

Lesson 1.6: Pioneers and Problems Solved by Computers

Objectives

In this lesson, students will:

- ❖ Be Introduced to Computer Science pioneers
- ❖ Learn to reflect on and consider problems in our lives that could be solved by computers
- ❖ Research contributions by a Computer Scientists
- ❖ Practice presenting their ideas to others

Agenda

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| 1. Computing Pioneers and their Contributions | 10 mins |
| 2. Student Activity: Role of Computers in our World, Exercise 1 or Exercise 2 | 25 mins |
| 3. Class Discussion and Wrap Up | 15 mins |

Preparation

- Print student activity worksheet, one per team.

Resources & Links

- Grace Hopper video: <https://tinyurl.com/hnvfywo>
- Addendum: Computer Science Pioneers (at the end of the lesson plan). Can optionally be incorporated into the lesson or just used as reference material.

1. Computing Pioneers and Their Contributions

The art of Computer Science often starts with a problem that needs to be solved. Throughout history, humans are always in search of finding solutions to problems and to make things more efficient, less dangerous and easier. In the last 100 years or so, computers have played a big role in solving problems around us and have a big impact on everything we do in life.

In the history of computing there have been many pioneers that have made big contributions to the advancement of computing systems, often by trying to solve a problem they were faced with.



One of the many computing pioneers was Grace Hopper. Here is a short video about her:

<https://tinyurl.com/hnvfywo>

Class Discussion



Discussion Points:

- Who was Grace Hopper?
- What did she study?
- What did she create?
- What is she known for?

2. Student Activity: Role of Computers in our World



There are 2 exercises in this activity. Choose one for your class or optionally allow students to choose the one they would like to work on. One of them could also be used as a homework assignment.

Students are grouped into teams of 2-4.

Explain the exercise to students and relate the examples given below.

Exercise 1 Instructions:

Explain the activity from the worksheet. Additionally, give the following example as a problem that could be solved with the help of a computer.

Example of a problem that could be solved by a computing system:

A street light in Allan’s neighborhood has been out for 3 weeks. The street is very dark and it is scary to walk there in the evening. The city has not fixed the light. Maybe they don’t know it is broken? One way to solve the problem could be to install a sensor that detects the light does not come on at night; it then sends a signal to a computer in the city office letting them know the light needs to be fixed. That way it can be repaired as soon as it is broken.

Exercise 2 Instructions:

Explain the activity from the worksheet. Additionally, give the following example for Grace Hopper of how they can answer the guiding questions for their research of another Computer Science pioneer.

1. What did the person invent or build?
Grace Hopper created a compiler to translate source code into computer language
2. Where did they live and what did they study?
She lived in New York and studied Math and Physics
3. What problem did the person try to solve with a computer or computing system?
She believed computer languages should look like english. She created a compiler that translates source code (programming language code we can read) into computer code.
4. What challenges did they have or overcome ?
She re-applied to Vassar college even though she was rejected the first time
5. What contribution did the person make to our history or what is the person known for?
She is known for the term “debugging”, she created a compiler and worked on the COBOL language committee

After students complete the activity, each team shares their research and ideas as a team.

3. Class Discussion



Each team shares a few items from their research and team brainstorming exercise.

Student Activity: Role of Computers in our World

Exercise I: Solving Problems with Computers

What to do:

1. On your team, come up with some problems you see in your school, on the street, in your city or in the world.
2. Somebody on the team should write down all your ideas and solutions. You can take turns being the notetaker.
3. Pick 1 of the problems and discuss ideas of how computers could solve this problem. If you finish early, pick another problem and come up with ideas of how to solve it.
4. Be prepared to share your ideas as a team.

Exercise II: Computing Pioneers

Here is a list of people who have made contributions to the advancement of computers.

Alan Turing
 Charles Babbage
 Erna Schneider Hoover
 Ida Rhodes
 Ada Lovelace
 Nakamatsu Yoshiro
 Tim Berners-Lee

What to do:

1. Pick a name from the list and conduct some online research on the person.
2. Focus your research on the person's impact and contribution to Computer Science. Try to answer the list of questions below about the person you picked.

It is not necessary to answer every question, but as many as you can. Be prepared to share your research with the class.

3. Questions:
 - a. What did the person invent or create?
 - b. Where did they live and what did they study?
 - c. What problem did the person try to solve with a computer?
 - d. What challenges did they have or overcome?
 - e. What contribution did the person make to our history or what is the person known for?

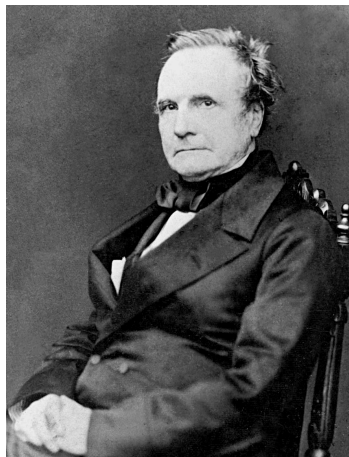
Be prepared to share.

Addendum: Computer Science Pioneers

Do you know when the first computer was invented?

The answer depends somewhat on what we mean by computer. The first programmable computer, the Z1 was created by German **Konrad Zuse** in his parents' living room between 1936 and 1938. It is considered to be the first electro mechanical binary programmable computer, and the first really functional modern computer.

However, many years before that, in 1822, British mathematician and inventor **Charles Babbage** invented the first mechanical computer. Mathematical tables were important in Babbage's era for use in navigation, science and engineering. They were calculated by hand and then compiled into tables. Errors were sometimes made either in the calculation or in the compiling of the tables.



It is with this background that Babbage decided to design a mechanical device that could perform calculations. Such a machine would always be accurate and would save time and money.

During the mid-1830s Babbage developed plans for the Analytical Engine, the forerunner of the modern digital computer. In that device he envisioned the capability of performing any arithmetical operation on the basis of instructions from punched cards, a memory unit in which to store numbers, sequential control, and most of the other basic elements of the present-day computer. His machines were considered as one of the very first mechanical computers ever to be invented. The fact that they were not actually built was not due to a design flaw but rather, it was due to lack of funding.

At a young age **Ada Lovelace met** Charles Babbage. They became friends, and the much older Babbage served as a mentor to Ada.

Ada, a writer and also a mathematician, was fascinated by Babbage's ideas and machines. Ada was later asked to translate an article on Babbage's **analytical engine**. She not only translated the original French text into English, but also added her own thoughts and ideas on the machine. Her notes ended up being three times longer than the original article.



In her notes, Ada described how codes could be created for the device to handle letters and symbols along with numbers. She also theorized a method for the engine to repeat a series of instructions, a process known as looping that programs use today, as we know. Ada also offered up other forward-thinking concepts in the article. For her work, Ada is often considered to be the first computer programmer. Ada Lovelace's contributions to the field of computer science were not discovered until the 1950s. Her notes were reintroduced to the world by B.V. Bowden.

Another pioneer whose work and invention had a significant impact on humanity is **Alan Turing**, often called the father of modern computing. He was a brilliant mathematician and logician. He was the first person to think of using a computer to do things that were too hard for a person to do. He developed the idea of the modern computer and artificial intelligence.



At the outbreak of World War Two, Alan joined the Government Codes and Cypher School at Bletchley Park. He worked on breaking the code for the German Enigma machine, a device for sending coded messages to units of the German forces. Alan developed a machine (the Bombe) which helped break the code. He also went on to break the Naval Enigma, an even more complicated machine. His wartime services helped to win the war, but his work was so secret that very few people

were aware of the importance of what he had done at Bletchley Park.

It has been estimated that his work shortened the war in Europe by more than two years and saved over 14 million lives.