates to students' personal lives. It is precisely the lack of organization of a body of information that compels us to understand it further. We have stimulated students' curiosity by using a strategy called "mystery." We confront the class with a problem.

The IQP group from last year also took into account the interests of teens at the library. They gave a survey to teenagers that asked what types of games they play, why they like playing games, and their previous experience with computer programs (Flynn, Pearsall, Pettiglio, & Wu, 2010). This gave the group an understanding as to the subjects they should include in their lesson planning.

Each of the teaching techniques previously mentioned helped provide information on a part of educational psychology. Our group gained insight into understanding how students of the target age group learn and what would catch their interest when learning about technology. This understanding was an important step towards planning a successful lesson and spreading interest and information to others.

II. III. Integrating Technology into Education

II. III. I. Video Games, Learning, and Literacy

When deciding on the format of a lesson plan, the potential incorporation of technology was a topic to cover. In an article entitled *What Video Games have to Teach Us about Learning and Literacy*, Dr. James Paul Gee, a professor at the University of Wisconsin, discusses the benefits video games can provide in a classroom setting. He acknowledges the fact that students learn at different rates and that some can be left behind if they learn slower than the pace of the

class. A benefit to using a teaching method involving video games is that many games have difficulty settings, which can be altered to allow the students to learn at a level suiting their needs (Gee, 2003).

Another point Gee argues is that the teacher giving the lesson might appear to engage the entire class, but may not engage the students on an individual basis. Video games allow the student to be immersed in what they are working on, and help them maintain a better focus on the material being taught (Gee, 2003). Gee admits that most information learned in the classroom is relevant to subjects covered in class, but not all of it can be readily applied to the current lesson. Video games allow students to learn necessary information pertinent to the issue in the game they are working on. Gaming also provides motivation through challenges and problem-solving situations that the player devises strategies in order to solve (Gee, 2003). Overall, Gee shows the possibility of incorporating technology and gaming into education, and using them as another learning tool in the classroom.

II. III. II. Quest to Learn

Teaching methods in the school setting traditionally involve a teacher giving a lecture, and presenting information pertinent to the lesson while the students take notes. However, Katie Salen, a game designer and professor of Design and Technology at Parsons School for Design in New York, plans to change that stereotype. Salen is overseeing the installment of a school in New York City called Quest to Learn. The school is entirely taxpayer-funded and seeks to educate children from the ages of 12 to 18 through the use of video games (Games Lessons, 2009).

Inspiration for Quest to Learn came from a number of different sources. One such source is the previously mentioned book, *What Video Games Have to Teach Us about Learning and Literacy*, by Dr. James Gee. Another source of influence for the school is the Digital Media and Learning Initiative enacted by the MacArthur Foundation. The initiative has acted as a test run for some of Salen's ideas for the incorporation of video games into education. Aspects of the Bank Street School for Children can also be seen in Quest to Learn. The school is an independent primary school in New York that uses interdisciplinary methods of teaching, and encourages collaboration among students (Games Lessons, 2009).

Traditional subjects, such as math, science, and history, are not taught in a lecture-based format at Quest to Learn. A normal school day consists of four 90-minute blocks that focus on the study of specific 'domains' which include: "Codeworlds (a combination of mathematics and English); Being, Space and Place (English and Social Studies); The Way Things Work (Math and Science); and Sports for the Mind (Game Design and Digital Literacy)." Each 'domain' ends with a two-week test entitled the "Boss Level" (Games Lessons, 2009).

The following are examples of the course work offered in the different 'domains' at Quest to Learn. In one part of "Being, Space and Place" students assume the role of an ancient Spartan who must determine the military capabilities of the Athenians and recommend a strategy for defense. Through this lesson they learn geography, history, and public policy. In "The Way Things Work" teenagers take on the role of scientists attempting to create a beam of light to reach a target. This lesson is designed to teach concepts in math, optics, cooperative learning, and creative and critical thinking. Another lesson of this class casts students in ancient Egypt as pyramid-builders. The point of this scenario is to teach geography, math, and engineering. If all goes according to Salen's plan, the school will serve as a model for other institutions seeking to

educate students through the integration of technology (Games Lessons, 2009). These samples of course work at Quest to Learn showed an example of a teaching method that incorporates technology, which is what our project aimed to do.

II. III. III. Video Games in a Library Setting

In order to facilitate the incorporation of technology and gaming into education Khalida Mashriqi, a librarian at a public school in New York, uses different forms of technology in teaching students of different grades and ages. Some devices she uses to teach include an electronic white board, topic-relevant videos and movies, informational computer games, and other devices. She also finishes every class with an assessment of some sort, whether it is a matching game or a multiple choice test, in order to determine how well the students retained the information taught as well as the effectiveness of her teaching method.

One example of a method used in her first and second grade classes was one in which she allowed them to create storyboards, and then film them using Flip™ cameras. She first showed the students a video about respect and then discussed with them the importance of treating others with respect. After the discussion, Mashriqi gave the students the assignment to create a movie teaching others about respect. Students were divided into groups, given construction paper and other supplies, and instructed to create fifteen pictures to form a storyboard for the group's movie. She then worked with each group to record every story. When the class was finished she played the videos for them so they could see how much they learned about respect for others through the project. Through her teaching methods she showed that incorporating technology into education can be very effective (Mashriqi, 2011).

The examples described in this section prove that technology can be effectively incorporated into education, and can be referred to for ideas when we begin to build our curriculum around Scratch™, the computer program we will be using in our lesson.

II. IV. Scratch™

The lesson plan designed during the course of our project was created around a computer program called Scratch™. Developed by the Lifelong Kindergarten Group at the MIT Media Lab, Scratch™ was first created with learning and education in mind, and especially intended for children within the ages of 8 and 16 years old. Since its release, it has been met with rave reviews outlining the countless possible applications and opportunities the platform provides users. The major facets of the beneficial nature of the program include those related to education and learning, as well as sharing and communication.

Scratch™ was created with educational goals in mind, and the success it has had since its release has been centered on its use in the classroom and libraries across the nation. In a field of education tools that is relatively narrow, "[Scratch] offers an important avenue for creative self-expression by allowing users to create animation, interactive games, and art, as well as learn math and programming concepts" (Nelson, 2009). Another feature that Scratch™ presents to users is the fantastic website associated with the program.

When a user visits the Scratch™ website at scratch.mit.edu, they are immersed in an online community where people come to create, share, and collaborate. The site provides a place to share their own personal creations, but due to the open-source nature of the programming language, the projects shared online also present viewers the opportunity to take these projects and "remix" them to produce their own version of that person's creation, or perhaps to learn how

concepts employed in the game were executed in the language of the program. To put the volume of content shared in the community in perspective, 2,329,870 projects from around the world were posted on the website as of February 17, 2012 (Scratch | Home | imagine, program, share, 2012)

II. IV. I. Features of Scratch™

Learning to use any of the common programming languages in use today can prove to have an arduous and steep learning curve to follow, especially for children. However, Scratch™ is different, and aims to be accessible to all potential users through the use of a straight-forward graphical interface. Most programming languages are purely text-based and use notation tags that number in the dozens, if not in the hundreds. With Scratch™, the user is presented with a toolbox that is smaller, and easier to manage. As shown in Figure 1, the front end of the programming interface is aesthetically simple, with all of the tools available to the user, at hand with just one or two mouse clicks.
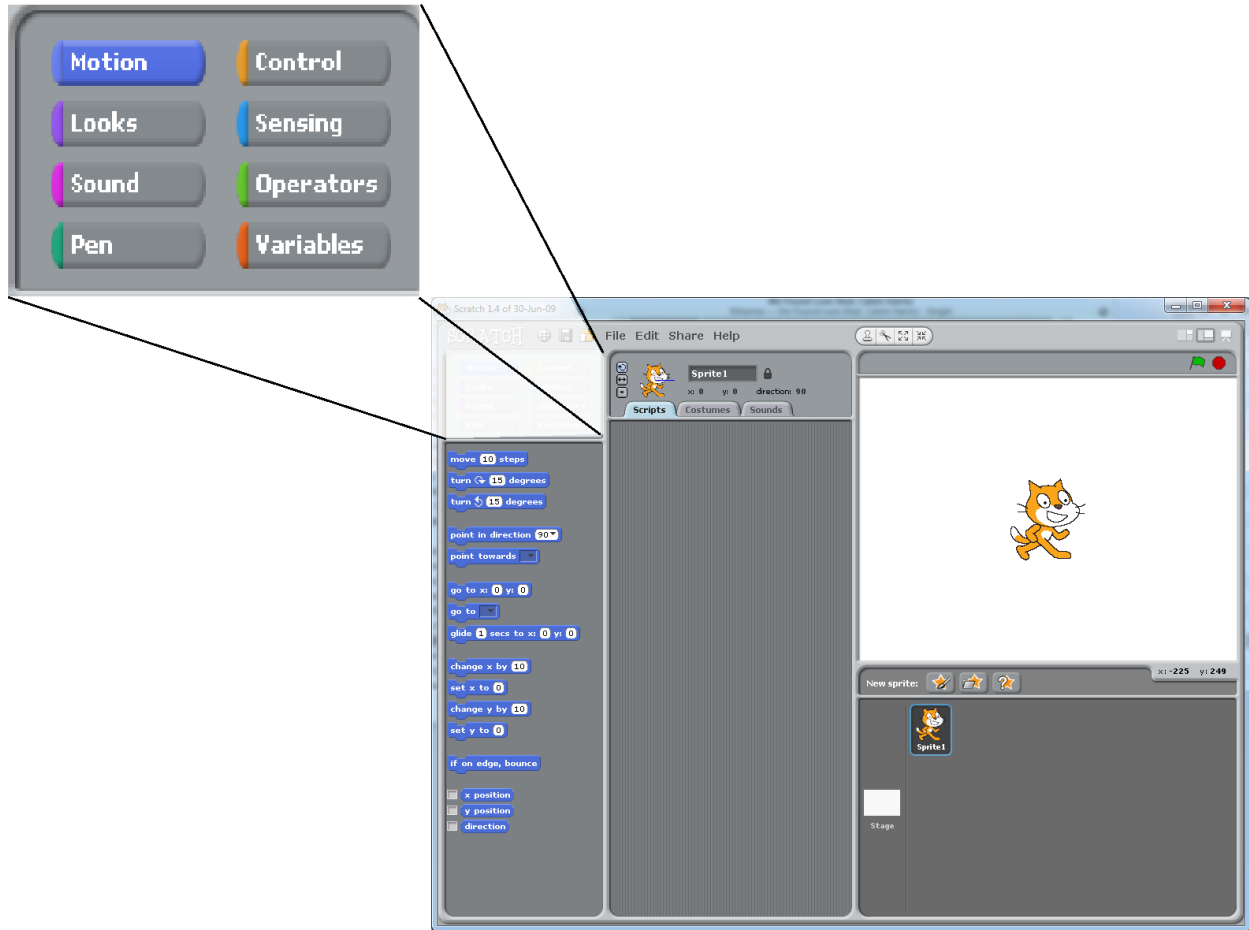
Figure 1: The main page of Scratch™, with the titles of the tool categories highlighted.

Using this graphical interface, children can easily tell what the different commands accomplish, such as affecting the movement, sounds, and coloring of a character. This allows even the novice programmer to more easily sense the association between objects and commands in the program.

While the Scratch™ program is engineered to be simple and easy to learn, the efforts to share the program, and educate children in its use would be for naught if potential participants were unaware of the learning sessions we were to host at the Worcester Public Library. A way to spread awareness about the program was through proper advertisement.

II. V. Advertising

Promotion of programs at the Worcester Public Library is how the library introduces new programs and gets potential participants interested in them. The IQP group from C Term 2011 that worked at the Worcester Public Library took a survey of various teens that visit the library. The survey included a question asking if they would be interested in participating in the Scratch™-based learning sessions they were planning, as well as questions concerning their various interests. Finding out what the teens were interested in allowed the group to organize the planning of their lesson (Flynn, Pearsall, Pettiglio, & Wu, 2010).

Programs available to teens that were already held at the Worcester Public Library were meetings of the Teen Program, All Day Anime, Teen Book Discussion, and Teen Advisory Group (TAG) (Worcester Public Library Calendar of Events, 2011). One way that the Public Library promoted these programs was putting them in the calendar of events on the "Teens" section of their website. They also used the website *Eventful*, which allows the user to search for events by area (Worcester Public Library Schedule, 2011). Events at the Worcester Public Library were among the results when searching for events in Worcester, so use of this website helped to promote the library's activities and events.

Other libraries have posted upcoming events in their local newspaper as another way to advertising for them. The Ashby Public Library used the *Worcester Telegram & Gazette* to advertise their "Pumpkin Festival" in the fall of 2000 (Bisol, 2000). There is a calendar of events on the paper's website that divides events into different areas of interest, such as art, business, and education (Calendar, 2011). Event locations and times are listed for anyone interested in attending. In order to be effective, an advertisement must spur the interest of the target group, and do so in a way that will be seen by many.

The lesson plan our group created had to hold the interest of the teenagers while teaching them the intended material, to result in a successful program. This success would be ensured through our learning more about the target age group, and in designing a curriculum that fit the results of the information gathered. This process, as well as advertisement for the learning sessions we held, was conducted using the methods described in the following section.

III. Methodology

In the following section, the methods that were used throughout the project are described.

III. I. Guiding Questions

To begin the process of gathering information pertaining to the project, we produced a list of research questions to guide us through the process of completing our project. These questions helped provide direction for our research and methods. By answering these questions we gained a better understanding of the central problem dealt with in our project, as well as how we would address it. Our guiding questions were:

1.) How do we make a lesson plan?

2.) What are members of the target age group interested in?

3.) What classes do members of the target age group enjoy the most in school and why?

4.) What topics did the previous IQP in this area cover in their learning session?

5.) In what ways can we promote the program at the library?

III. II. Justification for Questions

By answering the guiding questions listed above, we better understood the needs of our project and how to solve them. The first question was an important one to answer because our project involved teaching Scratch™ to teens. We learn how teachers prepare lessons, and then used what we learned to teach the target age group easily and successfully. The questions "What are members of the target age group interested in?" and "What classes do members of the target age group enjoy the most in school?" were vital questions to be answered because the lesson plans we formulated would be more effective if they appealed to the interests of the participants. Teenagers have different interests than those conducting this research. Therefore, a curriculum

we viewed as interesting could very well bore the participants, and cause disinterest in the program we were trying to teach them. The fourth question, "What topics did the previous IQP in this area cover in their learning session?" was vital to our group in the pursuit of building from the program that the IQP group from last year started at the Worcester Public Library.

Our curriculum was to correspond with, and improve upon that program. We did not want to teach Scratch™ in a manner that had already been used. Some students participating in the program may have attended last year's session, and we wanted everyone attending to learn something new. The final question, "In what ways can we promote programs at the library?", needed to be answered so that we could ensure maximum attendance at, and interest in, the program. By learning how the library advertised the programs they host and curbing our advertising to the target age group, we could better publicize our pilot learning sessions. We also made sure that the advertisement conveyed the topics the learning sessions would cover. Guiding questions served an important role in determining how we could solve our initial problem, and the methods we would use in our project.

III. III. Data Collection Techniques

The data collection was conducted in a way that upheld the moral and ethical standards of the IRB.

III. III. I. Interview of library personnel and previous IQP group

The first method of data collection was interviewing members of a number of groups related to the project. These groups included library staff and the members of last year's Worcester Public Library IQP group. Interviewing the librarians in a casual setting provided us with specific knowledge and accounts pertaining to the interests of teens at the library. The

questions for the librarians asked what they hoped to gain from the program, what they felt needs improving upon from last year's program, and what aspects of last year's program they enjoyed the most. The purpose of speaking with last year's IQP group was to obtain knowledge on their process for creating the curriculum, what they felt was successful about their program, and what they felt could be changed in order to improve upon it. The information gathered from these questions allowed our group to design a curriculum that was tailored to the interests of those involved, and built upon the current framework.

III. III. II. Target group survey

The next data collection technique was a survey of the target audience of our program. The group taking the survey was to consist of teens involved in the various teen groups at the library, such as some of those mentioned previously. Our group sat at one of the tables in the "Teen Zone" of the library, and placed a sign on the table that said "Take a survey…Get a chocolate bar!", and had the Scratch™ logo. Teens approached the table and took surveys in exchange for chocolate bars provided to us by Professor Kasouf. In addition, members of our group approached individuals in this area of the library and informed them of our project, asking them if they would participate in the survey.

We also distributed surveys to members of Anime Wings, a club for teenagers that meets weekly at the library. Surveying individuals from this group would provide a sample representative of the target audience as a whole. The teens interviewed would also most likely be those that would attend our program. This is why it was important to survey these teens, as well as the teenagers that visit the library on an occasional basis and occupy the "Teen Zone" area. The survey covered topics that we used to acquire knowledge about their age, interest in video games, knowledge of computers, and interests in school.

We used the surveys in order to determine the target age group that we designed our curriculum for and would attend our Scratch™ learning sessions. These surveys also supplied us with information that was used to develop a program that was appealing, entertaining, and educational for our target audience. The survey used can be found in the Appendix.

III. III. III. Pilot Program

Next we held six Scratch™ learning sessions for teenagers that registered for the program. Each session was an hour and a half long, held from 12-1:30pm and 2-3:30pm on February 21, 22, and 23. At the end of each session, participants filled out evaluations asking how they felt the class was constructed, and had space for them to write additional comments and feedback. The responses of the teenagers gave us ideas as to what teaching techniques we used in our program were successful.

III. III. IV. Archival research

We performed archival research on similar programs and on curriculum design we discovered in our internet-based background research, as noted in sections II.II. and II. III. I-III. We took note of the successes and failures of present and past programs in order to understand how to design ours. We also looked into any information regarding creating a lesson plan in order to gain insight on how to design a curriculum.

III. IV. Protocols and Method Justification

Setting: The learning sessions using our curriculum designed for Scratch™ took place at the Worcester Public Library, with all participants being active members of the library. All methods of data collection that involved subjects (surveys and interviews) took place at the library as well.

Subject Selection Criteria: Members of various teen groups and any teens interested in participating in our program at the Worcester Public Library were asked to partake in a survey. By having a large group to collect data from, the results were relatively realistic, which resulted in a more effective programming curriculum. Interviews of library staff and the members of the IQP project group from last year were conducted. These provide us with further information on what to include in our project, how to design the optimal curriculum, and how to improve upon the success of the previous project. Also, any teens that show interest signed up to participate in one or more learning sessions. The sessions were observed as they were conducted in order to determine if further changes could be made to the curriculum to improve the class.

Triangulation: Three points of data collection (surveys, interviews, and observations) allowed us to design a successful Scratch™ programming curriculum. The surveys given to teens yielded insight into their interests in both gaming and school, which allowed us to create a curriculum that they found engaging, entertaining, and informative. Through the use of the three points, it was possible for certain visible trends to arise in the data. The library staff can modify the curriculum of future sessions to match these trends, as well as to relate to the interests and needs of the students taking the course.

The interviews conducted within the various groups gave us insight needed to tailor our curriculum to the target age group, provided knowledge as to how the library staff promotes programs and runs them successfully, and yielded information on the successes and shortcomings of last year's project. Observation of the pilot program provided feedback as to how the teens reacted to the presented material and if they worked cooperatively or alone.

III. V. Schedule

The work done during our time spent at the Worcester Public Library during C Term progressed in a relatively natural manner. Before we could teach the teens in the target age group about Scratch™, or plan a curriculum, we learned to use the program ourselves. The first part of the term was spent getting familiar with the program so that we could provide participants in the learning sessions with an informed and educational experience. In addition, this familiarity with the program at hand would allow us to answer any question that could arise when interacting with the teens. During the course of our learning of Scratch™, we also conducted the surveys and interviews described in the Methodology.

Once our group learned to use the program, and gained knowledge from the research methods, we began designing a curriculum to use in the learning sessions. This curriculum was guided by the examples researched, and incorporated the interests of members of the target age group. This personalization ensured the success of the curriculum in teaching teens about computer programming through Scratch™ and created a fun and positive learning environment.

Near the end of the C term, we held the learning sessions in a computer lab at the Worcester Public Library during February Break for the local schools, and learned from observations made during the event. We also held the sessions for teaching the library staff, and worked with them to take the next step towards establishing a permanent Scratch™ program at the library. Once the sessions had passed, the final report was written, and the project was completed.

IV. Results

The results of this project are described in this chapter. These results include a survey of teenagers at the library, interviews with the previous IQP group, interviews with Library Staff, pilot programs with both teenagers and librarians, and the curriculums developed for the project. The survey was conducted in order to determine the target age group for the project, and determine the average activities of this age group to design the curriculum based on their interests. The interview of the previous IQP group was used to determine how our group could build off of their project, and determine how the curriculum should be created. The interview of the librarians was used to understand strategies for advertising programs at the library. The pilot programs demonstrate the effectiveness of the program and its ability to be continued by the librarians.

IV. I. Survey

The survey was used to gain basic information of teenage patrons of the Worcester Public Library. We collected 25 completed surveys from teenagers that frequent the library. The participants fell between the ages of 11 to 20; however the majority of those surveyed fell within the expected target age group of 12 to 18 years of age (Figure 2). The majority of the participants spend about 5 to 15 hours per week on a computer, whether it be for education, social, or gaming purposes; specifically 19 out of the 25 participants (Figure 3). For the question that asked participants what their interests were, most stated that they enjoyed playing video games or creating art of some kind. The survey also showed that 20 of the participants frequently play video games (Figure 4). The question asking how often participants use or go to the library showed that the majority are there on a frequent basis, with only 6 attending less than once a

week (Figure 5). The survey provided our group with information to determine our target age group and interests of that group for which to build our curriculum on.
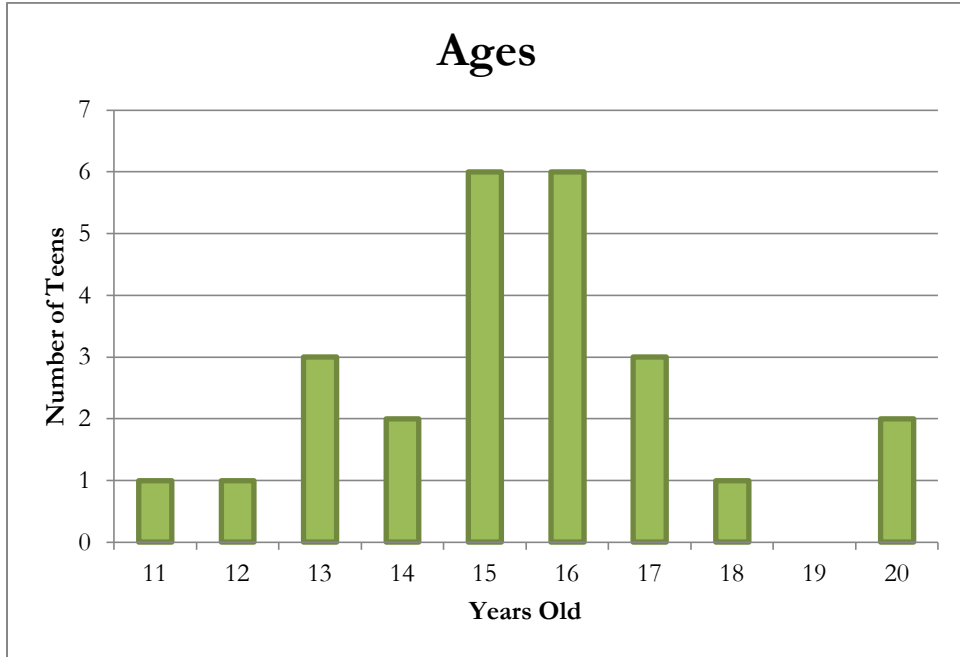
Figure 2: Graph of Participant Ages.
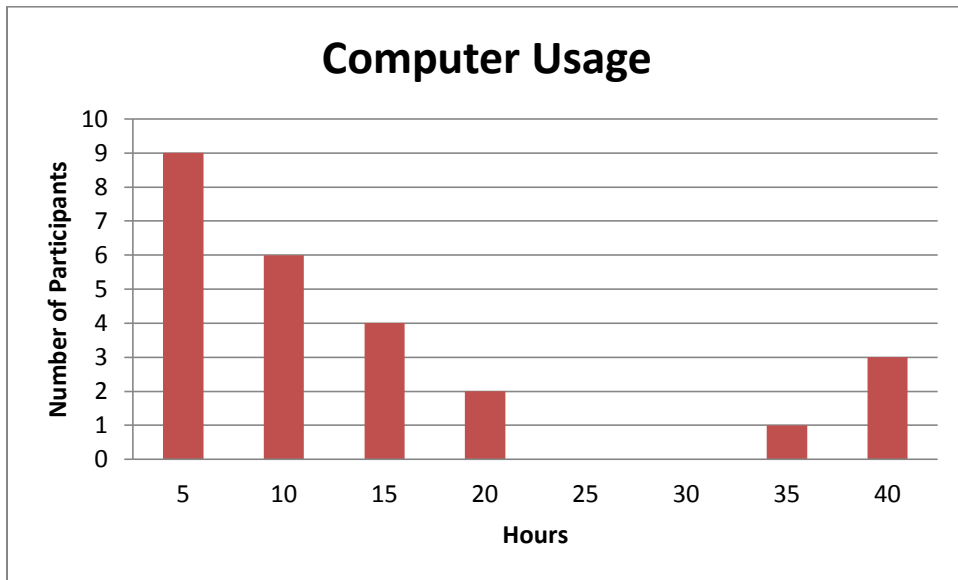
Figure 3: Participant Computer Use.

Do you play video games?

5 participants

20%

80%

20 participants

yes

no
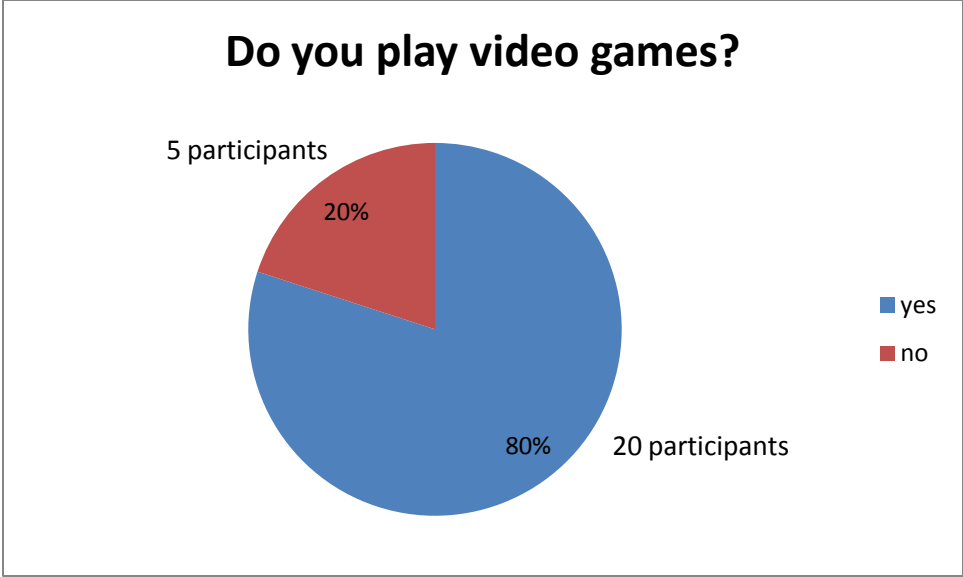
Figure 4: Participant Video Game Use.

Library Usage

Number of Participants

Number of Days a Week
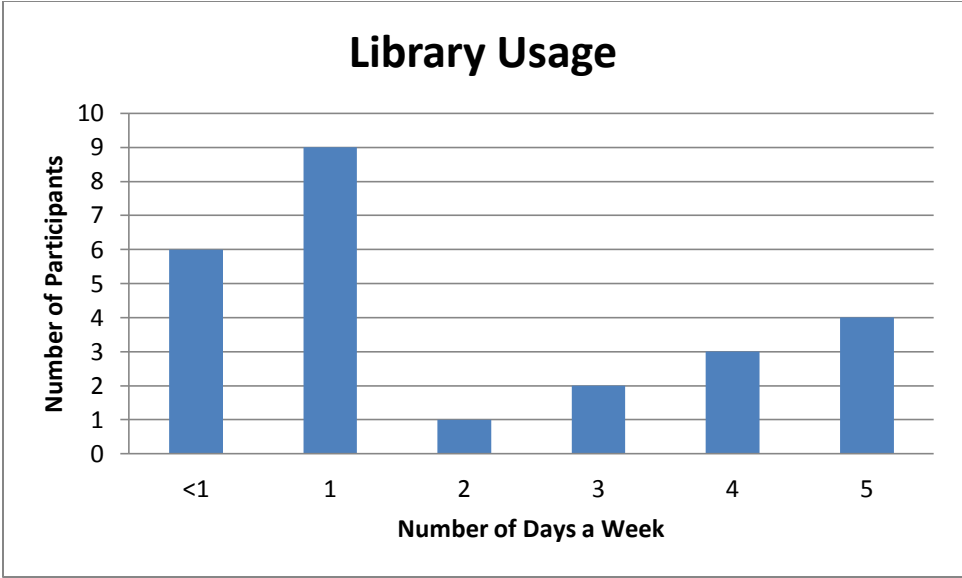
Figure 5: Participant Library Use.

The survey provided our group with a number important factors that would help us develop our curriculum. One factor was the target age group. The age group that we anticipated would attend our session was teenagers between the ages of 12 and 18. The data obtained from the survey showed that our expectation was correct. This information allowed us to develop a curriculum that would be suitable for this age group.

Another key piece of data obtained were the general interests of the target age group. There was a general trend in the interests of the participants. The majority of them said that their hobbies included playing video games and/or creating art. This information led our group to develop a curriculum that focused on video game design. Therefore, the curriculum incorporates both video games and art by allowing the teenagers to creatively design games, and play them once they are complete.

Lastly, the survey also provided us with information on how much the participants use computers, and how many days a week they go to the library. This information would allow us to estimate the likelihood that members of the target age group would participate in our program. The survey showed that most of the participants spent anywhere between 5 to 15 hours per week on the computer, and that most attend the library on a weekly basis. Based on this data, we determined that it would be fairly likely for local teenagers to attend our program, so we created different forms of advertising in order to spread interest.

IV. II. Curriculum

In order to begin to develop the curriculum used during our Scratch™ tutorials, our group had to first determine what material was covered by the IQP group from last year. We concluded that they had covered the basics of Scratch™, such as how to make a new character and how to

make that character move. In order to build on that curriculum, our group decided to focus on teaching these skills to participants through the creation of a game. In our opinion, making games was the next step that teenagers at the library would want to take to further their knowledge of Scratch™. Our group was allotted a block of 3.5 hours in the computer lab at the library during each of three days, so it was crucial to use this time effectively. We decided on the format of 2 blocks of time, each 1.5 hours in length with a half-hour in the middle for a break. Three lessons, each teaching a new game, would be cycled through over the course of the 6 sessions, teaching each game twice. The first lesson used our simplest game to teach and learn, and the third used the most challenging game. In order to aid us in teaching, PowerPoint presentations were created for students to follow along with during the session. These power points had step-by-step directions outlining how to make each game we taught.

IV. II. I. Curriculum Structure

While each of the three lessons taught were of different difficulty, the structure of the slideshows used as teaching tools remained relatively unchanged. To begin each lesson, a slide outlined the class objectives of that lesson. This slide described what the students could expect to learn during the tutorial, and what we hoped they could use on their own by the end. Figure 6 shows an example of this slide.
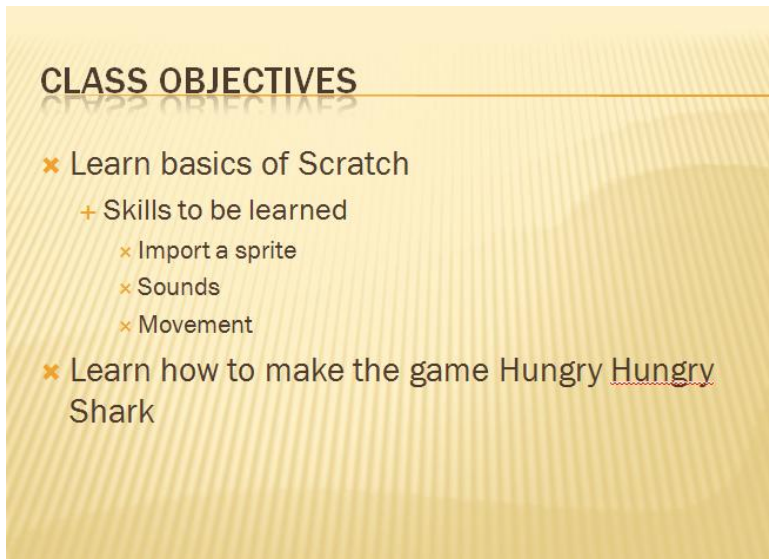
Figure 6: Example of a Class Objectives slide from the Hungry Hungry Shark game.

The next slide was quickly reviewed a couple of key terms to be used throughout the tutorial. An example of this slide can be seen in **Error! Reference source not found.**. The purpose of this slide was to refresh the student's memories of basic Scratch™ terms, so that they might better understand the explanations when the game began to take shape.
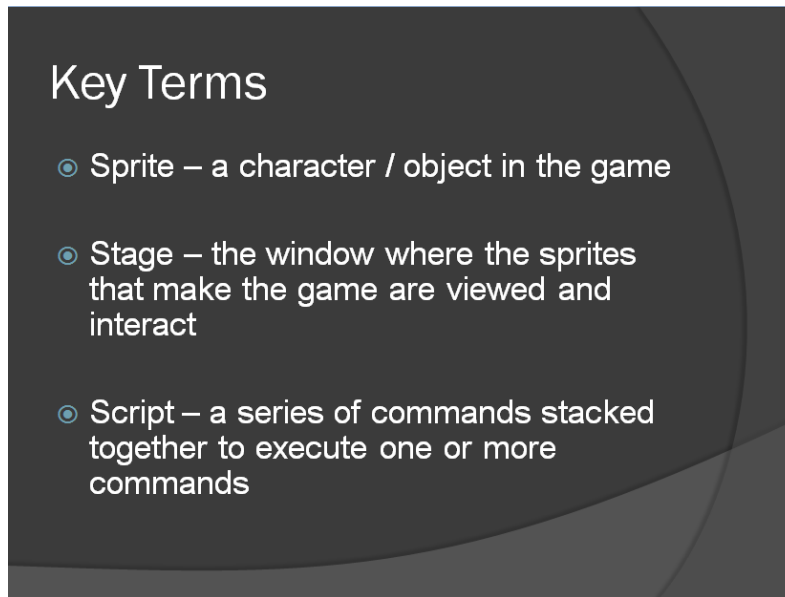
After the introductory slides came the thorough explanation of how to create each game. The Hungry Hungry Shark Game was chosen to be the first game because it reviewed some of the basic functions of Scratch™, such as how to choose a new background for a game, how to import a new character, called a sprite, and how to make the sprite move. Figure 8 is a slide from Hungry Hungry Shark showing the first simple step, which is adding a new background.
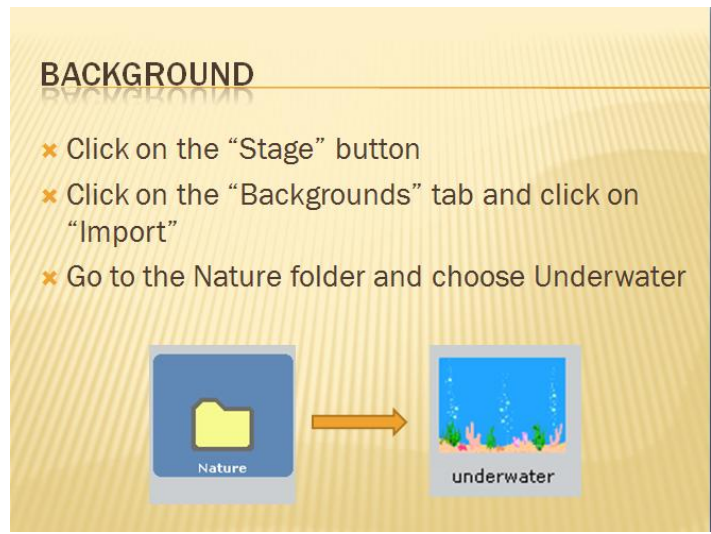
Figure 8: A slide showing the first step in making the game Hungry Hungry Shark.

Also included in the presentation were slides outlining the importing of preexisting sprites, or the creation of new ones. **Error! Reference source not found.** shows the slide used to import a shark sprite. This is a preliminary step that needed to be taught in order for the rest of the game tutorial to be understood.
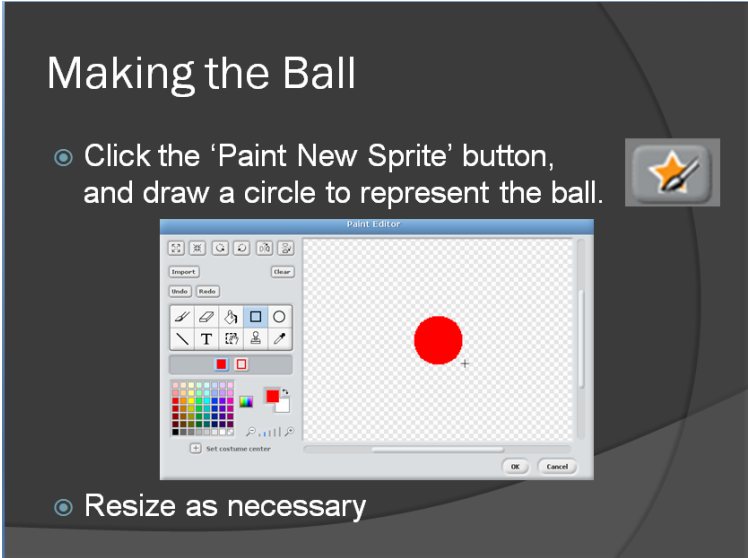
Figure 9: An example of a slide showing how to paint a new sprite from the Game PONG.

Another type of slide used explained how to use the Scratch™ script commands together in order to make sprites move and interact with one another and the stage. Figure 10 shows what script needs to be put together and how, in order to make the shark move about the screen. By learning the basic movement of the shark, the students can build upon that to make a more complicated game if they wish.
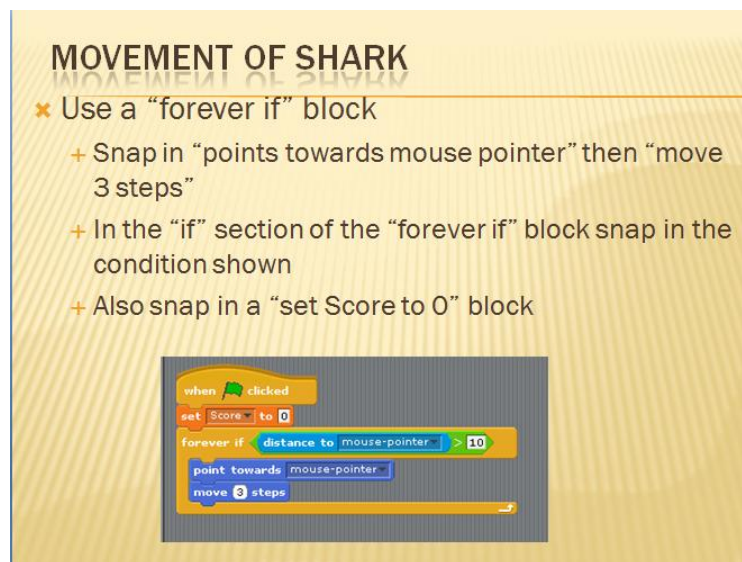
Figure 10: Slide explaining how to make the shark move in the game Hungry Hungry Shark.

The game called 'Hungry Hungry Shark' was taught first to participants, and then our group taught more complex games for the next two tutorials. These games, called 'PONG' and 'MineBoat' involved making more complicated scripts and furthered the students' knowledge and interest in Scratch. However, these higher-order concepts remained simple to follow using the different types of slides outlined above.

IV. III. Learning Sessions

IV. III. I. Teenager Learning Sessions

Our group planned learning sessions for teenagers that were held on February 21, 22, and 23. There were to be two sessions each day, with a different lesson taught at each. Unfortunately the first planned day of sessions had to be cancelled because the head of the Youth Services Division at the library, Anne Hrobsky, was not feeling well. This left our group with only two days to teach our curriculum.

On the second day the event post on the library's website had not accrued any sign-ups. However, Anne Hrobsky was able to invite two kids she recognized that were at the library to attend to the first session. The first game we taught was MineBoat. We had two projectors set up in order to aid in our teaching. John used one to go through the PowerPoint presentations we had made, while Andrew was on Scratch™ making the game so the students could follow along. Joan walked around answering any questions the students had. The sessions went smoothly and the students seemed to enjoy making their own game and characters. They were able to follow along fairly well and only had a few questions. After we finished teaching the game, the two students were able to explore Scratch™ on their own. They began changing the game we had just taught them, and truly making it into a game of their own. When the first session ended, the two students wanted to stay for the second one, so we began to teach them the game Hungry Hungry Shark. We were not able to finish because the teenagers had to leave, but they appeared to enjoy it like the first lesson.

Before the end of this, and every other learning session, evaluation forms were handed out to participants so that our group could receive feedback on the success of the course. As can be seen in Appendix D, The questions asked on the feedback sheet were how well the teens

thought the class was constructed, if there was anything our group could do to improve the class, and had room for any other questions or comments. Both students from the first session thought the class was constructed very well and commented that it was fun. They also both gave similar suggestions for improving the class, saying that there should be more students present. One suggested that we walk around the library for a couple of days before our sessions helping to advertise for the program.

The third and final day there were no online sign-ups but Anne Hrobsky was able to get some kids together for us again. We had four students and the first game we taught was PONG. Our group kept the same teaching roles as the previous day. This was our most complicated game to make and while teaching it our group realized that we needed to teach slowly in order for the students to be able to follow along. They had many questions, and because there were more of them than the previous day the lesson went a little bit slower. By the end of the lesson the students began to have fun with what they had created, and some wanted to make the game even more complicated. As was the case in the session from the previous day, all of the students were able to stay for the second session period. For this session, our group decided to teach Hungry Hungry Shark. This game was a little easier for the students to follow along with, and they seemed to enjoy making it. Once they discovered how to add sound to their game they had fun exploring the possibilities.

Once again, we asked the students to fill out evaluations sheets before they left. We only got three forms because one student left early and did not fill one out. All three students said the class was constructed very well, and two of them responded that they would have liked the teaching to be slower and explained better. Our group was glad that the students gave their honest opinions so that we could try to fix any problems.

IV. III. II. Librarian Learning Session

On February 27th, our group held two learning sessions for the librarian staff, as the Worcester Public Library is closed to the public on Mondays. Four members of the staff attended the first session in the morning, which was approximately an hour in length. For this session we chose to teach the game Hungry Hungry Shark, as this was the simplest game to teach in such a short amount of time. The librarian staff came to the event with minimal to no understanding of the Scratch™ program. However, when the pace of the lesson was paced to meet their needs, they seemed to take to the program quite well, and every participant either finished making the game or came very close.

The afternoon session was a bit longer in duration, so the game MineBoat was taught to the three members of library staff that attended. While the MineBoat game contains some concepts that are a bit more difficult to teach, we were able to convey the program to the librarians effectively by taking the time to fully explain each step, and wait until all members of the class were caught up before proceeding to the next. It was in this manner that all of the participants of the afternoon session were able to finish creating the MineBoat game, and give us their feedback on how the course went.

The general consensus of the responses we received after the session was that the class was constructed very well. The librarians loved how intuitive the program was, and said they were very excited to see it become part of the family of events offered at the Worcester Public Library. Some suggestions included reviewing in more detail what action each of the command blocks performed, and making sure the future sessions are longer than a single hour.

V. Recommendations

This section discusses the problems and limitations faced by our group while completing this project, and recommendations we have for further development of Scratch™ learning sessions at the Worcester Public Library. Our first recommendation is to advertise when a learning session will be held as early as possible. Our group did not get the word out as soon as we wanted, so the number of students that attended was much lower than expected. If we had gotten our fliers and other advertisements out at least two weeks before we held the sessions, the attendance would have been higher.

Another recommendation our group has would be to appoint a main librarian who can be the resident expert on Scratch™. This person could go through the tutorials available on the Worcester Public Library's website to become more familiar with Scratch™ and its features. This person could then hold more sessions for other librarians in order for more people to be comfortable with the program. By taking the time to educate as many librarians as possible

A third recommendation would be to propose a possible outline of a Scratch™ tutorial that could be taught to librarians or teenagers. Our group believes that to get the full learning experience of Scratch™ and to understand the program well, a three day workshop with a two hour learning session each day would be appropriate. We believe that these sessions should go over the material developed by both last year's IQP team and this year's team. To begin, the instructor should show the Scratch™ website and explain how there are millions of projects and games uploaded by users that are available for anyone to see. Next, the instructor should go over the basics of Scratch™ using some materials from the 2011 IQP group then go into material presented this year, such as game making. By making the sessions two hours long and over a

period of three days, it gives time for all the material to be covered and for the instructor to go at an appropriate pace for people to learn.

If possible, our group recommends that new games are made that can be taught at the library. If not, anyone who attends a learning session should be shown where to find the Scratch™ website so they can see other games and learn how to make those or games of their own. Students should be encouraged to share their work with others and to explore Scratch™ as much as they can.

VI. Conclusion

Our project incorporates technology into educational programs at the Worcester Public Library. Research conducted covered programs in the past that incorporated technology in education, successful lesson planning, the background of the Scratch™ program, and possible methods of advertising. Surveys were conducted of members of the target age group so as to involve their interests in the curriculum, as well as interviews of the librarians to learn techniques for successful advertising. This project at the Worcester Public Library provides an example of a curriculum for teaching the Scratch™ programming language that the library can continue in the future. By giving the library recommendations of how to best set up new Scratch™ tutorials for librarians and teenagers, our group hopes that Scratch™ can be a permanent fixture that is available for everyone to experience and learn at the Worcester Public Library.

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Appendix A: Survey Questions

Teenagers:

What is your age?

What do you like to do in your spare time?

How many hours a week do you spend on the computer?

Do you play video games?

What is your favorite subject in school?

How often do you come to the library / use the library's resources?

Teenagers that participated in last year's Scratch™ program:

What did you like about the learning session?

What did you not like / what would you change about the learning session?

Librarians:

How do you promote programs at the library?

What advertising techniques have worked in the past?

How many kids participated in the Scratch™ learning session last year?

How many computers are available for our use?

Appendix B: Milestone Schedule

Appendix B shows a milestone schedule the group used to stay on task in accomplishing goals through the term-long process

Week	Tasks
Week 1 (Jan 16-20)	Get sponsor involved, explore Scratch
Week 2 (Jan 23-27)	Survey teens, interview librarians, interview IQP group from last year, explore Scratch
Week 3 (Jan 30- Feb 3)	Explore Scratch, begin to develop curriculum, develop advertising strategies
Week 4 (Feb 6-10)	Curriculum development, advertise
Week 5 (Feb 13-17)	Curriculum development, advertise
Week 6 (Feb 20-24)	Students' February vacation; run the Scratch learning session
Week 7 (Feb 27- Mar 2)	Finish project report; Assess outcomes of learning session; train Library Staff for future usage

Figure 11: Milestone Schedule.

Appendix C: Lesson Materials

The following images include the flyer used to advertise for the program, as well as samples of the slides used in teaching the three lessons to the teens and librarians who participated in the learning sessions.
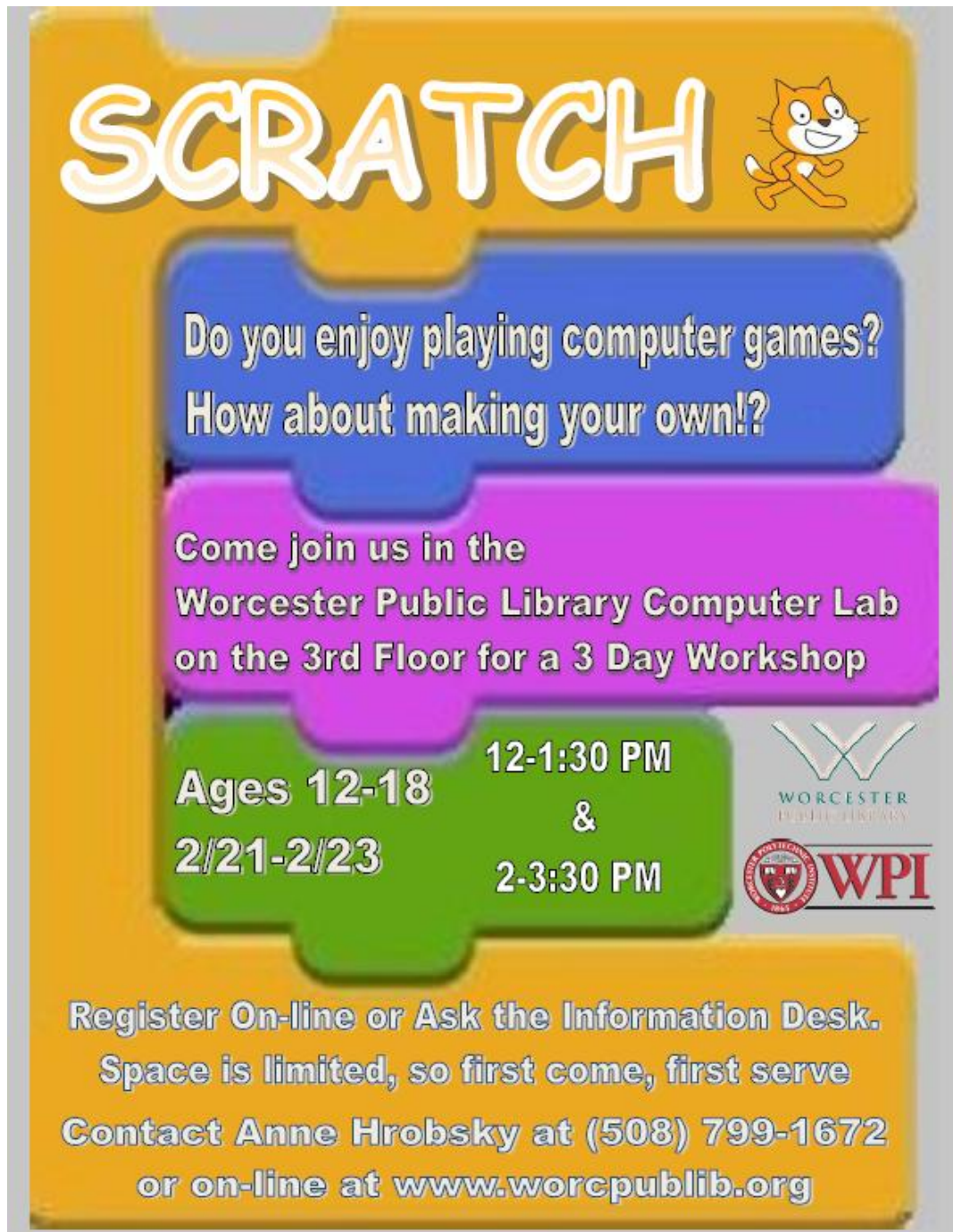
Figure 12: Flyer for the Scratch Learning sessions.

Figure 13: Sample of Hungry Hungry Shark PowerPoint slides.

Figure 14: Sample of PONG PowerPoint slides.

Figure 15: Sample of MineBoat PowerPoint slides.

Appendix D: Scratch™ Program Feedback

Feedback for the WPL Scratch™ Game Programming Class

(Circle One) How do you feel the class was constructed?

 Not Well   Well   Very Well

Do you believe we could do anything to improve the class?

_____

_____

_____

_____

Comments/Questions

_____

_____

_____

_____

Appendix E: Scratch workshop
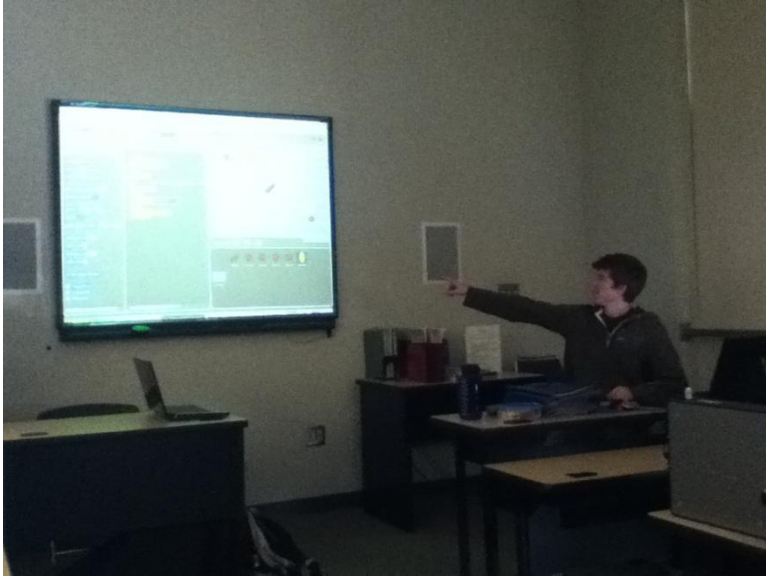
Figure 16: Photo of Scratch™ learning session.
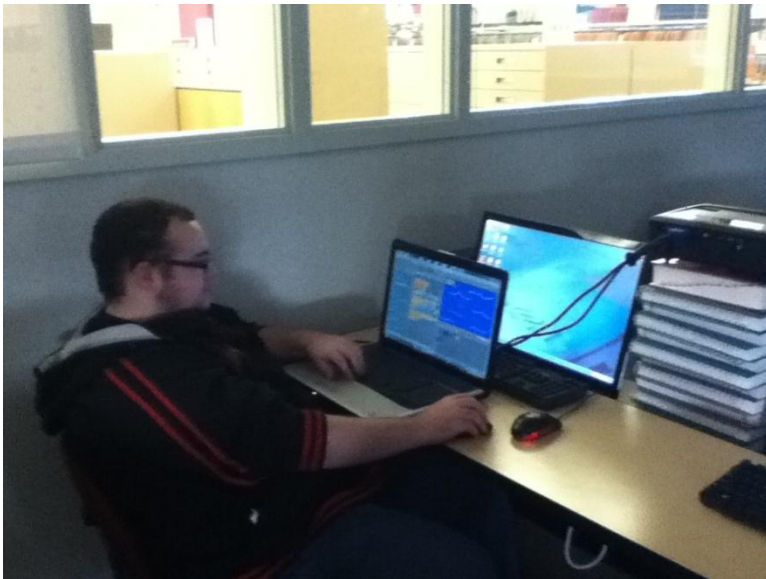
Figure 17: Photo of Scratch™ learning session.

Figure 18: Photo of Scratch™ learning session.

Figure 19: Photo of Scratch™ learning session.

Appendix F: Final Presentation

Figure 20: Slides from the Final Presentation