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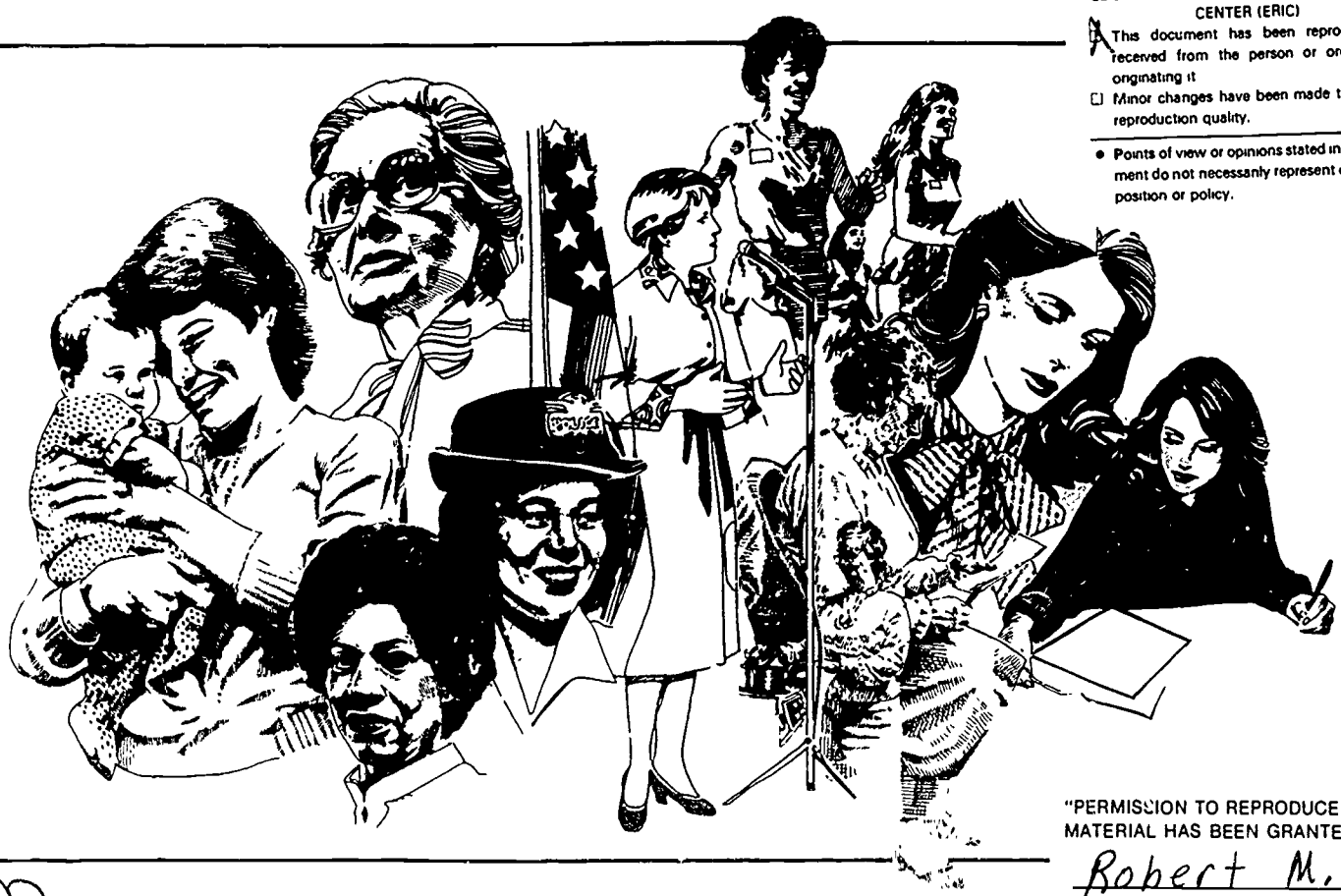
ABSTRACT

One of a five-part series, this booklet is designed to help teachers identify resources to combat the adverse effects of sex bias and sex-role stereotyping in the existing curriculum. Material is divided into five sections. Following a foreword, a brief section suggests methods for reducing math avoidance. A third section lists selected noteworthy women in mathematics and science throughout history. A total of 29 classroom activities is provided in section four. A bibliography of teacher resources including books, instructional units, and films concludes the document. (CFR)

WOMEN'S HISTORY WOMEN'S FUTURE

A Teacher Resource Guide



The University of the State of New York
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FOREWORD

Women's History Week, March 2-8, 1986, provides a focal point for encouraging schools and communities to expand their awareness throughout the year of the contributions women have made to our society. Knowledge of the richness of our heritage can often expand the perceptions and expectations of students. This expanded expectation often leads to greater achievement. Encouraging students to learn about the contributions of women may lead students, particularly females and minorities, to expand their horizons and to work toward their full potentials.

Mathematics education and science education are receiving considerable attention now because of the requirements of business and industry and modern life. When courses become elective, female and minority students tend to avoid math and science programs more often than nonminority males. *Women's History - Womens Future* has been developed to provide suggestions for reducing math avoidance behaviors and for expanding awareness of the contributions made by women in math and science areas. This publication also provides suggested classroom activities and a brief list of resources for integrating the study of women's history throughout the curriculum.

Integrating the study of women's history into the curriculum is a relatively new task for teachers and schools. Traditional textbooks and curriculum resources, until recently, often overlooked and undervalued the contributions of women. Women of every race, creed, ethnic background and socioeconomic level have played, and continue to play, a vital role in every aspect of our nation's life. The effort to increase awareness and acknowledge the inspiration of this previously overlooked record of activism is what the study of women's history is all about.

Women's History - Womens Future is the fifth in a series of Division of Civil Rights and Intercultural Relations resources designed to assist teachers throughout the year with integrating women's history into the curriculum. All five of the publications have been developed to help teachers identify resources to combat the adverse effects of sex bias and sex-role stereotyping in the existing curriculum. This teachers resource guide, as with the previous ones, is selective in its presentation of material and ideas rather than exhaustive of materials and ideas which are available. It is expected that this guide will stimulate inventiveness and creative adaptations for enriching the curriculum.

Women's History - Womens Future was developed by Michael J. Moon, Associate in Educational Integration. Technical assistance and teacher training workshops on a wide range of educational equity topics are available from the Division of Civil Rights and Intercultural Relations, Room 471 Education Building Annex, Albany, New York 12234.

CONTENTS

REDUCING MATH AVOIDANCE

A Nation at Risk and other reports have described the plight facing our country in meeting increased foreign competition in world markets. National attention has been focused on improving mathematics and science education as a method of improving the economic security of our country. To meet this challenge, the Congress, state legislatures and state policymaking boards have initiated programs to improve mathematics and science education. The Board of Regents Action Plan to Improve Elementary and Secondary Education Results in New York State includes enhanced math and science requirements for all students.

Many new programs and initiatives in math and science education will not benefit large portions of our female and minority students unless math avoidance behavior is reduced or eliminated. Female and minority students tend to avoid mathematics and science programs more often than non-minority males. Student math avoidance behavior can eventually lead to tremendously reduced career opportunities because of a lack of necessary math and science competency. Therefore, reducing math avoidance behavior, particularly by female and minority students, is essential for meeting the growing demand for math and science competency.

Eliminating the causes of student negative attitudes toward mathematics can benefit all students and improve mathematics instruction. Children do not have an innate dislike for mathematics, just as they do not exhibit sex, race, or ethnic bias and stereotyping at very early ages. This dislike and resulting math avoidance behavior is a trait that is acquired over an extended period of time, particularly by females.

Student math avoidance behaviors are generally a result of repeated exposure to several poor teaching practices and lack of parental and peer support for mathematics education. Teachers can help reduce student math avoidance behaviors by demonstrating the following positive mathematics teaching practices:

1. Emphasize many correct ways to solve each problem, encourage creativity.
2. Provide enough time for problem-solving to eliminate excessive time pressure for reaching a solution.
3. Use drill assignments on a limited basis.
4. Assign work to meet individual needs.
5. Assign written homework only as needed.
6. Begin each year with testing to determine the extent of review necessary of the previous year's curriculum.
7. Use the textbook as a resource not as the curriculum.
8. Correlate mathematics with real life situations.
9. Use mathematics-related problems, games and puzzles as a reward.
10. Use praise and reward for students who meet and exceed expectations.

Teachers should strive to develop creativity in mathematics instruction and relate classwork to real life situations. High teacher expectations for all students will promote interest and selection of mathematics and science education by greater numbers of students, particularly by female and minority students. Teachers' enthusiasm for mathematics can be contagious and can do much to overcome poor past student experiences. Improvements in mathematics teaching practices can lead to an increase in selection of mathematics education and, therefore, increase career choices and opportunities for women.

SELECTED WOMEN IN MATH AND SCIENCE

Margaret Gene Arnstein (1904-1972) Public health nurse. Nursing educator, and textbook coauthor.

Sarah Josephine Baker (1873-1945) Physician. Established the Division of Child Hygiene in New York City, the first public tax-supported agency for the health of children.

Florence Augusta Merriam Bailey (1863-1948) Ornithologist and nature writer.

Ruth Fulton Benedict (1887-1948) Anthropologist. Studied and wrote about western American Indians, taught Margaret Mead at Columbia University, author of *Patterns of Culture.*

Elizabeth Blackwell (1821-1910) Physician. First woman in America to become a doctor; established the New York Infirmary for Women and Children, organized Women's Central Relief Association which trained nurses, assisted in developing examinations long before they were compulsory, founded the New England Hospital for Women and Children in 1859.

Elizabeth Gertrude Knight Britton (1858 1934) Botanist. Leading expert on various forms of moss.

Rachel Fuller Brown (1898-1980) Organic chemist. Co-developer with Elizabeth Lee Hazen (1885-1975) of Nystatin, the first antifungal antibiotic for use in human disease, received the Squibb Award in Chemotherapy and were the first women to receive the Chemical Pioneer Award of the American Institute of Chemists.

Cloe Annette Buckel (1833-1912) Physician. Established field hospitals and appointed nurses during the Civil War.

Mary Bunting (1910-) Microbiologist. First woman member on the Atomic Energy Commission, made discoveries on the effects of radiation on bacteria.

Eleanor M. Burbidge (1919-) Astronomer. First woman Royal Astronomer at the Royal Greenwich Observatory in England.

Annie Jump Cannon (1863-1941) Astronomer. Classified the spectra of 350,000 stars from the North Pole to the South Pole while at the Harvard College Observatory.

Rachel Carson (1907-1964) Biologist. Alerted the country to the dangers of pollution through her book, *Silent Spring.*

Eugenie Clark (1922-) Marine biologist. Studied the behavior of sharks and taught them to recognize and choose different designs and colors.

Jane Colden (1724-1766) Botanist. Discovered and named the gardenia.

Anna Botsford Comstock (1854-1930) Naturalist, scientific illustrator. First woman professor at Cornell University, lectured and wrote books on the study of nature.

Gerty Cori (1896-1957) Biochemist, physician. First American woman to receive the Nobel Prize in Medicine/Physiology in 1947, researched carbohydrate metabolism on how the body uses its fuel supply of starches and sugars as related to certain hormone secretions.

Ella Phillips Crandall (1871-1938) Public health nurse. Instrumental in the creation of the National Organization for Public Health Nursing and was its first director.

Marie Curie (1867-1934) Chemist. First person to receive two Nobel Prizes, Physics in 1903 for the discovery of radium and Chemistry in 1911 for her research into radioactivity.

Annie Sturges Daniel (1858-1944) Physician. Public health reformer, pioneer in preventive medicine for tenement dwellers, professor at Women's Medical College.

Jane Arminda DeLano (1862-1919) Nurse. Recruited and trained nurses for World War I, coauthor of a Red Cross textbook, recipient of many awards from the United States and foreign governments.

Sister Mary Joseph Dempsey (1856-1939) Hospital administrator. Surgical assistant to Dr. William J. Mayo.

Margaret Clay Ferguson (1863-1951) Botanist. Teacher and administrator at Wellesley College, demonstrated the genetic research potential of *Petunia* as a tool for studying higher plant genetics.

Virginia Kneeland Frantz (1896-1967) Pathologist. Medical educator, made important contributions in tumor pathology.

Lillian Gilbreth (1878-1972) Industrial engineer. Developed time and human motion studies to reduce waste and increase efficiency in the office, factory, hospital and home settings.

Hetty Goldman (1881-1972) Archeologist. Interpreted the stages of prehistoric life in Greece, first woman professor at the Institute for Advanced Study at Princeton.

Winifred Goldring (1888-1971) Paleontologist First woman State Paleontologist for the New York State Museum in 1939, international expert on the link between algae and vascular plants.

Jane Goodall (1934-) Animal behaviorist. Conducted detailed studies to show that chimpanzees are intelligent, tool making, social animals.

Alice Hamilton (1869-1970) Physician Social reformer at Hull House, pioneer in industrial toxicology.

Beatrice Hicks (1919-) Electrical engineer. First woman engineer at Western Electric, received the Society of Women Engineers Achievement Award for her theoretical study and analysis of sensing devices under extreme environmental conditions.

Dorothy Crowfoot Hodgkin (1910-) Crystallographer. Received the Nobel Prize in Chemistry in 1964 for her research on the crystal structure of biochemical compounds, particularly penicillin.

Hypatia (c. 370-415) Mathematician. Mathematics and philosophy professor at the University of Alexandria, Egypt, developed the astrolabe and planesphere, instruments used for studying the stars.

Shirley Jackson (1946-) Physicist. First and only black woman currently in theoretical physics, participant in the International School of Subnuclear Physics in Italy

Irene Joliot-Curie (1897-1956) Physicist. Received the Nobel Prize in Chemistry for discovering a technique for making artificial radioactive elements.

Elise Strang L'Esperance (1878-1959) Pathologist. President of the Women's Medical Association of New York State and a recipient of numerous awards for outstanding work in cancer control.

Elsie Gregory MacGill (1905-) Aeronautical engineer. First woman chief aeronautical engineer, pioneer on engineering designs of fighter and transport aircraft.

Antonia Caetana DePaiva Pereira Maury (1866-1952) Astronomer. Made important contributions in spectroscopy.

Maria C. Mayer (1906 1972) Physicist. Received the Nobel Prize in Physics in 1963 for her work during World War II on isotope separation for the atomic bomb.

Barbara McClintock (1902-) Research scientist. Received the Nobel Prize in Medicine/Physiology in 1983 for her research in the cytogentics of maize.

Margaret Mead (1901-1978) Anthropologist. Studied and wrote on the cultures of the South Sea Island, childrearing and the role of women in society.

Lise Meitner (1878-1968) Physicist. First woman to be awarded the Enrico Fermi Award, for her work on splitting the atom.

Maria Mitchell (1818-1889) Astronomer. Discovered a comet which was named for her, assisted in the preparation of the American Nautical Almanac; first professor of astrology and director of the observatory at Vassar College; first woman to be elected to the American Academy of Arts and Sciences.

Emmy Noether (1882-1935) Mathematician. Professor of mathematics at Bryn Mawr and a member of the Institute for Advanced Study at Princeton, made disoveries in abstract algebra.

Eliza Lucas Pinckney (1722-1793) Botanist. Experimented with crops and developed indigo used in making blue dye, which became a major export of South Carolina.

Sally Ride (1951-) Astrophysicist, astronaut. First American woman in space.

Florence Sabin (1871-1953) Physician. Teacher of anatomy and histology at Johns Hopkins University, discovered the origin of red corpuscles and made contributions to tuberculosis research, received the National Achievement Award in 1932.

Nansie S. Sharpless (1932-) Neurochemist. Associate Professor of Albert Einstein College of Medicine, directs monoamineassay laboratory and conducts research in neurotransmitters, active on several advisory boards and committees involved in increasing educational opportunities in science for disabled students.

Odette L. Shotwell (1922-) Organic chemist. Research leader of the Mycotoxin Analytical and Chemical Research group at the Northern Research Regional Research Center of the U.S. Department of Agriculture, recipient of the Welsey Award for achievement in analytical chemistry and Peoria's Handicapped Professional Woman of the Year in 1983.

Susan Smith McKinney Steward (1847-1918) Physician. First black woman to receive a medical degree from the New York Medical College for Women.

Ellen Swallow (1842-1911) Chemist. First woman graduate from the Massachusetts Institute of Technology, founder of home economics as a scientific profession

Anne B. Swanson (1948-) Biochemist. Associate Professor at Edgewood College in Madison, Wisconsin, conducts research in nutrition and cancer.

Lucy Hobbs Taylor (1833-1910) Dentist First American woman to earn a degree in dentistry.

Valentina Tereshkova (1937-) Cosmonaut. First woman to orbit the earth.

Adah Belle Thoms (1863-1943) Nurse. First black person to hold an administrative position at New York City's Lincoln School for Nurses, instrumental in opening the doors to black women in the field of nursing.

Anna Johnson Pell Wheeler (1883-1966) Mathematician. Received her Ph.D. in mathematics from the University of Chicago in 1910; taught at Bryn Mawr College; first woman, and as late as 1970s, the only woman invited by the American Mathematics Society to deliver colloquium lectures.

Sarah Frances Whiting (1847-1927) Physicist, astronomer. Opened the second undergraduate laboratory for physics in the United States in 1878.

Martha Wollstein (1868-1939) Medical researcher. Pioneer in pediatric pathology.

Chien-shiung Wu (1912-) Physicist. Made important contributions to the research of nuclear forces and structures by experimental establishment of nonconservation of parity in beta-decay.

Rosalyn Sussman Yalow (1921-) Medical physicist. Received the Nobel Prize in Medicine/Physiology in 1977 for the discovery of radioimmunoassay, a method of measuring minute concentrations of hundreds of substances in body tissues important in determining the differences between diseased and normal tissue.

SUGGESTED CLASSROOM ACTIVITIES

1. Have students identify mature women in the community or in their families to be interviewed for the purpose of compiling oral social histories. The results of the interviews can be shared through discussions, reports and displays of photographs to relate the lives of ordinary citizens to our history.

2. Have students read biographies of women in U S history and develop oral and/or written reports on their lives. Nobel Prize winners Barbara McClintock and Rosalyn Yalow or other women in math and science areas, would be of interest.

3. Invite women and men working in nontraditional occupations and math and science areas to share their experiences with students.

4. Create a mural or bulletin board on women involved in a particular area, such as math and science, sports, politics, business or entertainment. Have students compile pictures or write reports on women for the selected area.

5. Feature various women poets by having samples of their writings read aloud in class or over the school public address system.

6. Create an employment resource file by having students collect pictures of women and men in nontraditional occupations.

7. Visit and/or collect information from the National Women's Hall of Fame in Seneca Falls, New York and other sources on the first Women's Rights Convention in 1848.

8. Conduct a local essay and/or poster contest sponsored by your parent-teacher organization or have students participate in one organized by others, such as the Women's Hall of Fame in Seneca Falls, New York.

9. Have students conduct research on the contributions women from their community have made to their local community and/or to our society.

10. Conduct student debates on various contemporary topics such as. compensation for jobs based on comparable worth, effects of Title IX of the Educational Amendments of 1972, employment in nontraditional areas, sharing responsibilities for household chores and parenting, or the Equal Rights Amendment.

11. Have students compare the changes in women's fashions and clothing with changes in their political, social and economic roles.

12. Have students research the events surrounding the arrest and trial of Susan B. Anthony for her illegal vote in the 1872 Presidential election.

13. Analyze the attitude of society as depicted in popular songs, fairy tales, television programs and commercials. Have students rewrite scripts to eliminate sex bias and sex-role stereotyping.

14. After studying the math-related skills necessary for quilt making, have students create a construction paper quilt based on traditional patterns.

15. After reading about Harriet Tubman, have students locate underground railroad routes and stations in New York State.

16. Have students research the role of women in Native American cultures indigenous to New York State.

17. Have students write a newspaper article about themselves 10, 20, or 30 years from today.

18. Observe and analyze how students stereotype each other. Discuss the resulting observations with students.

19. After having students identify their favorite toys, collect information on how the items are marketed and discuss your finding in terms of sex-role stereotyping.

20. Create a mural depicting the various occupations and household tasks of colonial women and the mothers and/or relatives of students. Discuss the comparisons.

21. Review textbooks for sex bias and write letters to publishers describing your findings and requesting corrections in future editions.

22. Have students write a play or skit to dramatize the material learned during the focus on women's history.

23. Have students list and discuss the additional barriers that are faced by minority women, including those with disabilities and those of specific racial and ethnic heritages

24. Create puzzles and matching games such as "twenty questions" to review the contributions of the women studied.

25 Have students conduct a miniature parade on a selected theme of women in U.S History, i e., women in math and science, native and colonial women's work, women in sports, political/social reform or fine arts. Miniature parade floats can be made using shoe boxes. Ribbons can be awarded to participants.

26. Have students develop a timeline placing the women who have been studied in historical perspective.

27. Have students develop a calendar indicating the birthdate of notable women in U.S. history. These birthdays can then be observed with an appropriate announcement and celebration throughout the year.

28. Have students request that the mayor or local governmental body issue a proclamation designating March 2-8, 1986 as Women's History Week.

29 Conduct an Open House display or assembly program to share the results of the students' activities for Women's History Week with the school and community.

RESOURCES

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