COMMUNITY SCIENCE CENTER

An Interactive Qualifying Project Report:

Submitted to the Faculty of the

WORCESTER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for the

Degree of Bachelor of Science By:

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Date: March 28, 2013

Approved:

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ABSTRACT

This project was established to assess the need for a community science center in the city of Worcester, Massachusetts and to develop a framework for such an institution. This paper outlines the research done, methodology used, and rationale employed during the completion of this project and gives our recommendations for the future continuation of this project. Primary research includes information on established community centers, state educational requirements, and sample science experiments. Other research methods and analyses including interviews, presentations, and social media profiles are also included with description. Many served to establish out platform for our decision making process.

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ACKNOWLEDGMENTS

To ensure the project was done thoroughly, we enlisted the assistance of professionals outside our group. As a team, we would like to acknowledge them for their contributions to the project. Dr. Warren FitzGerald, a Developmental Psychologist from Concord, New Hampshire gave us valuable insight into the teaching and learning processes and child brain development. Christine Cyr-Lawrence, a language arts teacher with a Masters Degree in Education from North Andover, Massachusetts told us about the state educational requirements and shared actual teaching methods that she has found effective throughout her career. Finally, we would like to thank Professor Germano Iannacchione and the graduate students in his Masters in Secondary Education class for agreeing to dedicate some of their class time to be interviewed and for the insight gleaned from that interview. Without the help of all of these professionals, this project would not have been possible.

EXECUTIVE SUMMARY

This Interactive Qualifying Project (IQP) was designed to assess the feasibility and logistics of establishing a Community Science Center for the city of Worcester Massachusetts. Through our research we have found that 72% of students are from low-income families, and that educational facilities are not meeting state benchmarks (Worcester Education Collaborative), particularly in the science department (Lawrance). This proposed Community Science Center would function as a facility to supplement the education provided by the schools and serve as a common facility where local schools and community members can use the shared equipment. The final goal of this project is to create a skeleton of a community science center that can be implemented in our community and others where similar problems are found. To do this, we have established a few major objectives; to assess the need for such a facility, determine the public interest, present a flexible curriculum for the students, and establish the logistics of obtaining a facility and equipment.

The goal of this Community Science Center is to establish a place where children from grades two to six can go to explore the sciences, and practically apply the lessons learned in the classroom in a fun and educational setting specifically for them. As a first step our team chose to decide what age group would benefit most from the Community Science Center. To do this, we designed a survey to establish a baseline of where we might want to begin to look. Upon receiving the results of the survey, we employed the assistance of a panel of graduate students studying education, a developmental psychologist, and many Massachusetts elementary school teachers to refine our search. The data collected from this research disclosed that the age bracket where our Community Science Center would see the most positive result was between grades 2 through 6. At this age children become students, they have become mature enough to be taught in an educational environment (Fitzgerald).

The next part of the project was to suggest some of these experiments. The results of the interviews with the teachers and the psychologist were used to design specific experiments and develop a portfolio of projects tailored to each grade and beyond. We did not establish this curriculum as a rigid set of guidelines, but rather as a starting point where students can find a project that interests them and have the resources to carry it to fruition. We decided not to limit the scope of these projects to simple tasks for young children. We learned that children are driven by curiosity, and decided to challenge them with projects designed for older children and provide them with the required support. This way, the children can have projects that they aspire to, but in order to achieve them they must first learn the prerequisite material. This interactive learning style coupled with the sound knowledge of our volunteers is designed to encourage curiosity and free thought very similar to WPI. Because of this, we are not limiting the students to our projects. They are welcome and encouraged to bring in their own experiments provided that they have a legitimate educational purpose. Our curriculum is designed to be flexible, fun, and educational.

A very important part of the project was getting the local community involved. In our modern society, there are many channels of communication and the key to effectively marketing a product is to choose the ones that are most likely to yield a positive result. We decided to tackle the issue of media and public outreach through informative programs and community feedback. Our goal was to inform the general public about the proposed community science center, and gauge their interest. To do this, we developed a website and made use of social media outlets in an effort to get our information to as many people as possible. We found that 71% of online adults are using social media. Because of this, we decided to create a Facebook page showcasing our ideas, and an Instructables link with some of the easier projects the students could do at home. After establishing our presence on social networks and informing others, we researched different methods to gain financial backing from local government and companies. To do this, we developed a concise and clear presentation detailing our message and specifically requesting for help in this endeavor. The role of social media in this project is particularly intriguing. This is a new method of spreading a message that has proven very effective for many other groups. Ten years ago, it was more difficult to encourage support for a project like this, but with the dawn of social media, simply by putting the idea on the Internet, infinitely more people have access to it.

Next, we researched similar programs both locally and nationally to develop a better understanding of how these programs operate. We researched these facilities and decided that some were better models than others for our project. Some of these were the EcoTarium in Worcester, The Boys and Girls Club of America, and the Taylor Community Science Center in St. Louis Missouri. Each of these establishments have certain aspects that we drew upon for inspiration when developing the groundwork for our facility. The Boys and Girls Club provides a safe and accessible environment for children after school, and also provides supplementary athletic facilities for schools that do not have their own. The EcoTarium has exhibits that ignite a curiosity in people of all ages and provide legitimate knowledge in a fun environment. The Taylor Community Science Center is a pinnacle to which we aspire. They are a fully functional facility that touches the lives of many students in the St. Louis area and we hope to bring these concepts to other communities across the country. There are things we would do differently, and do not want to be a franchise of any of these establishments, but overall we like their models.

Our final step is to take these abstract concepts and try to make them concrete. This is not a step for this project, but rather a series of recommendations for a future IQP team to finish what we have started. To make the facility a reality, we must find some way to fund it. We have included a few presentations that another group could use as a starting point for a campaign to acquire funding for the facility. They could look at grants, individual private investors, and corporate sponsors as places that might donate to the cause. The next step is to get the school system involved. Students would have to go to schools in Worcester and tell the administration about the program. This is critical because without the support of the schools, the program would not be able to get off the ground. With money and support, it would be time to

invest the money in resources and an actual facility. Once all of those have happened, the Community Science Center should be ready for operation.

CHAPTER 1: INTRODUCTION

The This IQP report contains information for developing a community science center. The report contains background information to support our rationale behind our decisions, details on our methodology, and our own assessments and recommendations on how to continue this project further. The ultimate goal of this project is to establish a guideline detailing how to start a community science center in any community where there is a need especially Worcester, Massachusetts.

Through our research, we have concluded that the public school system especially for elementary school students lacks a solid foundation in science (Lawrance). This is disappointing, because we also found out that elementary school is the most important age to begin to foster a child's interest in a subject matter. It appears that too much of this time is devoted to learning math and spelling. These subjects are important, but alone are not sufficient for the goals of the nation (Obama). Children are missing out on key opportunities to grow up learning to love science and instead become intimidated by the subject.

The primary goal of the project was to analyze the educational system in Worcester, Massachusetts and to determine if a community science center would be effective and feasible. This meant looking at other existing science centers and how they function, determining an age group in which to focus on in the early stages of our center, and incorporating an effective curriculum keeping expansion in mind. Doing this gave us the skeleton for a program that would supplement elementary school education and provide a space for children to practically apply the skills learned in the classroom.

After determining that no such facility exists for the Worcester School District, we decided on a few secondary goals. We wanted to find the most effective ways to send out our message, how we could get the facility to function effectively, and what resources we would need for the facility to be a success. This allowed us to add more to the skeleton, and make the project more concrete, not just an abstract concept. We researched effective marketing techniques, and began the process of employing them. This set the marketing wheels in motion, and brought us to the point where we decided to research ways to fund and staff the facility. As a team, we researched different educational grants for which we could apply, and began to

narrow down that process. We also developed the outline of what we would use the grant money for and assessed what we would need for a functional facility.

CHAPTER 2: BACKGROUND

This project required that we consult various professionals as well as draw upon our personal knowledge and independent research. We decided to divide the background into three sections: Education, Marketing, and Psychology. We found these to be our primary areas of focus for establishing what we should teach, to whom it should be taught, and how to make this project a reality.

EDUCATIONAL BACKGROUND

The education system is unable to support certain communities. The lack of better funding and resources has lead institution to cancel different subject programs, including science programs. This unfortunate scenario is reflected in the Worcester community and lived by many children. Although educational institutions provide a basic education in literature and math, children should be exposed to the different sciences at an early age. Some institutions provide science programs. However their quality, the space where the experiments are held and efficiency of the equipment are counterproductive to the learning experience (Lawrence). Students should have access to proper facilities and equipment, and course curricula should be formulated to encourage student learning and progress (Obama). The Community science center intends to provide a space where students can learn the different sciences by pursuing experiments that would challenge their knowledge.

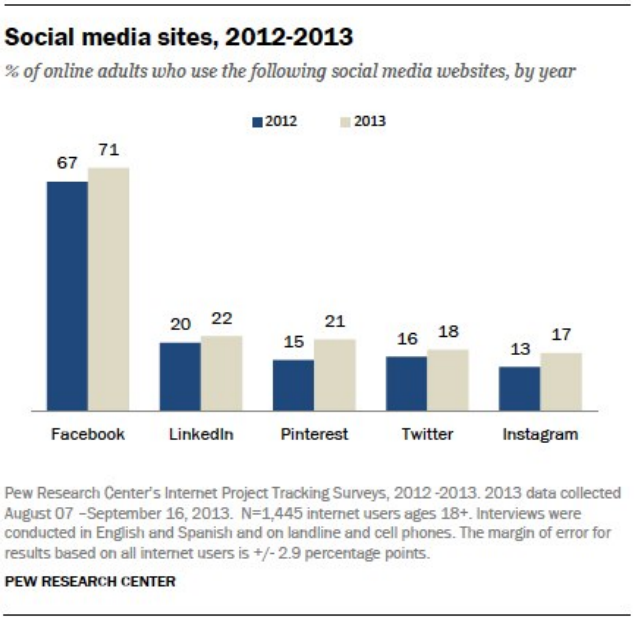
In order to determine the type of experiments that would be most effective with children, the team formed a panel of middle school teachers and professors of the local community in order to obtain information about children's learning process and how to encourage them to learn new sciences. Some of the comments acknowledged that most of the children are not interested in studying because it requires no physical activity. Having to sit down for eight hours during school and doing it again once back at home to do homework is what many of the kids dislike. Another comment suggested that good equipment and good ways of using them could enhance the learning experience. By using their minds as well as their hands children utilize more bodily resources to accomplish tasks. This helps children in the retention of new information. We concluded that children would learn faster if the experiments required some physical activity, would encourage them to seek knowledge and were well presented so that the material is easy to

understand. The experiments have to be both interesting and exciting to keep the children motivated and moving (Fitzgerald).

SOCIAL MEDIA BACKGROUND

We decided it was a good idea to implement effective ways to make people aware of our project. In today's world, there are tested methods that have been proven effective for communicating a message and spreading an idea quickly. However, there are also some that have not been explored to their fullest potential. We researched effective marketing techniques and media outlets to ensure we presented our message in a manner that would be best received by our audience. We realize that we will not always be addressing the same type of people, so naturally we will have different presentations tailored for different audiences. We have broken it down into Investors and Volunteers, WPI Administration, WPI Students, Worcester Teachers, and Worcester Students and their families. Although our general message is the same, each demographic is more likely to respond to different stimuli and will need a different message.

In today's world social media plays a critical role in keeping in touch with fellow classmates, relatives, and friends. Social media provides an outlet in which voices can be heard, individuals, organizations, and companies have the power to voice their opinions to anyone in the world who are willing to listen. Studies show that 42 percent of online adults use multiple social media sites. In 2013, 71% of online adults reported using Facebook and its popularity is only growing. The figure below represents the increase in social media use from 2012-2013. (Duggan and Smith)



Organizations and individuals are utilizing the strong popularity of these sites to get their "message" to the world. In the business world 93% of marketers use social media. This overwhelming statistic shows that it is a key tool for informing the world about your product or idea. Sites like KickStarter.com and Quirky.com provide a place for new ideas, KickStarter.com has provided a place where ordinary users can contribute to another's idea, fundraiser, or company. In 2013 alone, KickStarter.com has helped over 3 billion ideas, cumulating to $480 million.

PSYCHOLOGICAL BACKGROUND

To establish a background in child development we did some research and spoke to a professional psychologist. The interview with the psychologist will be included with the report in the form of voice recorder, and will be stored in the Gordon Library at WPI. Further details about the interview are included in the Methodology section of this report. In addition to the interview, we also used several textbooks and articles to assist us in our project. "Gateways to Mind and Behavior" by Coon and Mitterer, a Psychology textbook contained sections on child development and this provided us with a good place to start our research. Some of these were: Perceptual and Cognitive Development, Attachment and Affectional Needs, Ethnic Differences: The Four Flavors of Parenting, Piaget's Theory of Cognitive Development, and Vygotsky's Sociocultural Theory. These sections all reinforced what we learned in the interview and provided us with additional information to set a strong foundation for the merits of this project. From there we researched these individual topics and found more sources on them to ensure we were correct. We also found studies about the psychology of education and ways to teach young children. We have used this information to prove that we have found the best age bracket to teach, and to find effective ways to engage their interests.

From our research, we have found that the human mind never stops learning. We found that anytime in a person's life is a great time to learn, but the best time to learn something completely new is when you are young. The research found that young minds are the most inquisitive, and are most eager to learn. This allowed us to focus more on an individual's willingness to learn rather than their ability to learn. We also found various motivational techniques to encourage people to continue to learn, and to make learning a pleasant experience. We found that framing an environment to be positive will help yield a positive result with people. For example, if a child is learning in a happily decorated classroom, s/he is more willing to learn and more likely to enjoy it than a child educated in a drab blank room.

The knowledge of developmental psychology played an important part in helping us establish our curriculum. We researched: Motivation, Sensation and Reality, Habituation, Conditioning, Memory, Intelligence and many other topics ensure our curriculum was fun, educational, and effective. We also drew upon our individual educational backgrounds. We all

came from different locations and schools so we each brought a different perspective to the curriculum. This brought a synthesis of hands on and book learning that none of us actually experienced but wished we did.

SIMILAR PROGRAMS

While developing our Community Science Center, we drew inspiration from many different pre-existing companies. The Ecotarium in Worcester, the Taylor Community Science Center in St. Louis, and the Boys and Girls Club of America were the three establishments after which we chose to model our program. Below, is a description of these three companies, and which of their concepts we are choosing to adopt. There are many other establishments that exist that do a good job of teaching children to love science, but these three each had a key component that we found to be unique and applicable.

ECOTARIUM

The EcoTarium in Worcester has been an active part of the city's community since it was founded in 1825. It began as a society dedicated to fostering a love of natural sciences and has evolved into the science center it is today. Today they have a beautiful facility on Harrington Way in Worcester where they have hands on exhibits and programs about nature geared primarily towards children. Their mission is "To contribute to a better world by inspiring a passion for science and nature through discovery". This is similar in concept to what we would like to accomplish with this science center. The Ecotarium provides a location and an opportunity for young people to discover nature. We would like to foster a more broad interest in science by providing a space for young people to explore their educational interests in a way that will hold their interest. The Ecotarium offers many different programs to get children interested in nature. They are an interactive facility that teaches children about natural science in a unique and fun way that we would like to emulate. Their programs range from school field trips to summer camps and cover topics from dinosaurs to chemistry. They fund these programs by charging a modest admission fee for access to the facility. This is a key difference between the Ecotarium and our proposed facility. We would like to offer our programs to the community free of charge. For this reason, we are primarily using the Ecotarium as a model for developing a facility that is both educational and fun.

TAYLOR COMMUNITY SCIENCE RESOURCE CENTER

The Taylor Center is a very unique case, it is located in St. Louis, Missouri and is an excellent example of an operational community science center. It is a dynamic place that accommodates individuals of all ages, backgrounds, and educations. It began with fifteen students as the YES program, "Youth Exploring Science" in 1997 and evolved into the thriving. Their success is due primarily to the fact that their message is sound. They were established to

get young people interested in science and follow them with academic help through their primary and high school educations. This message attracted the attention of some local investors who donated 2.5 million dollars to help the program. Lack of that kind of funding makes a program like this difficult to replicate. Today, the Taylor Center is one of the largest museums in the country featuring over 750 exhibits and the YES program now works with 250 students. The exclusivity of the YES program caused us to take an interesting turn in our developmental model. They offer community outreach programs to encourage involvement, and if people are interested, they are encouraged to apply. This ensures that the students enrolled in the program want to be there, and are willing to get involved in the YES community. For this reason, we would like to institute an application process for our proposed community science center. The YES program offers a great model of what our community science center could. It is a facility that engages young people in the fields of math and science in a way that makes it fun and interesting for them.

BOYS AND GIRLS CLUB

The Boys and Girls Club is another existing center after which we would like to model ourselves. They began in 1860 with the idea to provide a positive and affordable alternative for boys who wandered the streets after school. Parts of our message is similar, we want to provide an alternative environment where children can go after school to learn about science. Most schools do not have after school programs for students interested in science. There are a lot of outlets for students interested in athletics or music, but there not many for those interested in science and academic exploration. Science clubs and math teams are usually dwarfed by larger after school activities like sports and band. The Boys and Girls Club sets the standard for a safe and fun after school environment that we strive to achieve. They are also a national company with new centers being established in cities all over the country. This is possible because they provide excellent support and a complete guide for starting a new center in your community. They are also a large influence in their individual communities. In addition to their after school programs, they also do community service programs and work with local schools that do not have athletic facilities for a physical education curriculum. We want to do a similar thing but with scientific equipment. We want to establish a place for schools that do not have scientific equipment to go during the day and perform lab experiments. The Boys and Girls Club offers programs both during school and after school that gave us a frame work for our proposed facility. They also stay with their members and offer them continued support when determining their future. They provide a safe place to learn and grow, and offer ongoing relationships with caring professionals. The Boys and Girls Club is a well-established national company that gives us a model of what our program could look like if it were to be implemented on a national scale. It also give us valuable insight in the day to day operations and logistics of an after school program. We used their model for the initial concept and we are using some of their criteria to assess a need for our program in our own community.

CHAPTER 3: METHODOLOGY

The following sections detail our process for developing the framework for the community science center. It will detail how we found an age bracket to begin working with at the Community Science Center, how we chose to reach out to the public, and how we decided on some experiments for the children.

ESTABLISHING OUR AUDIENCE

We started the project by deciding at what age group would a child the most positive impact from a Community Science Center. To do this we chose to implement two methods, conducting our own research and consulting professional opinions before we ultimately decided on an age group.

This project made use of a survey as a method of collecting first hand data. The survey is included in Appendix (A). The questions were designed to get the targets to think about and reflect upon their educational experiences especially in the fields of science and technology. Our research helped lead us to these questions, and the survey format. We included basic distribution questions like age and gender to ensure we collected data from a wide variety of sources, and so we have a general idea of where our information is coming from. In this section, we also asked if they attended college, and if so which one. These questions were designed to tell us about the people taking the survey; who they are and their education level. Next we asked the audience about their interest in the subjects of science and technology. These questions were about both their interest and experience in the fields. We asked: when their interest in the subjects began, what their favorite class was, if they took advanced math and science in high school, and to rate their actual math and science programs throughout their primary and secondary education. These questions helped us gauge the public's interest in science and technology. It also helped us establish a correlation between young interest in science and technology and high quality math and science programs. This helped us determine that a young audience would benefit the most from the Community Science Center. The final portion of the survey is designed to get people open to the idea of a Community science center. We asked what they did for extracurricular activities prior to college, and then asked if they would have liked to have access to a program that would supplement their learning in science and technology. These questions allowed us to determine if this would be a good use of resources. Overall, this survey helped us establish a target age group for the community science center, and also helped us correlate exposure to additional or superior math and science education to further academic success. It caused us to think critically about our results, and analyze our results. We found that while many people did not start to learn about science until middle school they still maintained an interest in the subject. However, we found that the younger a person started to become interested in science, the more they enjoyed the subject today.

INTERVIEW WITH PSYCHOLOGIST:

After conducting our survey, we expanded on our research by interviewing a developmental psychologist to learn what he thought of our research. We interviewed Dr. Warren Fitzgerald of Concord New Hampshire to get a better understanding of how children learn and techniques to motivate them to succeed and love learning. Dr. Fitzgerald is a seasoned psychologist with over 30 years of professional experience, and has seen many cases while practicing across country throughout his career. The full list of interview questions can be found in Appendix B. our first set of questions in the interview pertained to human development and education. We wanted to know at what age the human brain absorbed the most information and what age did events have the greatest impact on a person's development. This helped us determine what age group would see the greatest benefit from our science center. He informed us that children from grades two to six have the greatest capacity to learn new things. Children of this age are also very strongly impacted by their environment. A positive learning environment goes a long way towards fostering a love of learning in a child. Our next line of questions focused on teaching in general, and specifically teaching people in this age group. We wanted to know how to get a child's attention, keep their attention, make them learn without realizing it, and if boys and girls learn differently. Dr. Fitzgerald gave us several motivational techniques for children and young adults. Some of these were rewards, building up to larger more complicated experiments, and treating the children like equals not as your pupil.

We found that children actually absorb the most information when they are young, but they also need positive reinforcement as they age. He also noted that math and science tend to be additive so if you do not have a solid foundation from the very beginning, it is less likely that there will not be an interest later in life. To truly foster a love for math and science Dr. Fitzgerald says you must get the children involved and interested in it at a young age. To emphasize this, he compared our program to sports and the Head Start Program. Children who start playing sports at a young age are more likely to enjoy playing that sport as they grow up. He talked about reducing the stress that young people had too. Normally one does not think of children as being stressed, but he observes that children that struggle at home have similar stress levels to adults with high profile jobs. He also pointed out that children from low-income neighborhoods are more likely to not get enough nutrition. Lack of nutrition has been proven to have adverse effects on a student's academic performance. It is important to mitigate these stresses and put the students in a relaxed environment conducive to learning. Dr. Fitzgerald also talked about how children like to learn from people who treat them with respect. He says and we agree children are not stupid, they know when they are being talked down to and when someone is taking a genuine interest. They are capable of reason and thought and when they discover something new because of you; that is such a rewarding experience. To engage the student's interest, it is crucial that you first take the time to find out where the students interests actually lie. Then you must tailor your teaching to their interests while integrating the applicable knowledge when necessary and appropriate. Dr. Fitzgerald brings a unique view to the table,

because his wife is also a middle school teacher. He told us about the impact of rewarding the children for good behavior. Something as simple as tossing out a piece of candy or a pack of crackers for a correct answer left a lasting imprint on her students and they would come back and visit all the way through high school. Dr. Fitzgerald was very impressed with our model and believes that it will create a positive impact on the children.

ESTABLISHING A CURRICULUM

A very important part of this project is developing a portfolio of experiments designed to engage the student's interests. These experiments will range from basic to extremely advanced. Establishing our curriculum involves individual research and conversing with academic professionals. This helped us find a curriculum that would be both fun and educationally effective for the children.

TEACHERS

We also thought it would be valuable to get a teacher's perspective when we were establishing our target audience. A group member is in contact with a teacher in North Andover, and in addition to agreeing to an interview she also agreed to ask her colleagues for some of their effective teaching tips. It is important to gather information from many teachers with that work with many different age groups. Therefore, we decided to also get the opinion of a few other teachers from around New England to get a different perspective. We also met with a panel of teachers who were taking graduate classes in education at WPI. Most of our questions were tailored to establishing a curriculum and engaging the children's interests. We established a broad age group with our surveys and narrowed it down with the psychologist's analysis. We asked specifically what students learned in Massachusetts from second to sixth grade for a math and science curriculum. We also wanted to know which chapters were particularly interesting and engaging to the children. In knowing what subjects the students found most interesting, it is also helpful to know the chapters that hold the student's attention least. After learning where the children's interests lie, we wanted to know the most important parts of the curriculum and highlight the cross section. We asked for some effective lessons from each teacher and some lessons they wished they could do if they had access to better resources.

MEDIA OUTREACH

In order for this project to succeed, we must spread the word about our program and engage the public's interest. To do this we have established several forms of social media and a community outreach program. We launched a website, established a Facebook group and put together experiments on Instructables for children to do at home. In addition to an online campaign, we are also developing a more traditional marketing scheme with mail outs and flyers.

We are also trying to put together a program where a science bus would go to schools and do hands on experiments with the children to foster their love of science and promote our programs.

WEBSITE

After we established our audience and defined our curriculum, we decided that the most effective way to give people access to our concept was to launch a website. The website's home page has links to our "About Us" page, our "Programs" page, an "Investment Page", a page to find "Science Near You", and a page to "Contact Us" in the top banner. The center of the home page provides a short blurb, and a link to a page detailing how to establish a community science center in an area near you. This is our basic outline of how we would set up a website. It is the first wave of information for the consumer, so we decided to make it simple and informative.

FACEBOOK

Once we launched our website, we wanted to drum up interest on the WPI campus. With the recent success of various WPI related Facebook groups, we thought that this would be a good place to start to deliver our message to the community. This is especially effective, because in addition to being on a public domain, we can also link ourselves to WPI and other pages that offer similar programs thus expanding our audience. Making a Facebook group is very easy, and adding people is as easy as sending out a mass invite to your friends list. This allows for our message to reach not just the WPI campus, but all over the world. Facebook and other social media outlets offer unlimited potential for exposure and will open many doors for us.

The target for our initial Facebook group will be WPI students. It is important to encourage support for our idea within the community in order for it to succeed. We plan to rely heavily on WPI student volunteers to staff the Community Science Center, so we must first make them aware of this program. This idea, if put into action would cause some real good in the community and if people see this they will support it. Social media is key for us to spread our message quickly and efficiently.

INSTRUCTABLES

We and the professionals agreed that it is important to foster a love of science at school and at home. We decided that an effective way to do this was to design and post several easy experiments that children can do at home with their parents on a website called Instructables. This website is designed to give step by step directions to perform a task or do an experiment. We believe that this is an ideal outlet, because most children have access to a computer, and if they do not, they can print the instructions at their local library. This way, we are accessible to all children, and have a convenient list of experiments from which they can choose. This will help bring the love of math and science home for the children.

SCIENCE BUS

An interesting concept our group came across in our research was the concept of a science bus. This is an old school bus that is retrofitted to house a small group of kids for short lessons. It is a mobile classroom in concept, but it will also serve as a way to spread our message. The bus could travel to parks and places where children gathered and offer free experiments and science lessons to children. This is an idea for the future when the Community Science center is well established but we agreed that this was worth including as part of our future marketing campaign.

CHAPTER 4: ANALYSIS & RECOMMENDATIONS

STAFF AND FUNDING

To make this vision a reality will not be inexpensive, and the money needs to come from somewhere. This section will detail our plan to staff and fund the Community Science Center. We have explored many different grant options, federal, state, and private funding. We have discussed volunteers and mentor programs that would get the community involved and not cost a lot of money.

The first place we decided to look for funding were private companies. We realized the future value a Center like this would have for local companies. If they were willing to put forth an extra effort and invest time or money in the Center, it would pay back massive dividends in the future if it leads to the hire of just one quality employee. These companies can contribute in many ways including, financial contributions, highly trained individuals volunteering their time, or useful resources that they consider outdated for their cutting edge industry. Many companies might not directly invest money or donate their resources, but this message might strike a chord in the heart of a few employees that would like to donate their time.

We also looked closer at the city and its schools, and we concluded that it would make more sense economically for the city to invest in one facility rather than renovating all of them. This Science Center would be a place where children from all schools have access to top quality science equipment and instructors regardless of their background. It will also cost significantly less to make one exceptional facility rather than fifty mediocre ones. One small initial investment of property or money would have a lasting effect on the community. These are reasons that we believe would convince members of the city council to allocate funding for such a facility.

RECOMMENDATIONS:

We concluded the project by confirming our original hypothesis and providing the framework for future IQP groups to continue it. We decided that a future group would need to do more research on ways to fund the facility. This would mean actually applying for grants and presenting the idea to potential investors and companies. It would also include researching places that could house the facility and determining which of these locations would best fit the needs of the facility. After establishing an actual place of learning, the most important part of continuing this project will be to bring in the students. This would mean presenting the concept to various elementary school classes and trying to convince the administration of the value of the facility. This would go a long way in getting the facility to be fully operational and ready to function. Our team provided the feasibility assessment, set up the initial framework, and fleshed out some of the details but it is up to a future team to make this facility a reality.

Upon completing this assessment our group has several recommendations to make this project a reality. First, we hope future groups will review our work and begin where we left off. We have provided some materials like PowerPoint presentations and social network templates for future groups to use and edit as they see fit. As a group, we have come up with a few places where we think we would likely receive funding. They include the City of Worcester and Worcester County, the Commonwealth of Massachusetts, and possible federal funding for educational facilities. We also looked into private grants, but there is more to be found on this topic by a later group. The project should be pitched to these institutions as an investment in Worcester's schools and as an economic way to promote learning in underprivileged communities. We also advocate reaching out to technology companies in the local area. Seimens and iRobot are good places to start as they already have a working relationship with WPI. These companies probably have a community outreach committee that would support educating young people and would like to donate what they can. Success in these "sales pitches" is not limited to money. Any advice, equipment, property or volunteers would be welcome. There is a lot left to be done to make a project like this become a reality, but our group has determined that there is a need for such a facility, and have found a way to start it. Now, it is up to another group to finish what we have started. We put a lot of work into this project and there is a lot left to be done, but when it is complete, it will be a true source of goodness in the community.

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APPENDIX A

INTERVIEW QUESTIONS

Psychologist: Dr. Warren D. FitzGerald of Concord, NH

What age does the human brain absorb the most information?
What age are children most impressionable?
What age will supplemental education in science have the greatest impact?
What is the most effective way to teach children of this age group? (will be an actual number)
What are some effective techniques to gain the interest of a child?
How can we provide the proper incentive to engage a child's interest in a given subject matter?
Is there a difference in how boys and girls learn? If so what are some specific techniques to get their attention?
What is are some good techniques to help form friendship and community among the young children?

Teacher: Christine Cyr-Lawrence North Andover, MA
What is the science curriculum in Mass for grades 2-6?
What are the most effective science lessons?
Least effective?
What science lessons do students enjoy most?
Least?
What are effective ways to get children's attention and keep it?
How do children of this age learn? (hands-on visual audio)
Do boys and girls learn differently and if so how?
What are effective ways to mitigate this difference?

APPENDIX B

SURVEY: COMMUNITY SCIENCE CENTER

Our IQP team is investigating the feasibility of developing a community science center for the city of Worcester. We are trying to establish the age where the science center can do the most good. Please take a moment of your time and thoughtfully complete this survey so we can get the most accurate result.

Age: _____
Gender: Male Female
Do you attend college? If so, Which College do you attend?
Yes No WPI Other: _____
Academic Status:
Not Applicable Freshman Sophomore Junior Senior Graduate
What age did your interest in science start? _____
What was your favorite Science class?
Did you take advanced math and science in High school? If yes please list course title(s):
_____, _____, _____

At what age/When would you have preferred to start studying sciences: _____.
At what age/When would you have preferred to start studying sciences? _____.
Where you part of any extracurricular science programs/activities prior to college, Please list below

_____.

In order to provide an efficient place for community members to learn about science, we would like to determine the age target of the community science center. Please rate the following on a scale of 1-5 for each period as it applied to your life.

	Not at all				Extremely
Your interest in Science & Technology					
Elementary School (1^{st} – 4^{th})	1	2	3	4	5
Middle School (5^{th} – 8^{th})	1	2	3	4	5
High school (9^{th} – 12^{th})	1	2	3	4	5

School's emphasis on science and technology

Elementary School (1^{st} – 4^{th})	1	2	3	4	5
Middle School (5^{th} – 8^{th})	1	2	3	4	5
High school (9^{th} – 12^{th})	1	2	3	4	5

What level do you wish your school had put emphasis on the sciences?

Elementary School (1^{st} – 4^{th})	1	2	3	4	5
Middle School (5^{th} – 8^{th})	1	2	3	4	5
High school (9^{th} – 12^{th})	1	2	3	4	5

Gauge your interest in a community science center for the following years:

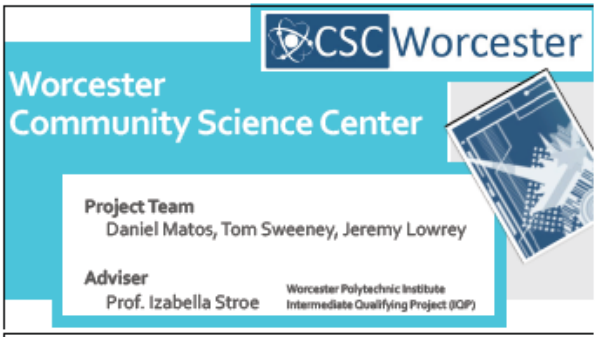
Elementary School (1^{st} – 4^{th})	1	2	3	4	5
Middle School (5^{th} – 8^{th})	1	2	3	4	5
High school (9^{th} – 12^{th})	1	2	3	4	5

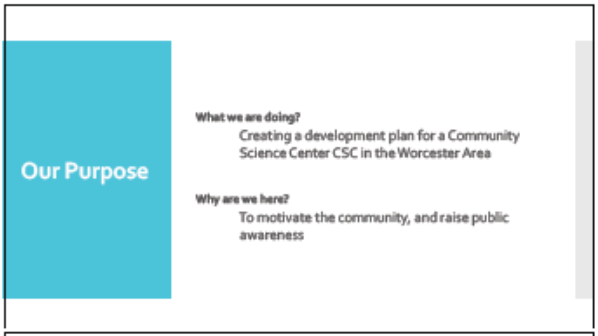
How interested would you be in volunteering in a community science center in the city of Worcester?

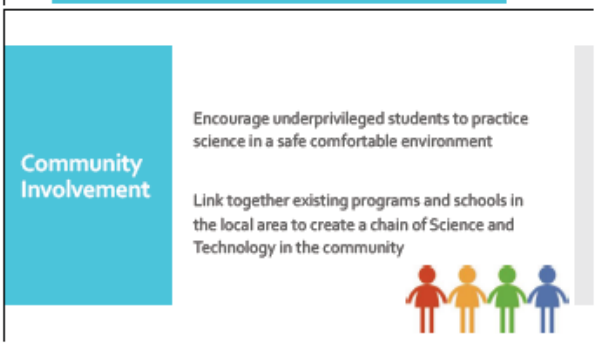
1 2 3 4 5

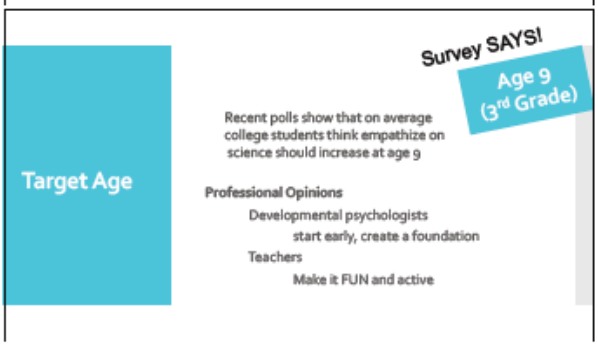
APPENDIX C

CUSTOMER PRESENTATION









What makes us Different

Strengthening the Community

Consortium of Programs

Non-Profit

Unique Facility & Resources

Mentor Programs

Choose what you want to Learn!

Projects & Experiments

An Opportunity to be Creative!

Real Practical Applications Demos

Summary

Practical , FUN Science

Develop transferable knowledge and skills in the community

Encourage the underprivileged

Create a safe, comfortable place for children to spend their free time

Not competing with museum's or current programs, we want to be the link that binds them together

CSC Worcester

Learn More

Contact Email:

worcestercsc@wpi.edu

Visit our website at:

sites.google.com/site/worcestercsc/

LIKE US ON facebook

APPENDIX D

WEBSITE

APPENDIX E

FACEBOOK PAGE

APPENDIX F

"TOWERS" ARTICLE

Giving Back to the Community

Since the Bartlett Center was built in 2005, WPI has been in a constant state of construction and expansion. The campus has been growing in size and is becoming a bigger presence in the City of Worcester. WPI has been very fortunate over these past few years and as the saying goes, "to whom much is given much is expected". With this new growth, WPI needs to increase our sense of community and responsibility. We already have a lot of community outreach programs that are doing a good job but as a leader in the science and technology community, we should be doing more to foster a love of science in the city that has been our home for almost 150 years.

There are a lot of elementary schools throughout the City of Worcester, and as most of you are aware, some parts of the city are better than others. The same goes for the schools in these areas. Many students do not receive adequate education in math and science because these schools cannot afford the necessary resources or equipment. We have experienced an abundance of good fortune over these past seven years as is made clear by the recent expansion. Let's use some of these resources to give back to the community.

For our IQP, my team members and I are analyzing the feasibility of developing a community science center for schools in the City of Worcester. The center would function during the day as an extension of the classroom where a class would come in each day and do fun hands on experiments that they cannot currently do in their school due to lack of resources. After school hours, it would also function as an after school program where students who show a particular interest in science can come can do their homework, and have access to the equipment. We are putting together a proposal that will address the operations costs, lesson plans, and a list of potential schools that would benefit from the center. We are coordinating these details and all we need is funding to make the proposal a reality. However, there is something we would need from the WPI community - VOLUNTEERS!

This is the most integral part to the success of this project. We are the future of the scientific community, and this is the opportunity to share our wealth of knowledge and spark an interest in someone who might not recognize it otherwise. I was young when I first became interested in science and technology, and I had people encouraging me to pursue my interest. I would not be where I am today without these mentors, and this is your opportunity to give someone that chance. We need to recognize how fortunate we are to have the education we do, and share it with the community.
To whom much is given much is expected. For the WPI community to get more involved in the City of Worcester, it must first start at an individual level. Everyone should take some time to think about a way they can give back to their community when they experience success and good fortune. It is not just good morals, it is our duty. When a community shares in success, everyone benefits, but someone has to ignite the spark to start it. This project can be as successful as the community makes it, and we are relying on your support to do some good for the city we have called home for four years.

APPENDIX G

SELECTED EXPERIMENTS

MAKE GLOWING WATER

Make glowing water with the help of a black light in this fun science experiment for kids. Tonic water doesn't look very strange under normal light but what happens when you look at it under a black light? Does the dye from a highlighter pen do the same thing? Find out what happens and why it happens with this cool experiment that you can do at home.

What you'll need:

1. A black light (you can find them at places like Walmart and hardware stores, as well as online stores like Amazon).
2. Tonic water or a highlighter pen.

3. A dark room to do the experiment.

Instructions:

If you are using a highlighter pen carefully break it open, remove the felt and soak it in a small amount of water for a few minutes.

Find a dark room.

Turn on the black light near your water, how does it look? What's happening?

Simple explanation:

The ultra violet (UV) light coming from your black light lamp excites things called phosphors. Tonic water and the dye from highlighter pens contain phosphors that turn UV light (light we can't see) into visible light (light we can see). That's why your water glows in the dark when you shine a black light on it. Black lights are used in forensic science, artistic performances, photography, authentication of banknotes and antiques, and in many other areas.

Detailed explanation:

Black light (also known as UV or ultra violet light) is a part of the electromagnetic spectrum. The electromagnetic spectrum also includes infrared, X-rays, visible light (what the human eye can see) and other types of electromagnetic radiation. A black light lamp such as the one you used emits a UV light that can illuminate objects and materials that contain phosphors. Phosphors are special substances that emit light (luminescence) when excited by radiation. Your water glowed under the black light because it contained phosphors. If you used a highlighter pen then the UV light reacted with phosphors in the dye. If you used tonic water then the UV light reacted with phosphors in a chemical used in tonic water called quinine.

There are different types of luminescence, they include fluorescence (used in this experiment, it glows only when the black light is on), phosphorescence (similar to fluorescence but with a glow that can last even after the black light is turned off), chemiluminescence (used to create glow sticks), bioluminescence (from living organisms) and many others.

MAKE AN EASY LAVA LAMP

Learn how to make an easy lava lamp with this fun science experiment for kids. Use simple household items such as vegetable oil, food coloring, Alka-Seltzer and a bottle to create chemical reactions and funky balls of color that move around like a real lava lamp.

What you'll need:

1. Water
2. A clear plastic bottle
3. Vegetable oil
4. Food coloring
5. Alka-Seltzer (or other tablets that fizz)

Instructions:

Pour water into the plastic bottle until it is around one quarter full (you might want to use a funnel when filling the bottle so you don't spill anything).
Pour in vegetable oil until the bottle is nearly full.
Wait until the oil and water have separated.
Add around a dozen drops of food coloring to the bottle (choose any color you like).
Watch as the food coloring falls through the oil and mixes with the water.
Cut an Alka-Seltzer tablet into smaller pieces (around 5 or 6) and drop one of them into the bottle, things should start getting a little crazy, just like a real lava lamp! When the bubbling stops, add another piece of Alka-Seltzer and enjoy the show! What's happening?
If you've tried our oil and water experiment you'll know that the two don't mix very well. The oil and water you added to the bottle separate from each other, with oil on top because it has a lower density than water. The food coloring falls through the oil and mixes with the water at the bottom. The piece of Alka-Seltzer tablet you drop in after releases small bubbles of carbon dioxide gas that rise to the top and take some of the colored water along for the ride. The gas escapes when it reaches the top and the colored water falls back down. The reason Alka-Seltzer fizzes in such a way is because it contains citric acid and baking soda (sodium bicarbonate), the two react with water to form sodium citrate and carbon dioxide gas (those are the bubbles that carry the colored water to the top of the bottle).
Adding more Alka-Seltzer to the bottle keeps the reaction going so you can enjoy your funky lava lamp for longer. If you want to show someone later you can simply screw on a bottle cap and add more Alka-Seltzer when you need to. When you've finished all your Alka-Seltzer, you can take the experiment a step further by tightly screwing on a bottle cap and tipping the bottle back and forth, what happens then?

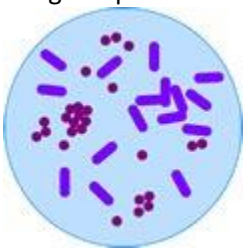
MICROSCOPIC CREATURES IN WATER

Water can be home to a lot of interesting creatures and microorganisms, especially if it's dirty water found in ponds or near plants. Take some samples, view them under a microscope and see what you can

find. How clean is the water from your tap compared to the water found in a pond? Experiment and see what kind of microscopic creatures you can find!

What you'll need:

1. A concave slide
2. A dropper
3. A microscope
4. Different samples of water (tap water, pond water, muddy water etc). Near plants or in the mud are good places to take samples as they usually contain more microorganisms.



Instructions:
Set up you microscope, preferably using its highest setting.
Use the dropper to take some water from one of your samples and put it on the concave slide. Focus the microscope, what can you see? Be patient if you can't see anything. If you still can't see anything and have checked that you are in focus, try a different water sample.
Look at how the creatures move. After observing their movements you might like to record their behaviors and draw them.

Organisms You Might See:

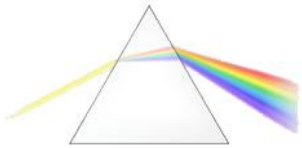
Euglenas - These are between a plant and an animal, they have a long tail called a flagellum which allows them to move.
Protozoa - They have a flagella (tail) which can be hard to see, the difference between protozoa and algae is often hard to define.
Amoebas - These microorganisms swim by wobbling. They also surround their food like a blob in order to eat it.
Algae - Not considered to be plants by most scientists, these organisms might be colored yellowish, greenish or reddish. They may also be found by themselves or in chains.
There might even my larger creatures such as worms or brine shrimp in your water samples, depending on where you took them.

MAKE YOUR OWN RAINBOW

Learn how to make a rainbow with this fun science experiment for kids. Using just a few simple everyday items you can find out how rainbows work while enjoying an interactive, hands on activity that's perfect for kids.

What you'll need:

1. A glass of water (about three quarters full)
2. White paper
3. A sunny day



Instructions:
Take the glass of water and paper to a part of the room with sunlight (near a window is good).
Hold the glass of water (being careful not to spill it) above the paper and watch as sunlight passes through the glass of water, refracts (bends) and forms a rainbow of colors on your sheet of paper.
Try holding the glass of water at different heights and angles to see if it has a different effect. What's happening?

Explanation:
While you normally see a rainbow as an arc of color in the sky, they can also form in other situations. You may have seen a rainbow in a water fountain or in the mist of a waterfall and you can even make your own such as you did in this experiment.
Rainbows form in the sky when sunlight refracts (bends) as it passes through raindrops, it acts in the same way when it passes through your glass of water. The sunlight refracts, separating it into the colors red, orange, yellow, green, blue, indigo and violet.