

gender chip^{the} project



Curriculum

a project of **Media Working Group**

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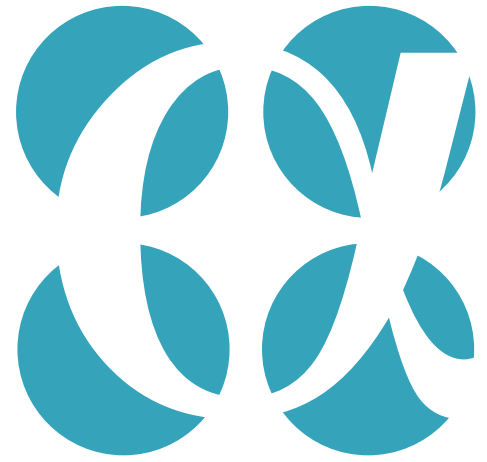
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Note: Throughout this document, we use the acronym **STEM** to refer to “science, technology, engineering and math.”

The Gender Chip Project is a unique partnership of women in science, educators, science organizations and media producers. The multimedia project is designed to provide role models and encouragement for girls and young adults who wish to enter science, technology engineering and mathematics (STEM) careers; and to raise public awareness about the continuing need to develop education and career opportunities for young women who dream of taking one of these life paths. These resources will help girls and young women identify and articulate possible gender-based obstacles they might meet on the way and it will provide the tools for navigating them. There are very few films and other media that address the topic of girls and STEM as well as the unique problems encountered on academic paths to these careers.

introduction

This curriculum has been designed to meet the needs of many different viewers – from school groups, to non-profits to college students. The common goal amongst these groups is the encouragement of young women in pursuit of their vision and dreams. Our hope is that we are offering a curriculum that respects the diversity and experience of all the participants and learners and one that may be engaged with on many levels.



Rather than take the standard approach of providing a series of lessons based on ages and types of groups. We have instead found ourselves revisiting the questions the movie raises for our own lives, work and thinking. As a result of these shared experiences, we found ourselves enmeshed in discussions that could have been entered into by a fifth grader wondering what classes to take in middle school or a high school student struggling with checking the appropriate “major” box on college applications, or with young college women looking at career choices. We realized that these are conversations and experiences that we may have, and we may revisit them many times over the course of our lives. So rather than prescribe a one-time set of lessons we hope we have created a series of experiences, tools and resources that will allow for the conversations we need to have to help young women grow into their own vision of what might be.

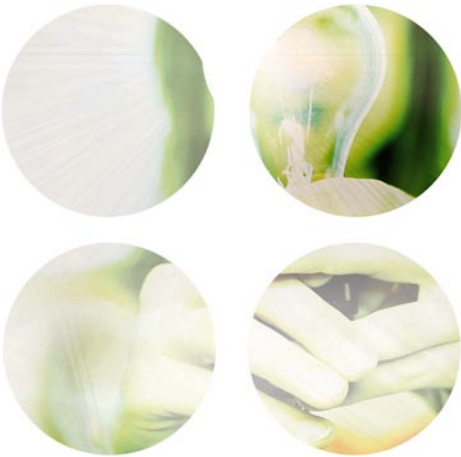
In order to do this, we have designed a program that includes individual lessons that can stand-alone or be combined to create units or dovetail with other units that meet certain educational goals. We begin with a series of objectives and a series of discussions surrounding the decisive moments in young women’s pursuit of science. Next, we have provided several learning experiences that may be used as they are written or function as the brainstorming for teachers as they create their own lessons. Realizing that many of us would like to mentor and support young women, but often don’t know where to begin, we have included a formative assessment tool. Finally, we have included a list of the references we use in our work to get you started or further your work with young women.

The Gender Chip curriculum was constructed within the framework of the National Science Education Standards issued by the National Research Council in 1996-“the comprehensive vision for the improvement of science teaching and learning” (NSTA, 2005) designed to connect the critical junctures of content, process, technology and capacity building, within the context of a “scientifically literate populace”. The curriculum promotes inquiry-based instruction, professional development, sound assessment practices and an in-depth understanding of subject matter, in addition to addressing knowledge gaps about female participation in the construction and implementation of the sciences.

Gender Chip Project Curriculum Goal

Encourage use of the documentary film, *The Gender Chip Project*, to increase the possibility, interest, and persistence of girls and young women in the study of science, technology, engineering and mathematics (STEM).

overall curriculum objectives



- Develop an understanding of the educational preparation necessary for entering STEM fields.
- Increase awareness of effective support measures for women pursuing a degree in the STEM fields.
- Develop personal and educational empowerment skills for young women.
- Create a forum for studying the contributions to STEM of women throughout history.
- Develop STEM career understanding and options from the vantage points of several young women followed in the film.
- Increase awareness of possible careers and career paths in the STEM professions.
- Expand career decision-making skills for young women and their mentors.
- Enhance formative assessment skills so that young women and their mentors may continually identify learning strengths and hurdles.
- Promote increased knowledge of effective support measures for young women pursuing STEM careers.
- Develop sensitivities for students of both genders to career options decision-making for girls and women

curriculum levels

5th Grade Classrooms:

Role Models & Talking About Careers

9th Grade Classrooms:

Career Decision Points

Non Profit Organizations for Girls Empowerment:

Role Models & Talking About Careers

After School Programs:

Role Models & Talking About Careers

Secondary School Counselors & Advisors:

Talking About Careers

General Activities:

Role Models & Talking About Careers

5th Grade Classrooms:

Role Models &
Talking About Careers

Much of the research indicates that the 5th grade comes at a critical time in the social development of girls, including their emerging view of what is socially condoned and what is possible for them in their future. Because the classroom environment is so important, these curriculum suggestions were developed from the perspective of introducing and providing depth to several concepts: 1) women have been involved in developing science, technology and mathematics

since we have begun recording events in human history, 2) while social and cultural patterns historically have not included the lives and contributions of women in science, can be access points for adding to and further developing the knowledge base of girls and boys about women of science, 3) the film, The Gender Chip Project can be used as a catalyst for discussion about career development and further inquiry into the roles of science careers for all, and 4) investigating the specific kind of preparation necessary to have options of careers in science.

Suggested Activities

Timeline for Women in Science

Book of Career Choices

Career Map

Science in Everyday Life
Scavenger Hunt

Objectives for Curriculum Work with 5th Graders

- Create a forum for studying the contributions to STEM of women throughout history.
- Develop personal and educational empowerment skills for young women.
- Develop sensitivities for students of both genders to career options decision-making for girls and women
- Increase awareness of possible careers and career paths in the STEM professions.
- Develop STEM career understanding and options from the vantage points of several young women followed in the film.

9th Grade Classrooms: Career Decision Points

Like the 5th grade, much of the research indicates that the 9th grade is a pivotal point for pre-college preparation and career decision-making for girls. The classroom environment is still very important; these curriculum suggestions were developed from the perspective of providing depth to several concepts: 1) depth about decision-making in preparation for a career, 2) the availability of preparation for women (and all) in science, math and technology careers, 3) access points—especially for women of science, and 4) the film, *The Gender Chip Project*, should be used as a catalyst for discussion about career development and further inquiry into the roles of science careers for all.

Suggested Activities

Preparation for Career Choices

Women in Science in the Movies

Career Maps

A Collection of Local Science Mentors

Objectives for Curriculum Work with 9th Graders

- Develop personal and educational empowerment skills for young women.
- Develop sensitivities for students of both genders to career options decision-making for girls and women
- Increase awareness of possible careers and career paths in the STEM professions.
- Develop STEM career understanding and options from the vantage points of several young women followed in the film.
- Develop an understanding of the educational preparation necessary for entering STEM fields.
- Develop awareness of effective support measures for women pursuing a degree in the STEM fields.
- Expand career decision-making skills for young women and their mentors.
- Enhance formative assessment skills so that young women and their mentors may continually identify earning strengths and hurdles.
- Promote increased knowledge of effective support measures for young women pursuing STEM careers.

Non Profit Organizations for Girls Empowerment: Role Models & Talking About Careers

Non profit and gender specific organizations add to the social development of girls, including their emerging view of what is socially condoned and what is possible for them in their future. Because this environment is so important, these curriculum suggestions were developed from the perspective of introducing and providing depth to several concepts: 1) women have been involved in developing science, technology and mathematics since we have begun recording events in human history, 2) while social and cultural patterns historically have not included the lives and contributions of women in science, can be access points for adding to and further developing the knowledge base of girls and boys about women of science, 3) the film, The Gender Chip Project can be used as a catalyst for discussion about career development and further inquiry into the roles of science careers for all, and 4) investigating the specific kind of preparation necessary to have options of careers in science.

Suggested Activities

Preparation for Career Choices

Women in Science in the Movies

Career Maps

African American/ Native
American/ Latina, Arab
American/Asian American
Women of Science

Objectives for Curriculum Work: Non Profit Organizations

- Develop personal and educational empowerment skills for young women.
- Increase awareness of possible careers and career paths in the STEM professions.
- Develop STEM career understanding and options from the vantage points of several young women followed in the film.
- Create a forum for studying the contributions to STEM of women throughout history
- Develop awareness of effective support measures for women pursuing a degree in the STEM fields.
- Expand career decision-making skills for young women and their mentors.
- Promote increased knowledge of effective support measures for young women pursuing STEM careers.

After School Programs: Role Models & Talking About Careers

After school and similar programs have been found to be effective in aiding in school success and career decision-making; they can also be useful in developing another layer of information about the educational preparation for careers in science technology, engineering and mathematics at each level of their contact with children and young people.

Many after school programs are starved for materials and ideas. The emphasis here has been to have several ready-to-go ideas for staff/ mentors of after school projects. Where there is direct linkage with in-school programs, it may be helpful to collaboratively plan several of these approaches.

Suggested Activities

Preparation for Career Choices

Book of Career Choices

African American/ Native
American/ Latina, Arab
American/Asian American
Women of Science

Mayan Mathematics

Objectives for Curriculum Work: Non Profit Organizations

- Develop personal and educational empowerment skills for young women.
- Increase awareness of possible careers and career paths in the STEM professions.
- Develop STEM career understanding and options from the vantage points of several young women followed in the film.
- Expand career decision-making skills for young women and their mentors.
- Promote increased knowledge of effective support measures for young women pursuing STEM careers.

Secondary School Counselors & Advisors: Talking About Careers

School counselors and other advisors are critical in the shaping of career choices for most young people. It is significant that these professionals consciously play a role in: 1) helping students/young people develop a healthy concept of success as an adult, 2) bring concrete examples into this process (perhaps in terms of case studies of some successful adults), 3) underscore and promote the critical junctures places for decision-making and career choices, 4) help students attend to how they learn as a means of empowering their own decisions, and 5) serving as a resource through information and skill in linking students with information about career choices.

Objectives for Curriculum Work: School Counselors and Advisors

Suggested Activities

Preparation for Career Choices

Book of Career Choices

African American/ Native American/ Latina, Arab American/Asian American
Women of Science

Mayan Mathematics

Film & Use of Discussion Guide

- Develop an understanding of the educational preparation necessary for entering STEM fields.
- Increase awareness of effective support measures for women pursuing a degree in the STEM fields.
- Develop personal and educational empowerment skills for young women.
- Develop STEM career understanding and options from the vantage points of several young women followed in the film.
- Increase awareness of possible careers and career paths in the STEM professions.
- Expand career decision-making skills for young women and their mentors.
- Enhance formative assessment skills so that young women and their mentors may continually identify learning strengths and hurdles.
- Promote increased knowledge of effective support measures for young women pursuing STEM careers.

General Activities: Role Models & Talking About Careers



We have found that to a large extent, all children and adolescents have possible mentors throughout the community. In fact, research from the Search Institute of Minneapolis suggests that each resilience child/youth needs 2 or more adults outside of his parents to help provide an environment for life success. It is important for the education and support of young people to be conceptualized as a more than school or girl's clubs endeavor.

Young people are also in-tuned with what their local communities and families value and what seems possible. These activities maybe used in a variety of settings and by a diverse group of people toward the aims of: 1) explicating career choices, 2) opening up cross generational discussion about women in science technology engineering and math careers, 3) empowering the choices that lead to success in high school and college, and 4) the empowerment of ethnic/racial community members in their career choices.

Objectives for Curriculum Work: Non Profit Organizations

- Develop personal and educational empowerment skills for young women.
- Increase awareness of possible careers and career paths in the STEM professions.
- Develop STEM career understanding and options from the vantage points of several young women followed in the film.
- Expand career decision-making skills for young women and their mentors.
- Promote increased knowledge of effective support measures for young women pursuing STEM careers.
- Expand career decision-making skills for young women and their mentors.
- Enhance formative assessment skills so that young women and their mentors may continually identify learning strengths and hurdles.
- Develop sensitivities for students of both genders to career options decision-making for girls and women

activities & experiences

Timeline for Women in Science

Most Levels

Narrative

This is a 'safe' way to develop knowledge about women in science and to fill in gaps of history and textbooks. It involves students in direct-

ing their own scope of study and working together to assemble a project that all can contribute to.

Objectives

- Create a forum for studying the contributions to STEM of women throughout history.
- Develop personal and educational empowerment skills for young women.
- Develop sensitivities for students of both genders to career options decision-making for girls and women
- Increase awareness of possible careers and career paths in the STEM professions.
- Develop STEM career understanding and options from the vantage points of several young women followed in the film.

Materials Needed

- The Gender Chip Project (film)
- List of Women Scientists
- Paper, pencils, ruler or yardstick, for constructing timelines

Guided Experience

Students are asked to choose one of the persons from a list of women scientists and research their lives. They are each women noted in science, math, engineering or technology. Students are asked to construct a timeline for the person they have chosen. The timeline depicts important social and career events in their lives. They are then asked to present their timeline to a group/class. During the presentation they should answer these items:

- What did ____ do to prepare for her career when she was young?
- Describe how she was able to be successful in this career.
- What are some recent examples of discoveries or inventions made by others in the same field?

After the presentations the teacher will display the timelines of the students around the classroom. Class views the documentary: The Gender Chip Project. Post Viewing Questions might include:

- Which young woman seemed to have the hardest choices to make and why do you think so?
- How did the young women in the film react to different conditions over time?
- Choose one of the women/students. If you had been in her shoes would you have made the same choices: why/why not?

Book of Career Choices

Most Levels

Narrative

The focus here is directly on the choice and decision-making process for a career. It enables students to see what kinds of choices others have made and facilitates their own self-appraisal and reflection.

Objectives

- Develop personal and educational empowerment skills for young women.
- Develop sensitivities for students of both genders to career options decision-making for girls and women
- Increase awareness of possible careers and career paths in the STEM professions.
- Develop STEM career understanding and options from the vantage points of several young women followed in the film.

Materials Needed

- The Gender Chip Project (film)
- List of Women Scientists
- Paper, pencils, ruler or yardstick, for constructing timelines
- Internet access for list of colleges and university programs

Guided Experience

Develop a list of careers in science, technology and math (see resource list for possibilities). Each student is asked to take two from the list and research the career. Find out what a person does in this career and what kind of educational path they need to prepare them for this career. Students are asked to make a list of the colleges and or universities that students can attend to prepare for these careers. Show *The Gender Chip*. With the class, discuss the post viewing questions. Class will make a collection of the careers and assemble a book of the career choices



Career Maps

All Levels

Narrative

Provides an opportunity for in-depth discussion about career choices and what it takes to get from life as a student to a professional position.

Objectives

- Develop personal and educational empowerment skills for young women.
- Develop sensitivities for students of both genders to career options decision-making for girls and women
- Increase awareness of possible careers and career paths in the STEM professions.
- Develop STEM career understanding and options from the vantage points of several young women followed in the film.

Materials Needed

- The Gender Chip Project (film)
- List of Women Scientists
- Paper, pencils, ruler or yardstick, for constructing timelines
- Internet access for list of colleges and university programs
- List of high school requirements
- List of entrance requirements for local and national colleges & universities

Guided Experience

Variation on Career Choices exercise, where students make maps (visual representations of the pathway) to achieve success in science, math, technology careers. Useful discussion can be made about the choices of careers and the patterns and visual representations. Suggest that after viewing the film, The Gender Chip Project discussion questions probe for examination of the career paths of each of the young college women. These maps might also include the high school course sequence in mathematics for entry into college at a level of competing for application to science careers. Career maps are displayed on the classroom wall.

Preparation for Career Choices

All Levels

Narrative

Provides an opportunity for in-depth discussion about career choices and what it takes to get from life as a student to a professional position.

Objectives

- Develop personal and educational empowerment skills for young women.
- Develop sensitivities for students of both genders to career options decision-making for girls and women
- Increase awareness of possible careers and career paths in the STEM professions.
- Develop STEM career understanding and options from the vantage points of several young women followed in the film.

Materials Needed

- The Gender Chip Project (film)
- List of Women Scientists
- Paper, pencils, ruler or yardstick, for constructing timelines
- Internet access for list of colleges and university programs
- List of high school requirements
- List of entrance requirements for local and national colleges & universities

Guided Experience

After viewing the Gender Chip address these Questions:

- What did _____ do to prepare for her career?
- What were the important career decisions she had to make? What did she decide?
- Given the same situation what decisions would you have made? Why?
- How did she reflect her strength and independence through her choices?
- What have you observed that suggests that she will be able to be successful in a career usually dominated by men?

Research the career choice of one of the students or of a similar field. Develop a list of 5 schools that offer this kind of education (prepare students to enter this field). Choose one of the schools and discuss what each of the schools requires as math courses the applicant must have completed to be accepted into the school. Have students list out the math courses and sequences for their own school. Make a chart of the courses that students need to complete in order to be admitted to one of the schools they researched. Make a graph of where students in this class are along the math sequence.

Women in Science: A-Z

All Levels

Narrative

Provides an opportunity for in-depth discussion about career choices and what it takes to get from life as a student to a professional position. Also makes local contact which may help students identify better with career choices.

Objectives

- Develop personal and educational empowerment skills for young women.
- Develop sensitivities for students of both genders to career options decision-making for girls and women
- Increase awareness of possible careers and career paths in the STEM professions.
- Develop STEM career understanding and options from the vantage points of several young women followed in the film.

Materials Needed

- Access to the Internet and library for research
- The Gender Chip Project (film)
- Paper, pencils, ruler or yardstick, for constructing timelines
- Internet access for list of colleges and university programs
- Noted Female Scientists list
- Access to local university of science or technology firm/office

Guided Experience

Several web-based compilations and a few books have been made of lists of women in science. Some accounts go back to Ancient Greece, others are more contemporary. The objective is to have young women doing their own investigation and finding out, and reporting out, information on women in science. Through this exercise they develop a sense of female participation across time, particularly as it may have been omitted or minimized in formal study of history and other social studies. Mentors and teachers may make decisions about boundaries for the investigation, such as 'Ancient Societies and women of Science' that would

include only those women prior to 800 AD in Egypt, China, Greece, Rome, Indus River Valley, Mesopotamia, Mesoamerica, etc. Another strategy would be to pursue primary sources as far as possible in this investigation. Students would then find an opportunity to display and share their information in several possible venues such as 'A Walk Through History' or wall and art displays or a collection bound into a book.

Each student will use the Noted Female Scientist list or create a list from the Internet to prepare a 3-5 page biography of that person. Students will share the biographies and assemble a class book of biographies. Students will view the documentary: The Gender Chip, and discuss the post viewing questions. A local Woman in the Sciences (contact a local university/ engineering or technology firm) might be invited to speak to the class about her work. Ahead of time students will prepare a list of important questions about her educational preparation and her work for the visit. The visitor will be presented with a copy of the student's book on women in science. After the visit group discussion can reflect on points made by speaker that differ from, or add to student research.

19th or 20th Century Women in Science

All Levels

Narrative

This is another 'safe' way to develop knowledge about women in science and to fill in gaps of history and textbooks. It involves students in directing their own scope of study and working together to assemble a project that all can contribute to.

Objectives

- Create a forum for studying the contributions to STEM of women throughout history.
- Develop personal and educational empowerment skills for young women.
- Develop sensitivities for students of both genders to career options decision-making for girls and women
- Increase awareness of possible careers and career paths in the STEM professions.

Materials Needed

- Access to the Internet and library for research
- The Gender Chip Project (film)
- Noted Female Scientists list

Guided Experience

This is a variation on several previous activities where the limits of investigation are grounded in certain time frames. The value of this exercise is to gain a more specific sense of what was taking place within a time frame. It would also be suggested that this activity might include an international selection of possible women so that each student might pursue choices that they feel a connection with. (It might be interesting and helpful to ask students why they chose their subject.) Due to the advent of lithographs and

photography, it is highly possible to obtain images of these women scientists as part of making the connection with their choices and their lives—this would be strongly recommended. Again, students would then find an opportunity to display and share their information in several possible venues such as 'A Walk Through History' or wall and art displays or a collection bound into a book.

US Scientists in the 21st Century

All Levels

Narrative

This is another way to develop knowledge about women in science and to fill in gaps of history and textbooks. It involves students in directing their own scope of study and working together to assemble a project that all can contribute to.

Objectives

- Create a forum for studying the contributions to STEM of women throughout history.
- Develop personal and educational empowerment skills for young women.
- Develop sensitivities for students of both genders to career options decision-making for girls and women
- Increase awareness of possible careers and career paths in the STEM professions.

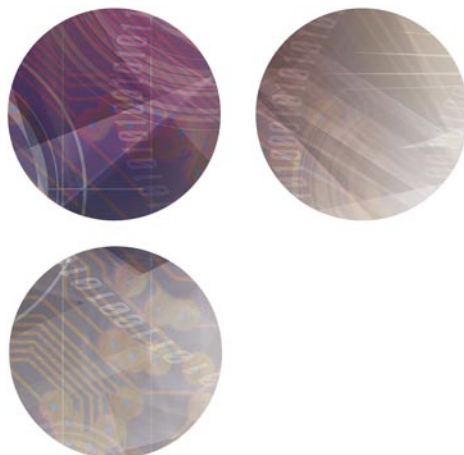
Materials Needed

- Access to the Internet and library for research
- The Gender Chip Project (film)
- Noted Female Scientists list

Guided Experience

This is also a variation on several previous activities where the limits of investigation are grounded in a contemporary time frame. The value of this exercise is to obtain a sense of what is going on now for women in science. The availability of images and information in news media make this particularly exciting and the recency helps demystify some of the connection between students and historical approaches. (It might be interesting and helpful to ask students why they chose their subject.)

Again, students would then find an opportunity to display and share their information in several possible venues such as 'A Walk Through History' or wall and art displays or a collection bound into a book. Students collect and write up information about scientists, and then display and share this information.



African-American Women in Science, Native American Women in Science, Asian-American women in Science, Latinas in Science, Arab and North African Scientists

Narrative

This is another way to develop knowledge about women in science and to fill in gaps of history and textbooks. It involves students in directing their own scope of study and working together to assemble a project that all can contribute to.

Objectives

- Create a forum for studying the contributions to STEM of women throughout history.
- Develop personal and educational empowerment skills for young women.
- Develop sensitivities for students of both genders to career options decision-making for girls and women
- Increase awareness of possible careers and career paths in the STEM professions.

Materials Needed

- Access to the Internet and library for research
- The Gender Chip Project (film)
- Noted Female Scientists list

This is a variation on several previous activities where the limits of investigation are grounded in certain social grouping frames. Clearly this maybe an investigation that surprises students due to the many omissions of science study and the study of history and social life that they may have experienced. It can be an informational aide in addressing some elements of racism and it offers to students the possibility of raising self esteem and racial and ethnic pride. It might be suggested that these activities could parallel each other so that one group might be

Guided Experience

Again, students would then find an opportunity to display and share their information in several possible venues such as 'A Walk Through History' or wall and art displays or a collection bound into a book.

Students collect and write up information about scientists, and then display and share this information.

working on African American women of science while another works on Latinas in science, etc. This offers real possibility of students of color making connections with possible role models so that each student might pursue choices that they feel a connection with. (It might be interesting and helpful to ask students why they chose their subject.) This is also an exercise where pairing boys and girls together presents some distinct possibilities for increased information about, if not understanding of, the needs for family and spousal support during the decision-making processes for emergent women in science. Due to the advent of lithographs and photography, it is highly possible to obtain images of these women scientists as part of making the connection with their choices and their lives—this would be strongly recommended. Again, students would then find an opportunity to display and share their information in several possible venues such as 'A Walk Through History' or wall and art displays or a collection bound into a book.

Mayan Mathematics

Most Levels

Narrative

This activity offers yet another possibility for investigation of science, technology, engineering and mathematics careers because it develops an understanding of the different cultural contexts of science and math, all while augmenting a particular set of history that has been ignored or trivialized due to racism. It can be a distinct learning experience for teachers, coaches and mentors who themselves have not had much opportunity to learn about this culture in Mesoamerica due to the biases of texts and historical study. This look also involves math as a concretized study and like much Egyptian and West African science, engineering and math work, ties function to form very clearly. The use of visuals: pictures, diagrams, etc., is also high with this activity and its displays are limited only by the imagination. This activity also offers a real possibility of students of color making connection with possible role models so that each student might pursue choices that they feel a connection with.

Objectives

- Create a forum for studying the contributions to STEM of women throughout history.
- Develop personal and educational empowerment skills for young women.
- Develop sensitivities for students of both genders to career options decision-making for girls and women
- Increase awareness of possible careers and career paths in the STEM professions.

Materials Needed

- Access to the Internet and library for research
- The Gender Chip Project (film)

Guided Experience

Some teachers have had student groups actually reconstruct a Mayan pyramid model, using mathematical scaling in the reproduction—an excellent exercise for those interested in architecture and engineering. Students use sources to compile an understanding and representation two or three dimensional of Mayan pyramids. Again, students would then find an opportunity to display and share their information in several possible venues such as 'A Walk Through History' or wall and art displays or a collection bound into a book.

Women in Science in the Movies

All Levels

Narrative

The availability of movies (or television) on video or DVD recording helps make this activity even more dynamic.

Students have an opportunity to become critical about role models of women in film, more sensitive to how women scientists are portrayed in mass media, and the use of the media is generally considered to be fun.

Objectives

- Develop personal and educational empowerment skills for young women.
- Increase awareness of possible careers and career paths in the STEM professions.
- Enhance formative assessment skills so that young women and their mentors may continually identify learning strengths and hurdles.

Materials Needed

- Access to the Internet and library for research
- Current movies portraying women in science on video or DVD (Volcano, etc., paper or transparencies to record group work)
- The Gender Chip Project (film)

Guided Experience

This experience may be structured in any one of several different ways, including dividing an investigation into categories of strong and autonomous women scientists in the movies, and weak, male-dependent roles. It clearly involves aspects of media literacy and because certain scenes can be captured and replays, students and others can become familiar with both media portrayal and comparison and contrast with less fictionalized accounts. Students might themselves develop a set of questions that inform their investi-

gation, such as: which women scientists appear to use scientific method to solve problems? Another variation—and there are many—might involve only examining true stories as they have appeared in movies. This activity can also be helpful in demystifying STEM careers as well as media representation of women, and there are ample opportunities for a very wide range of career choice examinations such as volcanologists, astronomers, mathematicians, oceanographers, mining and other civil engineers, and archeologists. (It might be interesting and helpful to ask students why they chose their subject.) Students collect and write up information about scientists, and then display and share this information. Again, students would then find an opportunity to display and share their information in several possible venues such as “A Walk Through the Movies” or wall and art displays, or a collection bound into a book.

Women in Science in Science Fiction

All Levels

Narrative

This is another activity that can be enlivened with examples from the media. While it could be limited to reflections of women scientists in books it might be more helpful to have it range across several medium: books, movies, television, etc. It can also be revealing by certain historical period—such as pre-1950 era books where science fiction was largely conceived of as for males, and rarely contained any heroines; especially intelligent or science savvy ones. Again, the availability of movies (or television) on video or DVD recording helps make this activity even more dynamic.

Objectives

- Develop personal and educational empowerment skills for young women.
- Increase awareness of possible careers and career paths in the STEM professions.
- Enhance formative assessment skills so that young women and their mentors may continually identify learning strengths and hurdles.

Materials Needed

- Access to the Internet and library for research
- Current movies portraying women in science on video or DVD (Volcano, etc., paper or transparencies to record group work)
- The Gender Chip Project (film)

Guided Experience

It may be structured in any one of several different ways, including dividing an investigation into categories of 'strong and autonomous women' scientists, and 'weak, male-dependent' roles. It clearly involves aspects of media literacy and because certain scenes can be captured and replays, students and others can become familiar with both media portrayal and comparison and contrast with more realistic accounts. Students might themselves develop a set of questions that inform their investigation,

such as: which women scientists appear to use scientific method to solve problems? . (It might be interesting and helpful to ask students why they chose their subject.) Students collect and write up information about scientists, and then display and share this information. Again, students would then find an opportunity to display and share their information in several possible venues such as 'A Walk Through the Movies' or wall and art displays, or a collection bound into a book.

A Collection of Local Science Mentors

All Levels

Narrative

This is also a variation on several previous activities where the limits of investigation are grounded in a contemporary or geographical frame. The value of this exercise is to obtain a sense of what is going on now in science. The availability of images and information in news media make this particularly exciting and the recency helps demystify some of the connection between students and historical approaches. (It might be interesting and helpful to ask students why they chose their subject.)

Objectives

- Develop personal and educational empowerment skills for young women.
- Increase awareness of possible careers and career paths in the STEM professions.
- Enhance formative assessment skills so that young women and their mentors may continually identify learning strengths and hurdles.

Materials Needed

- Access to the Internet and library for research
- Current movies portraying women in science on video or DVD (Volcano, etc., paper or transparencies to record group work)
- The Gender Chip Project (film)

Guided Experience

Students collect and write up information about scientists, and then display and share this information. Again, students would then find an opportunity to display and share their information in several possible venues such as 'A Walk Through History' or wall and art displays or a collection bound into a book. Featured local scientists might be invited into the class or to the center of girls' group to view the work of the students and comment on their own careers.

Challenge by Choice

Challenge by choice is an outdoor education phrase that reminds participants that they may choose to do edgework and push the limits of their comfort zone. This phrase often helps participants choose to take part in activity because it empowers them to choose. It also respectfully offers participants a choice not to participate. For more information please see Processing the Experience in the resources section.

Fear and The Magic Hat

All Levels

Narrative

In learning situations most students face some type of fear -- whatever fear that may be. That fear may become a critical juncture where the learning process may be derailed. This experience is designed to provide

participants a chance to face their fears, realize they are not alone in their fears and to create a positive way to face those learning obstacles.

Guided Experience

Each participant will need a marker, one piece of construction paper and one index card. After or before viewing the film, offer the participants the chance to think about what their greatest career dream is. Then ask them to think about what they fear might happen in the pursuit of that dream. Then offer them the chance to write down their biggest fear on their index card. (No names!!!) Have them fold their fears in half and place them in the hat.

Objectives

- Create a forum for studying the contributions to STEM of women throughout history.
- Develop personal and educational empowerment skills for young women.
- Develop sensitivities for students of both genders to career options decision-making for girls and women
- Increase awareness of possible careers and career paths in the STEM professions.

Materials Needed

- The Gender Chip Project (film)
- A large hat
- A way to post all the index cards on paper or walls
- Index cards
- One piece of construction paper per participant
- Markers

De-brief questions

- What role does fear play in a career decision-making process?
- What did the young women in the film fear?
- How did they overcome the fears?
- Who can young women who wish to pursue STEM learning turn to for support?
- What is the difference in talking to yourself with a positive or a negative voice?
- As mentors, how do our fears influence the advice we give?

Participants then have the opportunity to hear each fear read aloud. Possible conversations might center on: How each fear might be faced, supports that learners might access, positive phrases to counter the negative fears.

To offer participants an opportunity to see their strengths as well as their fears, ask each participant to place their name in big bold letters on the construction paper. Each participant will have the opportunity to write one strength about each person in the room on the paper with that person's name on it. After the paper is passed around and reaches it's original owner, ask each person to take the time to read and reflect on what was written. They might want to consider if this collection of words is how they see themselves and how their strengths might help overcome their fears.

Make Your Own Box

All Levels

Narrative

One of the young women, Erin, mentioned that one of her secrets to completing her degree was by surrounding herself with people who believed in her. This commentary leads to the question: How does external and internal commentary shape our learning and career choices?

Objectives

- Develop personal and educational empowerment skills for young women.
- Increase awareness of possible careers and career paths in the STEM professions.
- Enhance formative assessment skills so that young women and their mentors may continually identify learning strengths and hurdles.

Materials Needed

- The Gender Chip Project (film)
- Technology to show the film
- Enough boxes for format chosen
- Glue
- Art supplies
- Old magazines

Guided Experience

We can envision several ways to go about this project based on the participants. The objective of this experience is to allow participants to create a model about how internal and external feedback shapes our learning and career experiences. The big concept is to have participants create a box with external commentary on the outside and internal on the inside. Participants can create their own smaller boxes or work together in groups to create a giant appliance box. Participants would ideally create two boxes -- one with the internal and external feedback they are currently receiving and a second

with the type of feedback they want to pay attention to. For example, some young women might hear external feedback regarding having a family and settling down and others might hear the external feedback that there is a way to balance family and careers. This feedback might be represented by words, magazine pictures or visual images of the participants choosing. Discussions surrounding this experience might include comparing how society expects women to behave or how young women envision a life that is different than the options society seems to be presenting.

This experience could be expanded upon by asking participants to create a play or dialogue based on the journey between the two boxes. What advice might a wise character offer a young woman traveling between the two boxes?

Mentoring: Experience and the Literature

Narrative

Oftentimes when we are working with young people we can draw from a wealth of literature that exists on almost all subjects. But what we

cannot often find are case studies exactly like the young person sitting in front of us. At that point our professional judgement, observational skills and life experiences help us provide guidance and support. The purpose of this activity is to provide participants with an opportunity to: sharpen observation skills, compare and share the literature we draw from and to provide a forum to discuss each case study.

Please note that we wrote this experience for mentors and counselors and we then realized that young women of all ages have the opportunity to mentor someone:

middle school students working with kindergartners and college students work with middle school students are just some of the possibilities where mentoring skills could be developed along with the STEM skills.

Objectives

- Develop personal and educational empowerment skills for young women.
- Increase awareness of possible careers and career paths in the STEM professions.
- Enhance formative assessment skills so that young women and their mentors may continually identify learning strengths and hurdles.

Materials Needed

- The Gender Chip Project (film)
- Technology to show the film
- Butcher paper
- Markers
- Art supplies
- Old magazines

Note: The discussion question guide may be used to cue up the group discussion or guide any of the small groups that are stuck.

Guided Experience

Please ask all participants to bring their favorite sources for coaching young women in the science and math fields. In order to include both new and experienced counselors, sources might include books and/or inspirational writing or quotes.

Before showing the movie *The Gender Chip*, divide the large group into five smaller groups. Each group should then be assigned one of the young women in the film. Their task is to observe each young woman and create a case study. Allow each group a few minutes to assign tasks and roles.

After the movie have each group meet and create a case study of the young woman. Paying particular attention to noting where she struggled, what resources she searched for and the pattern of questions she asked and where she drew her support. Have each group present their study to the whole group.

As a whole group ask every student to create a timeline profile of what the literature says a young woman will need and experience. Next, have each group present their case studies. In discussion, compare the case studies with the literature. Ask the group to consider which resources and sources will assist each young woman and share what sources in the room the counselors can draw from as they work with young women.

Three Dimensional Success in STEM

Narrative

As the movie begins, it appears that each woman is the same -- one who wishes to learn science. However, as the film unrolls it becomes apparent that each woman is motivated by very different goals and passions. We believe, each young woman would define success differently and that young women would benefit from discussions that examine what success means to them.

Materials Needed

- The Gender Chip Project (film)
- Technology for viewing the film
- Venue with moveable seating to allow for a discussion circle or square
- Art materials for sculpture (see tips)

Design Ideas

If participants need guidance they can consider the following aspects of design:

Elements of Design: Value, color, form, shape, line, space & texture.

Principles of Design: Contrast, rhythm, unity, emphasis, pattern, movement & balance.

A poster series from Crystal Productions has great ways to illustrate this: www.crystalproductions.com

Guided Experience

After a discussion about what motivates each of these women, participants can brainstorm what their vision of success is. Participants can then choose to create a three dimensional figure that represents their definition of success. Their art and definitions can then be displayed and offered for discussion. One discussion question might include: How does your definition of success model how you interact with the learning experience?

Tip

Model magic is the easiest sculpting compound to work with. But other sculpting materials such as clay, paper mache or homemade play dough can be used. Or participants can be creative and make statues out of just about anything

What is Learning and Who is Learning What?

Narrative

One of the interesting points about the movie is that it never specifically addresses how each young woman learns and if their way of learning changes over time. There are many different types of learners and they all need different supports at different times. The challenge in this activity is to watch the movie and note the clues that suggest how these young women learn.

Materials Needed

- The Gender Chip Project (film)
- Venue with moveable seating to allow for a discussion circle or square

Guided Experience

Sarason (2004) defines learning as:

“Learning is not a thing. Learning is a process that occurs in an inter-personal and group context, and it

is always composed of an interaction of factors to which we append labels such as motivation, cognition, emotion or affect and attitude. Neither singly nor in their interactions is the strength of these factors ever zero” (p. vii).

Keeping that definition in mind, participants can create five butcher paper people-- one for each of the five women in the movie. With each group responsible for understanding the learning story of one woman have them meet and determine roles and what they might be looking for as they watch the film. After viewing the film, have the groups complete their person. They might want to consider what obstacles they encountered, how they learned (auditory, visual, kinesthetic, auditory, sequential, visual, introvert, extrovert, etc.), what were their strengths, where did they need support, what supports were effective? Further discussion might include how the young women talked with themselves about learning. What types of learning were most important at different times in these young women’s academic experiences?

Gender Chip Film Discussion Guide

Narrative

Discussions offer a place for everyone to bring their experiences together in a community of learning. In order to begin conversations

about some of the issues raised in the Gender Chip we have created a series of discussion starters. With modification, these questions can be used with all age groups.

Materials Needed

- The Gender Chip Project (film)
- Technology for viewing the film
- Venue with moveable seating to allow for a discussion circle or square

Possible Discussion Questions

- What were the skills these young women needed to enter science programs?
- What skills did they need to complete the program? How are these skills different?
- What is the role of laughter in the movie?
- Where does each young woman's ideas seem to come from?
- What is the source of strength for each of these young women?
- What internal conflicts is each of these young women facing?
- What resources and supports allow them to face these conflicts?
- What external hurdles are these young women facing? • What resources and supports allow them to overcome these hurdles?
- How does each young woman define success?
- How does each young woman define herself?
- Is there a difference between how these young women define success and how they define themselves?
- What does learning mean to each young woman?
- How did each young woman go about asking for help? Did some seem to need assistance through a critical juncture and not ask?
- What clues did each woman offer that she was facing a critical juncture in her learning experience?

Tips

- Ask discussants to write down their ideas if too many hands are raised at once.
- To keep discussion flowing, suggest that what the last speaker said and then link their comments so that a flow of thought is created.
- At the end of the discussion, allowing a 30 second statement or pass from each person can make sure that all had a chance to have their voice heard.

Resources for Activities & Experiences

Some Noted Female Scientists

(Sources: Infoplease and 4000 Years of Women in Science)

Possible STEM Careers List

Agricultural extension agent
Soil or water chemist
Civil Engineer
Organic chemist
Computer software designer
Hospital laboratory analyst
Hurricane chaser (meteorologist)
Amusement park ride designer
Astronaut/physicist
Zoological Dietician
Astronomer
Middle school math teacher
Petrochemical engineer
Brain surgeon
Robot designer
Prosthetics designer
Veterinarian

[The teacher/mentor or class may develop their own list, if they choose.]

Maria Gaetena Agnesi- Italian mathematician
Mary Anning – British geologist
Elizabeth Blackwell-US physician
Mary E. Britton-African-American physician
Cornelia Clapp- US marine biologist
Sur Juana Inez de la Cruz, Mexican astronomer, musician, artist
Marie Curie-French chemist and physicist
Gertrude Belle Elion, US pharmacologist
Dian Fossey- US primatologist
Anna Freud- British psychoanalyst
Jane Goodall-British ethologist
Grace Hopper, US computer scientist and naval admiral
Hypatia-Greek mathematician
Mae C. Jemison-US astronaut and physicist
Elizabeth Kenny-Australian nurse
Sonya Kovalevsky- Russian mathematician
Mary Douglas Leakey, British archaeologists and paleontologist
Margaret Meade- US anthropologist
Maria Montessori-Italian physician and educator
Niebla Elvia US environmental scientist
Ellen Ochoa- Hispanic engineer and astronaut
Eliza Lucas Pickney- US horticulturalist
Sally K. Ride-US astrophysicist and astronaut
Ellen Churchill Semple-US geographer
Mary Edwards Walker-US surgeon and feminist
Rosalyn Sussman Yallow-US medical physicist

[The teacher or class may develop their own list, if they choose.]

Additional Gender Chip Film Discussion Questions:

- What did _____ do to prepare for her career?
- What were the important career decisions she had to make? What did she decide?
- Given the same situation what decisions would you have made? Why?
- How did she reflect her strength and independence through her choices?
- What about you observed suggests that she will be able to be successful in a career usually dominated by men?

formative assessment tool

Critical Juncture	Description	Possible Discussion Questions
Content	The learning that leads to the knowledge necessary to understand scientific concepts.	<p>What are you doing well in?</p> <p>Is there anything you are struggling with?</p> <p>How do you know you are not doing well?</p> <p>How do you see the connection between your math and science classes?</p> <p>How do you see all of your classes interconnecting?</p> <p>Have you mapped out your classes by prerequisites?</p> <p>How do you learn best?</p>
Process	The opportunity to learn science by participating in experiments, hands-on learning and the inquiry process.	<p>Have you had the chance to do any science projects?</p> <p>Would you like to try an internship?</p> <p>Is there an experience or learning opportunity you have always wanted to try?</p> <p>What background work or support would you need to have to try those learning opportunities?</p>
Technology	The ability to access and use technology to enhance learning, collect data and communicate findings.	<p>Do you have access to the computers you need for homework?</p> <p>Are they available when you need them?</p> <p>Is the cost of printing, programs, hardware a factor?</p> <p>What technology have you had the opportunity to use to collect data?</p> <p>Have you had the opportunity to use technology to interpret data?</p>

Critical Juncture	Description	Possible Discussion Questions
Capacity Building	The ability to create the connections and supports necessary to have the learning experiences necessary for a STEM career.	<p>Have you found a teacher/professor that you can ask questions about science or math projects?</p> <p>Are you aware of these (list) learning support networks available in this area/school?</p> <p>Have you considered taking classes other than STEM?</p>
Problem Solving	The learned ability to handle the unpredictable world of engaging in STEM research and learning experiences.	<p>Do science experiments ever fail?</p> <p>What do you do if an experiment/problem does not come out the way you planned?</p> <p>What do you do if you cannot figure out the math homework?</p> <p>What do you say to yourself when things go awry?</p> <p>Who can you ask for help?</p>
STEM Identity	The developing ability to picture yourself as a member of a group and determining where/how you want to contribute to the field.	<p>Are you comfortable formulating your own research questions?</p> <p>How do you know you have reached a valid conclusion?</p> <p>How do you see yourself in five years? Ten? Twenty?</p> <p>If you could contribute one thing to your field, what would that be?</p>



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Girls and Women in STEM Careers: A Curricular Statement

One particular launching point of this curriculum is emergent from my own history: my mother, Shendrine E. Boyce. Henry, was a pioneer Black woman chemist in the early 1950s, and along with her 20 year career as a high school science teacher at Mc Kinley Tech in Washington DC, this witness to the challenges of her career have informed, if not formed, many of my endeavors. In the late 1990s, shortly before my mother's death, I recall a conversation with my uncle Felix, who shared with me that just prior to my mother's engagement to my father he had been present when my grandfather had spoken emphatically and passionately about the need for my mother to marry someone who would be supportive of her choice of a career in the sciences. My grandfather had clearly been a mentor, and an integral part of Mom's career choices; he expected that her decision on a marriage partner would also actively support her work in the sciences. After gaining a perspective of the depth of my father's support, he consented to the marriage. As I watched The Gender Chip Project for the first time, I was reminded of the essential role that spouses, families and other close-in support plays in the opening of doors to women in the sciences in our society as well as advancing the continuing choices of young women in life decision-making.

Curriculum design issues, if I may paraphrase one of my mentors, Dwayne Huebner, are not only always political in the sense of access to knowledge being about power, but they are also personal—deeply rooted in relationships. In creating this curriculum, we tried to be mindful of this personal and communal dimension of curricular design along with the continuum of age, development and interest. We also intended that this curriculum piece would help play a catalytic role for girls and women's mentors from different institutions and positions in life. While research on risk and resiliency informs us of the importance of at least two adults needed to mentor each child, we are operating here with the belief that as many positive messages as possible be provided to support the choice of STEM (science, math, engineering and technology) careers. We hope that these mentors will use these materials and develop their own materials to open up the external environment for career choices, while they also deepen the inner spaces where reflection and refraction can challenge social norms and prescriptions—including those societal subtext perspectives about how things should be.

This curriculum guide is dedicated to the memory of my mother, and to the present work with my teen daughter; looking toward the kind of experience-based mentoring that creates the critical and informed spaces for possibility and positive life choices for girls and women.

Wendi Laurence



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I come from four generations of teachers and so I got to grow up in an atmosphere where teaching was not work, rather teaching and learning are a life that is led. My Mom constantly makes curiosity possible. Things can be touched, explored, mucked around in and messed up. As a kid, I had no idea that I was always learning and she was also continually teaching and learning -- I just thought we were having adventures. I keep a photo on my desk of my Mom and our boys, in the picture they are blowing bubbles and looking at them through the light streaming in our front window. The boys bounced, asked questions, touched, laughed, made a mess and had a blast. That photo exemplifies the childhood I remember and I am so glad our boys get to do the same.

It is in this spirit that I offer what I have written. It is about the possibility that comes from engaging in learning. It is about the belief that it makes a difference when someone reaches out and shares in learning and dreams. It is about my understanding that sometimes someone went ahead and asked me the difficult questions, offered me tools and connections and then gave me the space to find my answers.

My contribution to this work is defined by the two sides of the bridge I am currently building. I am forever glad to be one of Mom's kids -- my brother and I -- and all of her kids that she learned with during her forty-two years as a classroom teacher. So I dedicate this to my Mom, Barbara Bain, for always believing in me, learning and the dream of teaching. On the other side of the bridge I would like to thank Bill Becker, Director of the Center for Science Education, for the rope he threw me when I didn't know how to connect my vision with the reality of education. I am grateful that both are willing not just to offer advice but have been just crazy enough to mentor me and to muck around and do the real work that comes with dream construction. Jim, Connor and Kelton live the dream with me each day and I am glad they believe that our future is based on what Connor has termed "creat-osity". I hope some of the work in here offers what I have learned in the process of trying to create my dream and helps people connect with young women who need chances to learn, muck around, dream and be asked the difficult questions so they can build their own bridges.

Have fun out there.