Recommended for GRADES 3-5 (you may modify for other ages)

Computers are Amazing! – Curriculum Guide (Item 1 of 2)

Adapted from the book: *Her Story: A Timeline of the Women Who Changed America* by Charlotte S. Waisman and Jill S. Tietjen, New York: HarperCollins, 2008.

Dear Educator,

We are pleased that you are receiving this slide presentation (See Item 2 of 2) to use in your classes. This document provides comments, directions, and options for your use in preparing curricula for your class.

We welcome you to read our book and to connect with us. (See www.herstoryatimeline.com) To develop these teaching materials, we have chosen to follow one theme from our book. For classroom and curriculum use, there are many other ways to use the information in the book by concentrating on different thematic issues. For example, one can follow the important women in politics and public service. Another thread is to follow the women who played a significant role in major social movements. You will come to know the book as a whole; it contains brief profiles of over 850 key and influential women in the history of the United States, in a timeline format that also clarifies important moments in our country's history. The overwhelming majority of the women who are identified are excellent role models for both girls and boys.

The focus for this particular curriculum is on a series of slides that accompany this document. They highlight some of the women who made noteworthy contributions in mathematics and computer sciences. We have chosen to name this module *Computers are Amazing!*

This teaching module is meant to identify a number of different types of contributions made by women who worked in mathematics and the field of computer science. Any of these topics could be expanded in further detail in a series of lessons that you create to aid in that exploration.

Use our ideas "as is" or incorporate changes that are appropriate for your learning environment. Most of all, enjoy reading and teaching about these exemplary women "on whose shoulders we all stand."

Curricular Standards

This curriculum has been developed to conform to the Texas Essential Knowledge and Skills standards for Grades 3-5. Specifically, the presentation and optional assignments provide the following:

Third Grade

English Language Arts and Reading

§110.5 English Language Arts and Reading, Grade 3.
(b) Knowledge and Skills.
(8) Reading/vocabulary development. The student develops an extensive vocabulary. The student is expected to: (C) use resources and references such as beginners' dictionaries, glossaries, available technology, and context to build word meanings and to confirm pronunciations of words (2-3);

Mathematics

§111.15 Mathematics, Grade 3.
(b) Knowledge and skills.
(3.1) Number, operation, and quantitative reasoning. The student uses place value to communicate about increasingly large whole numbers in verbal and written form, including money. The student is expected to: (A) use place value to read, write (in symbols and words), and describe the value of whole numbers through 999,999. (B) use place value to compare and order whole numbers through 9,999.
(3.4) Number, operation, and quantitative reasoning. The student recognizes and solves problems in multiplication and division situations.
(3.7) Patterns, relationships, and algebraic thinking. The student uses lists, tables, and charts to express patterns and relationships.
(3.14) Underlying processes and mathematical tools. The student applies Grade 3 mathematics to solve problems connected to everyday experience and activities in and outside of school.
(3.16) Underlying processes and mathematical tools. The student uses logical reasoning. The student is expected to: (A) make generalizations from patterns or sets of examples and nonexamples; and (B) justify why an answer is reasonable and explain the solution process.

Science

§112.5 Science, Grade 3.
(b) Knowledge and skills.
(3) Scientific processes. The student knows that information, critical thinking, and scientific problem solving are used in making decisions. The student is expected to: (E) connect Grade 3 science concepts with the history of science and contributions of scientists.

Social Studies

§113.5 Social Studies, Grade 3.
(a) Introduction
(1) In Grade 3, students learn how individuals have changed their communities and world. Students study the effects inspiring heroes have had on communities, past and present. Students learn about the lives of heroic men and women who made important choices, overcame obstacles, sacrificed for the betterment of others, and embarked on journeys that resulted in new ideas, new inventions, and new communities. Students expand their knowledge through the identification and study of people who made a difference, influenced public policy and decision making, and participated in resolving issues that are important to all people. Throughout Grade 3, students develop an understanding of the economic, cultural, and scientific contributions made by individuals.

(b) Knowledge and skills.
(3) History. The student understands the concepts of time and chronology. The student is expected to:
(B) create and interpret timelines.

(13) Culture. The student understands the role of real and mythical heroes in shaping the culture of communities, the state, and the nation. The student is expected to: (A) identify the heroic deeds of state and national heroes such as Daniel Boone and Davy Crockett.

(15) Science, technology and society. The student understands how individuals have created or invented new technology and affected life in communities around the world, past and present. The student is expected to:

(A) identify scientists and inventors such as Louis Daguerre, Cyrus McCormick, Louis Pasteur, and Jonas Salk who have created or invented new technology.

Fourth Grade

Mathematics

§111.16 Mathematics, Grade 4.
(b) Knowledge and skills.
(4.1) Number, operation, and quantitative reasoning. The student uses place value to represent whole numbers and decimals. The student is expected to: (A) use place value to read, write, compare and order whole numbers through 999,999,999.
(4.4) Number, operation, and quantitative reasoning. The student multiplies and divides to solve meaningful problems involving whole numbers and decimals.
(4.7) Patterns, relationships, and algebraic thinking. The student uses organizational structures to analyze and describe patterns and relationships. The student is expected to describe the relationship between two sets of related data such as ordered pairs in a table.
(4.14) Underlying processes and mathematical tools. The student applies Grade 4 mathematics to solve problems connected to everyday experience and activities in and outside of school.
(3.16) Underlying processes and mathematical tools. The student uses logical reasoning. The student is expected to: (A) make generalizations from patterns or sets of examples and nonexamples; and (B) justify why an answer is reasonable and explain the solution process.

Science

§112.6 Science, Grade 4.
(b) Knowledge and skills.
(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to: (E) connect Grade 4 science concepts with the history of science and contributions of scientists.

Social Studies

§113.6 Social Studies, Grade 4.
(a) Introduction.
(1) . . . . Students identify the contributions of people of various racial, ethnic, and religious groups to Texas and describe the impact of science and technology on life in the state.

(b) Knowledge and skills.
(21) Science, technology and society. The student understands the impact of science and technology on life in Texas. The student is expected to: (A) identify famous inventors and scientists such as Gail Borden, Joseph Glidden, and Patillo Higgins and their contributions.

Fifth Grade

English Language Arts and Reading

§110.7 English Language Arts and Reading, Grade 5.
(b) Knowledge and Skills
(13) Reading/inquiry/research. The student inquires and conducts research using a variety of sources. The student is expected to: (D) interpret and use graphic sources of information such as maps, graphs, time lines, tables, or diagrams to address research questions (4-5).

(23) Viewing/representing/interpretation. The student understands and interprets visual images, messages, and meanings. The student is expected to: (B) interpret important events and ideas gleaned from maps, charts, graphics, video segments or technology presentations (4-8).

Mathematics

§111.17 Mathematics, Grade 5.
(b) Knowledge and skills.
(5.1) Number, operation, and quantitative reasoning. The student uses place value to represent whole numbers and decimals. The student is expected to: (A) use place value to read, write, compare and order whole numbers through 999,999,999,999.
(5.3) Number, operation, and quantitative reasoning. The student adds, subtracts, multiplies and divides to solve meaningful problems.
(5.6) Patterns, relationships, and algebraic thinking. The student describes relationships mathematically.
(5.14) Underlying processes and mathematical tools. The student applies Grade 5 mathematics to solve problems connected to everyday experience and activities in and outside of school.
(5.16) Underlying processes and mathematical tools. The student uses logical reasoning. The student is expected to: (A) make generalizations from patterns or sets of examples and nonexamples; and (B) justify why an answer is reasonable and explain the solution process.

Science

§112.7 Science, Grade 5.
(b) Knowledge and skills.
(3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to: (E) connect Grade 5 science concepts with the history of science and contributions of scientists.

Social Studies

§113.7 Social Studies, Grade 5.
(a) Introduction.
(1) . . . . In Grade 5, students learn about the history of the United States from its early beginnings to the present with a focus on colonial times through the 20th century. Historical content includes the colonial and revolutionary periods, the establishment of the United States, and issues that led to the Civil War. An overview of major events and significant individuals of the late-19th century and the 20th century is provided. . . Students examine the importance of effective leadership in a democratic society and identify important leaders in the national government. . . Students describe customs and celebrations of various racial, ethic, and religious groups in the nation and identify the contributions of famous inventors and scientists.

(b) Knowledge and skills.

(5) History. The student understands important issues, events, and individuals of the 20th century in the United States. The student is expected to: (B) identify the accomplishments of notable individuals such as Carrie Chapman Catt, Dwight Eisenhower, Martin Luther King, Jr., Rosa Parks, Colin Powell, and Franklin D. Roosevelt who have made contributions to society in the areas of civil rights, women's rights, military actions, and politics.

(24) Science, technology and society. The student understands the impact of science and technology on life in the United States. The student is expected to: (A) describe the contributions of famous inventors and scientists such as Neil Armstrong, John J. Audubon, Benjamin Banneker, Clarence Birdseye, George Washington Carver, Thomas Edison, and Carl Sagan.

Experiential Learning Activity

So, you can see how the module meets/exceeds the Texas Standards.

Now—to the IDEAS!

A specific, practical module to incorporate into your overall teaching plans is developed below.

- Activity Summary. Show a PowerPoint presentation (provided) that makes the students aware of the women who have made contributions in the fields of mathematics and computer science.

- Age of Students. The *Computers are Amazing!* curriculum has been developed for third to fifth grade students. (You could also change this specific focus to meet the needs of your students' ages.) The book, *Her Story: A Timeline of the Women Who Changed America*, while clearly written for an adult audience, is useful as a reference since it is so highly visual. You may wish to have at least one copy of the book available in your classroom and/or in your school library.

- Classroom make-up. It is anticipated that the class will be both boys and girls.

- Goals (Outcomes):
    1. To identify a number of important, historical female figures who have contributed to the fields of mathematics and computer science.
    2. To understand the importance of mathematics to the functioning of computer programs and computers.

3. To interest students in a project or assignment, based on this teaching module, that takes their learning deeper.

- Group Size. There is no minimum or maximum number of students who would be the best audience for this module. The "typical" classroom size would work well. There is no need to divide into smaller groups, or subgroups although this can be a useful variation, should your class benefit from small group discussions.

- Time Required. From your introduction through showing the slides, through processing (or discussion or small group activity), the module itself may take one or more than one typical class period. Projects undertaken outside of class will require additional time and efforts on the part of the students. We have been deliberately flexible here, so as to encourage you to use this material as part of your overall curricular strategy in the ways it works best for you.

- Materials and AV Requirements.
    1. A computer to show the PowerPoint slides
    2. An LCD projector
    3. A screen
    4. A white board (or flip chart) and chalk or markers
    5. Blank paper and pencil/pen for notes or questions (each student will need to have these)
    6. Assignment Sheet (teacher-generated from ideas below)
    7. Copies of the quick quiz or word search puzzle (provided) to distribute to all students

- Physical Setting. A typical classroom where the lights can be dimmed for projection purposes will work. There are no special seating or table requirements.

- Facilitating risk. The risk to the teacher is low, as all information is supplied in a step-by-step manner.

- Other. This curriculum module on *Computers are Amazing!* would, generally speaking, be introduced in a history or mathematics class.

- **Process: (step by step)**
    1. To stimulate interest, ask the students to share out loud "how they use computers in their daily lives".
    2. Post their ideas/suggestions.

3. Ask if they know any national or local women throughout U.S. history who are or who have been engaged in contributing the field of mathematics and developing computers and the internet – alternatively, have students answer the quick quiz or word search puzzle provided later in this document.
4. Show the PowerPoint presentation that identifies (listed by historical year) both the women and their contributions.
5. Use the note pages that are below the slides to help provide the narrative you will say. (Or, print out the notes in a script format for yourself.)
6. Stop at any time during the slides to take questions or to pose issues to your class.
7. After the slides, conclude the module by returning to the ideas they had offered before the discussion and determine any new elements that have arisen as a result of what the students have seen.
8. Create an assignment list from the choices noted below, that you wish to pursue.
9. Give out your "add-on" assignments with due dates you assign, length you choose, and the like.

- Assignment Topics [Note to Teacher: The optional assignments vary in their difficulty and complexity. The description below is a summary of each of the assignments. They are described in more detail on the notes section of each slide.]

1. Christine Ladd-Franklin. Assignment on binary system.
2. Amalie Emmy Noether. Assignment on hexadecimal mathematics.
3. Admiral Grace Murray Hopper. Assignment on computer memory and pointers.
4. Euphemia Lofton Haynes. Assignment on memory and storage space requirements.
5. Vinita Gupta. Assignment on text compression.
6. Anita Borg. Assignment on color optimization.
7. Ann Livermore. Assignment to learn about sorting.
8. Carol Kovac. Assignment on prime and composite numbers.

Be sure to connect with us if you have any questions or issues. Also, let us know how your module goes!

Most Sincerely,

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Glossary:

Algebra (OWL·gee·bra): a branch of mathematics that uses equations to describe relationships between quantities
Binary (BYE·nuh·ree): made up of two parts
Compiler (come·PILE·er): computer software that translates human languages into numbers the computer understands
Compression (come·PRESS·shun): to press together or squeeze; to make smaller
Hexadecimal (HECKS·ah·des·ah·mull): base 16 arithmetic
Logic (LODGE·ick): the science of reasoning
Software (SAWFT·wear): programs for a computer. The computer equipment itself is called hardware.
Theory (THEE·uh·ree): an idea about how to do something or how something works.

Quick Quiz – Match the Woman With Her Accomplishment

Many women have contributed to the fields of mathematics and computer science. Place the letter of the woman in the space in front of her numbered accomplishment.

A. Admiral Grace Murray Hopper
B. Ann Livermore
C. Christine Ladd-Franklin
D. Euphemia Lofton Haynes
E. Vinita Gupta
F. Carol Kovac
G. Amalie Emmy Noether
H. Anita Borg

_____ 1. She worked for IBM. She helped bring computer technology into the healthcare industry.

_____ 2. She developed the Systers email list for women computer scientists..

_____ 3. She was a mathematician and educator. She was the first black woman to earn a PhD in mathematics in the U.S.

_____ 4. She is an electrical engineer. She started a company. Her company makes equipment that allows us to use the internet.

_____ 5. She developed the first computer compiler. She found the first computer bug. There is a U.S. Navy destroyer named in her honor.

_____ 6. She was a mathematician who studied logic.

_____ 7. She works for Hewlett-Packard. She makes equipment that helps us use the internet.

_____ 8. She loved mathematics. Her field was abstract algebra.

ANSWERS:

Additional information on all of these women is contained within the book *Her Story: A Timeline of the Women Who Changed America* (HarperCollins, 2008) by Charlotte S. Waisman and Jill S. Tietjen.

Let's see how you did.

1. F
2. H
3. D
4. E
5. A
6. C
7. B
8. G

Computers Are Amazing!
Word Search Game

A	B	E	C	A	R	G	B	H	E	R	U	X	A	O
N	E	U	P	H	E	M	I	A	N	E	C	J	M	T
I	N	F	J	I	R	R	W	Y	W	H	Y	V	A	D
L	M	U	S	L	H	T	C	N	A	T	M	D	L	G
K	L	O	F	T	O	N	E	E	M	E	M	A	I	C
N	A	W	T	C	P	I	B	S	Q	O	E	N	E	A
A	D	K	F	G	P	T	Y	V	B	N	D	I	P	V
R	D	M	R	S	E	A	O	U	I	M	E	T	Z	O
F	E	O	Y	A	R	H	F	T	A	N	J	A	E	K
D	B	H	W	R	F	J	S	N	L	B	I	N	K	G
D	R	P	U	I	K	I	D	S	P	L	G	T	V	U
A	T	M	U	S	R	D	G	O	J	C	O	V	A	C
L	V	Y	R	H	L	H	N	G	U	P	T	A	H	R
A	O	G	C	A	R	O	L	I	K	F	K	H	N	I
Y	L	B	L	I	V	E	R	M	O	R	E	Y	P	N

Find each name of the amazing women in mathematics and computer science:

Christine Ladd-Franklin
Amalie Emmy Noether
Grace Murray Hopper
Euphemia Lofton Haynes
Vinita Gupta
Anita Borg
Ann Livermore
Carol Kovac

Answers to Problems in Powerpoint Slides:

Christine Ladd-Franklin

Decimal 20 = 10100 in the binary system
Decimal 32 = 100000 in the binary system
Decimal 70 = 1000110 in the binary system
In the binary system, these numbers are all exponents of 2 (2, 4, 8, 16, 32, 64, 128 = 2^1, 2^2, 2^3, 2^4, 2^5, 2^6, etc.)

Amalie Emmy Noether

Decimal 30 = 1E hexadecimal
Decimal 48 = 30 hexadecimal
Decimal 150 = 96 hexadecimal
Decimal 255 = FF hexadecimal

Admiral Grace Murray Hopper

THIS IS HOW A COMPUTER WORKS.

Euphemia Lofton Haynes

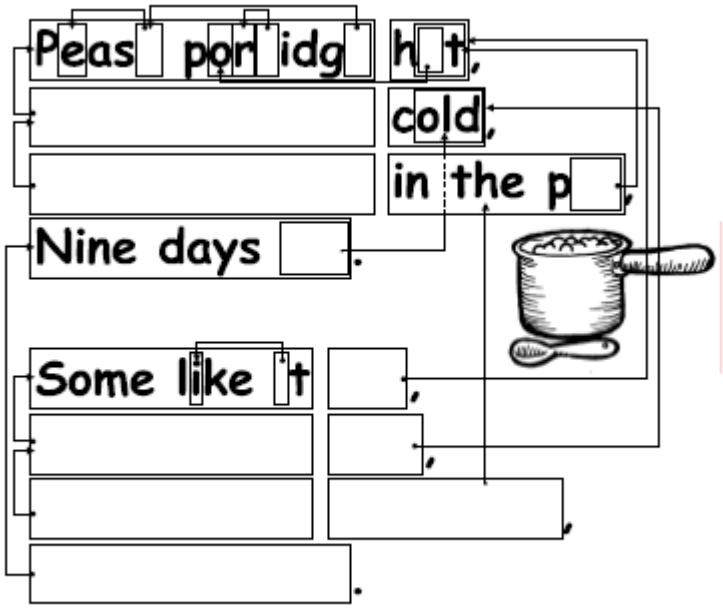
Use as close to 4,600 characters per block as possible. Since each record is 503 characters long, divide 4,600 by 503. Rounding to the nearest whole number, the best answer is 9 records per block.

Use as close to 18,400 characters per block as possible without going over. Record size is 503, so divide 18,400 by 503. A block cannot contain more than 18,400 characters, so even though the answer is more than 36.5, round down to 36 since an answer of 37 would result in 18,611 characters – more than the maximum number of characters. Using 36 records per block, find the total number of blocks needed by dividing the total number of records (115,000) by the number of records per block (36). The answer is 3,195. In this case, round up since 3,194 blocks were used, plus one partial block. This is not quite half of the disk.

No more than 6,800 blocks can be used, and there are 115,000 records to store using as close to 4,600 characters per block as possible. One way to figure out the answer is to divide the 115,000 records by the total number of blocks (6,800). Taking the answer 16.91, round up to 17. (Sixteen is closer to the most desirable answer of nine, but 16 would require more than 6,800 blocks). For this question, the best answer is 17 records per block.

Note that by using a block size, 115,000/9 or 12,778 total blocks would be used – nearly two magnetic disks. Minimizing space uses 3,194 blocks, which is about 47% of one disk. Very often in business data processing, there are compromises, as in the third part of this problem. The goal is to spend as little money as possible on equipment (in this example no more than one magnetic disk).

Vinita Gupta



Anita Borg

Note: More than 4 colors are never required.

Ann Livermore

Generally, the sorting process that uses two groups of four will be faster.

Carol Kovac

	Number of letters in first name	Prime or Composite?	Number of letters in last name	Prime or Composite?	Number of letters in complete name	Prime or Composite?
Christine Ladd-Franklin	9	C	8	C	21	P
Amalie Emmy Noether	6	C	7	P	17	P
Grace Murray Hopper	5	P	6	C	17	P
Euphemia Lofton Haynes	8	C	6	C	20	C
Vinita Gupta	6	C	5	P	11	P
Anita Borg	5	P	4	C	9	C
Ann Livermore	3	P	9	C	12	C
Carol Kovac	5	P	5	P	10	C

Additional References and Sources of Problems in Powerpoint Slides:

Parker, Marla, editor. *She Does Math! Real-Life Problems from Women on the Job.* The Mathematical Association of America: Washington, DC. 1995.

Perl, Teri. *Math Equals: Biographies of Women Mathematicians + Related Activities.* Addison-Wesley Publishing Company: Menlo Park, California. 1978.

Computer Science Unplugged: http://csunplugged.org/