



THE HISTORY OF COMPUTERS

Teacher's Guide



INTRODUCTION

This Teacher's Guide provides information to help you get the most out of The History of Computers. The contents in this guide will allow you to prepare your students before using the program, assist them as they navigate through the program, and present follow-up activities to reinforce the program's key learning points.

LEARNING OBJECTIVES

To gain an awareness of the technological and historical development of the modern computer.

After viewing this program, students will...

- Have an understanding of the many steps it took to create the computers we have today
- Be introduced to the pioneers who built on each other's ideas
- Understand that WWII played a role in the computer's development
- Understand that the Space Race pushed the development of computers
- Know how the PC originated
- Have an idea about the future of computers
- Understand why Boolean Logic and the Binary system are used in computers
- Realize that the computer was invented to fill specific needs
- Have an overview of the technological developments that progressed computing
- Know that businesses didn't use computers until the 1950's

EDUCATIONAL STANDARDS

This program correlates with the following National Standards for Technology Education:

- Recognizes that an understanding of how things work and designing solutions to problems of almost any kind can be facilitated by systems thinking, which

employs mathematical modeling and simulation

- Identifies features and uses of current and emerging technology related to computing.
- Knows of significant advances in computers and peripherals.
- Knows that science and technology are pursued for different purposes (i.e., scientific inquiry is driven by the desire to understand the natural world and seeks to answer questions that may or may not directly influence humans; technology is driven by the need to meet human needs and solve human problems).
- Knows examples of advanced and emerging technologies (e.g., virtual environment, personal digital assistants, voice recognition software) and how they could impact society.
- Knows that technology can benefit the environment by providing scientific information, providing new solutions to older problems, and reducing the negative consequences of existing technology (e.g., monitoring a habitat or measuring greenhouse gases, improving renewable energy sources, and creating scrubbers to improve coal-burning facilities).

PROGRAM OVERVIEW

This video covers the pioneering people who built on each other's knowledge and experience to develop computers as we know them. It begins with the concept of a computer and follows some of the key developments in technology. The focus is on the people and the machines that made an impact or presented a next step in computer development.

MAIN TOPIC AREAS

- **Topic 1: Defining a computer**

The program starts with an introduction to computers, what they are, and their four defining characteristics.

■ **Topic 2: The first computer**

Scientists, mathematicians, and engineers in Europe and North America race to create the first computational computer, the first running, programmable computer, and the first stored, programmable computer.

■ **Topic 3: Advances that made computers more user-friendly**

This section reviews the progress made in the computer industry to write a universal language, and the development of personal computers and integrated circuits.

■ **Topic 4: The future of computers**

The program describes how computers have become more powerful, less costly, and smaller in size. One of the newest advancements in computers is artificial intelligence.

FAST FACTS

1. December, 1941: Zuse finishes his Z-3 calculator.
2. June 21, 1948: First program run on the Manchester Mark 1.
3. The president in the 1952 election is predicted by UNIVAC.
4. December, 1947: The transistor is invented at Bell Labs (Lucent).
5. Summer, 1958: The integrated circuit is invented by Jack Kilby at Texas Instruments.
6. Moore's Law: The number of components that can fit on an integrated circuit will double every eighteen months.
7. 1971: Tedd Hoff of Intel invents the microprocessor (the 4004).
8. 1974: The Altair is invented by H. Edward Roberts. It's the first successful Personal Computer.
9. 1985: Windows is introduced.

VOCABULARY TERMS

Artificial Intelligence: When a computer can communicate with a human without the human knowing it is a computer.

Binary System: A base two counting system that uses only ones and zeros. This works well with computers that have on/off switches. 'On' can be 'one' and 'off' can be 'zero,' or visa versa.

Boolean Logic: A mathematical logic that uses simple questions like AND, OR, and NOT to perform calculations.

Capacitors: A form of memory that uses electrically charged plates to hold numbers.

Computer: Machine that has internal memory for data and programs, a processor, and input and output.

Integrated Circuit: A block of silicon with components such as transistors, capacitors and resistors built into it.

Internet: World wide computer accessed communication, business, and information system.

Magnetic Core Memory: Using magnets as memory. The southern and northern polarity of a magnet can be chosen to equal a one or a zero.

Stored Program Computer: The programs are stored in memory right along with the data to be processed.

Quantum Computer: A computer that uses laser controlled ions as bits. It can perform length-equations all at once instead of step-by-step.

PRE-PROGRAM DISCUSSION QUESTIONS

1. What criteria would you use to determine which was the first computer?
2. What are some of the reasons that computers were built?
3. How would you define the term 'computer'?
4. What is the difference between a computer and a calculator?
5. What would you want a computer to be able to do?
6. What is the future of computing?
7. Have computers been detrimental to some aspects of life?

8. How have computers benefited our world?

POST-PROGRAM DISCUSSION QUESTIONS

1. What is the origin of the Internet?
2. Who were some of the people who made the first PCs useful?
3. Which pioneers contributed what to the development of the computer?
4. What were the initial problems in getting the Personal Computer to be useful?
5. Where did Apple computers get their ideas for the revolutionary MAC?
6. Which computer was the first to be a household name, and why?
7. Why did John Atanasoff want to build his own computers?
8. Which early computers represented major steps in the development of modern computers?
9. What is the historic progression in types of memory?
10. How advanced would computers be if the military had not been interested in them?

GROUP ACTIVITIES

1. Solve a set of mathematical problems using the binary system.
2. Boot up a computer in DOS and operate it using DOS commands.
3. Write a simple FORTRAN program for finding prime numbers, and execute it.

INDIVIDUAL STUDENT PROJECTS

1. Research and report on the English forerunners of computers, the code-breaking machines of WWII.
2. Do an Internet search for collections of old computers in your area. Arrange a field trip to see the computers and hear about their history.
3. Check with a local university to see if someone in the Computer Science department is knowledgeable

about the history of computers. Invite him or her to speak.

4. Research quantum computers and report the latest developments.
5. Research IBM, Bell Labs, Xerox PARC, and other computer research centers for futuristic work being done.

INTERNET ACTIVITIES

1. Access Bell Labs, IBM, Xerox PARC, Stanford Research Institute, and other websites to formulate an overview of current trends in computer development.
2. Choose a specific brand and model of a computer and do in-depth research about its development.
3. Find out what some of the PC pioneers are doing today. There's information on Steve Jobs, Steve Wozniak, H. Edward Roberts, Bill Gates, Paul Allen, Ted Hoff, and Doug Engelbart on-line.

ASSESSMENT QUESTIONS

Q: Describe a stored-program computer.

A: A computer that has the program stored in memory right along with the data to be processed.

Feedback: Many early computers did not have a way to store programs internally. These are not considered to be true computers by modern definition. They were forerunners of the modern computer.

Q: What is the binary system?

A: A base two system of mathematics using ones and zeros.

Feedback: Normally we use base ten in mathematics (the digits zero through nine). The system that works best for computers uses only two digits: one and zero. This allows for the electronic switches to represent a one or zero by being either off or on.

Q: Who started building computing machines in Germany?

A: Konrad Zuse.

Feedback: Zuse was the first person in the twentieth century to build a computing machine. The first of his machines to actually work well was the Z-3. The Z-1 and Z-2 didn't operate accurately.

Q: Who was the first person in the United States to build a computing machine?

A: John Atanasoff.

Feedback: Atanasoff was a college professor who was tired of doing complicated mathematics on adding machines. He devised a computing machine called the ABC.

Q: Who created the first microprocessor?

A: Tedd Hoff.

Feedback: Hoff was an engineer at Intel. He realized that there were enough components in existence to create a computer on one chip of integrated circuit.

Q: Who created the first successful Personal Computer?

- A. Steve Wozniak
- B. H. Edward Roberts
- C. Gary Kildall
- D. Paul Allen

A: H. Edward Roberts

Feedback: Roberts owned an electronics company called MITS. It was based in Albuquerque, N.M. He created the Altair computer.

Q: Which computer ran a program on June 21, 1948?

- A. Harvard Mark 1
- B. EDSAC
- C. Manchester Mark 1
- D. EDVAC

A: Manchester Mark 1.

Feedback: This was a British computer that was based on U.S. computer designs. It was a prototype, meaning that it was just a test model of a much larger computer. It ran the first internal stored program on that date.

Q: Which computer correctly predicted the winner of the U. S. presidential election of 1952?

- A. ENIAC
- B. BINAC
- C. EDSAC
- D. UNIVAC
- E. EDVAC

A: UNIVAC.

Feedback: John Mauchly and J. Presper Eckert created the UNIVAC to be the first general purpose business computer. They wanted publicity for it, so they put it on television to predict the winner of the election. UNIVAC became a household name.

Q: Who created magnetic or iron-core memory?

- A. John von Neumann
- B. Jay Forrester
- C. Thomas Watson Sr.
- D. Jack Kilby

A: Jay Forrester

Feedback: Forrester developed iron-core memory for the Whirlwind computer. The magnets could be given a southern or northern polarity. One polarity would represent a one and the other a zero. When it was installed in 1953, Whirlwind's operating speed doubled.

Q: What is a "chip"?

- A. A transistor
- B. A capacitor
- C. An integrated circuit
- D. A silicon diode

A: An integrated circuit.

Feedback: An integrated circuit has components on it, like transistors and capacitors. It was invented by Jack Kilby at Texas Instruments.

Q: Grace Hopper programmed the Harvard Mark 1. True or False?

A: True

Feedback: The Harvard Mark 1 was a military calculator, and in 1944 the Navy sent Lt. Hopper to program it. She went on to program the Harvard Mark 2 & 3. She continued to program computers into the early 1990's.

Q: Steve Jobs designed the Mac icons. True or False?

A: False

Feedback: Susan Kare was the designer of the various icons as well as the overall look of the GUI (graphic user interface).

Q: Bill Gates and Paul Allen created a version of DOS that worked on the Altair. True or False?

A: False

Feedback: Gates and Allen created a version of BASIC for the Altair. IBM hired them to create a version of DOS for its PC.

Q: Charles Babbage's Analytical Engine could add and subtract, but it could not multiply and divide. True or False?

A: False

Feedback: Like a modern calculator it could add, subtract, multiply and divide. It used rods, levers and gears to operate.

Q: Transistors are semiconductors. True or False?

A: True

Feedback: They have the ability to conduct electricity. That is what allows them to act as switches, or ones and zeros, in a computer.

BOOK RESOURCES

- *Bit by Bit: An Illustrated History of Computers*, by Stan Augarten
- *A History of Modern Computing*, by Paul Cerruzi.
- *Computer: A History of the Information Machine*, by Kelly Campbell.

OTHER RESOURCES

The Computer Museum History Center
Chris Garcia (650) 604 2572
www.computerhistory.org

Computer Museum of America
David Weill (619) 465 8226
www.computer-museum.org







