

Europeana Learning Scenario

Title:

How the hardware is chasing Moore's Law

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Abstract

The teaching scenario elaborates and describes the differences between computers from past centuries and modern computers used today. The goal is to emphasize the fact of rapidly evolving technology. What do you use technology for? Do you think your computers are powerful enough to perform all the tasks you assign them? Were computers much slower in the past than they are today? And will they be faster in the future? Students will be divided into three teams and will search for computers from the last century using the Europeana portal to explore the specifications of those computers. Students will then search the internet (e.g. Wikipedia) to find the specifications of today's computers. They will compare the specifications of then and today's computers and conclude whether Moore's law holds. Moore's law is the observation that the number of transistors in a dense integrated circuit doubles approximately every two years. The observation is named after Gordon Moore, CEO of Intel. The trend begins with the invention of the integrated circuit in 1958. Using digital tools, each team will present their work to other teams, and each team will evaluate the success of presenting the work of other teams. The assessment method will be a Kahoot quiz, and feedback and discussion will be given using a Mentimeter.

Keywords

Old computers, modern computers, computer specifications, CPU, Moore's Law.

Table of summary

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Subject	Informatics
Topic	Computer hardware and properties
Age of students	13-14
Preparation time	2 hours
Teaching time	90 minutes
Online teaching material	<u>Online:</u> 1. Introductory activities: 1.1 Game - find pairs



	<ol style="list-style-type: none"> 1.2. Video: Old computers - manufacturer and date of manufacture 2. QR codes (students can use these QR codes – every QR code leads them to europeana source). 3. Work on the presentation (students can choose one of the following tools): <ol style="list-style-type: none"> 3.1. Piktochart, 3.2. Google Slides, 3.3. Office tools (Office365 - Word Online, PowerPoint Online, Sway) . 4. Peer evaluation <ol style="list-style-type: none"> 4.1. Team 1 evaluates Team 2 and 3, 4.2. Team 2 evaluates Teams 1 and 3, 4.3. Team 3 evaluates Team 1 and 2. 5. Kahoot quiz (it can be played as a guest, no need for login). 6. Assessment. 7. Wikipedia.
Offline teaching material	Workbook (optional)
Europeana resources used	<ol style="list-style-type: none"> 1. Macintosh <ol style="list-style-type: none"> a) Macintosh 1, b) Macintosh 2, c) Macintosh 3. 2. IBM <ol style="list-style-type: none"> a) IBM 1, b) IBM 2, c) IBM 3. 3. Toshiba <ol style="list-style-type: none"> a) Toshiba 1, b) Toshiba 2, c) Toshiba 3.

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Integration into the curriculum

Student describes the structure of computer devices, explains the ways of data transfer in a computer and analyzes and evaluates some features of the computer that significantly affect the quality of the computer itself (Croatian national curriculum, 8th grade).

Aim of the lesson

Students will compare specifications of old computers with specifications of modern computers and learn about how technology is progressing rapidly. Students will investigate whether Moore's law holds. They will present their research to other teams.

Outcome of the lesson

Through the presentation of the work, students will make a short research and conclude about whether the number of transistors doubles every two years.

Trends

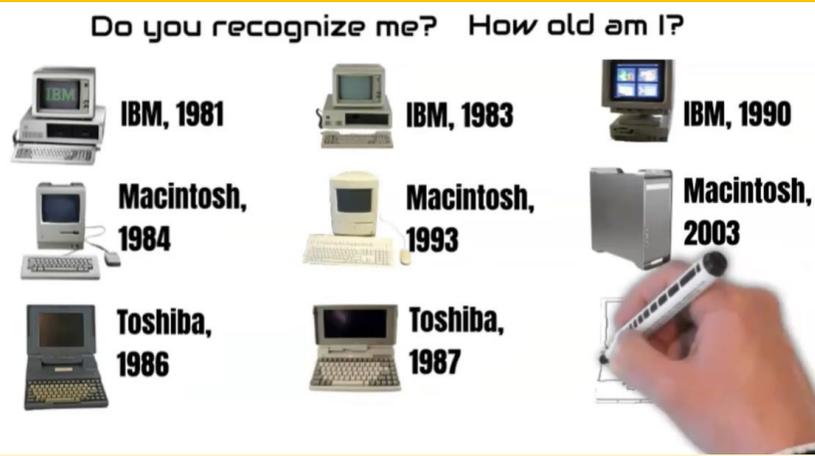
- Collaborative Learning: a strong focus on group work,
- Peer Learning: students learn from peers and give each other feedback,
- Student Centered Learning: students and their needs are at the center of the learning process,
- Visual Search & Learning: images and multimedia are more powerful than verbal stimuli,
- Open Source Learning: teachers copy, share, adapt, and reuse free educational materials,
- Learning materials: shift from textbooks to web resources and open source books,
- BYOD: students bring their own mobile devices to the classroom (if they want to).

21st century skills

- Critical thinking: finding solutions to problems. Compare computer components and apply Moore's law.
- Collaboration: working with others in a team.
- Communication: talking to others.
- ICT skills: searching the Internet, using various digital tools to create and present work, solving quizzes.
- Media literacy: understanding the methods and outlets in which information is published.

Activities

Name of activity	Procedure	Time
1. Introductory activities	Students play a game of pairs to remember the capacity of RAM and the speed of the computer's processor (CPU). It is necessary to remember the ratio of GHz to smaller units. Students watch a short video about old computers. The video encourages them to think about the year the computer was manufactured, the computer manufacturers, and the specifications of the old computers. YouTube video (2:57).	5

Name of activity	Procedure	Time
	 <p>Do you recognize me? How old am I?</p> <p>IBM, 1981 IBM, 1983 IBM, 1990</p> <p>Macintosh, 1984 Macintosh, 1993 Macintosh, 2003</p> <p>Toshiba, 1986 Toshiba, 1987</p>	
<p>2. Team formation</p>	<p>Students will work in teams. There will be three teams. A team leader is selected. If epidemiological measures are in place, team members' collaboration can take place using digital tools such as Zoom or Teams, either in the classroom or at home.</p>	<p>2</p>
<p>3. Task assignment</p>	<p>Every group is given an assignment. One group is given an assignment to compare Macintosh computers and modern computers. The other group is given an assignment to compare IBM computers and modern computers. The third group is given an assignment to compare old Toshiba computers and modern computers. Each team will explain whether Moore's Law can be applied to the computers being compared.</p>	<p>3</p>
<p>4. Europeana search</p>	<p>Students search Europeana portal. Links are given above, but students can search and explore their own examples of old computers on Europeana portal. Keywords are: Mac, Macintosh, Apple Macintosh, IBM, Toshiba. Students will collect data for at least the following specifications:</p> <ol style="list-style-type: none"> 1. CPU speed, 2. Amount of RAM memory, 3. The price of a computer. 	<p>20</p>
<p>5. Internet search</p>	<p>Each team will explain whether Moore's Law can be applied to the computers being compared. Moore's Law refers to Moore's perception that the number of transistors on a microchip doubles every two years, though the cost of computers is halved. Students search (using Wikipedia, for example) for specifications of modern personal computers so they can compare them with specifications of old ones. For easier and more convenient recording, students can enter data into a spreadsheet (see annex below).</p>	<p>15</p>

Name of activity	Procedure	Time
	<p>Students will search for all the required specifications listed in activity 3 and will also answer the following questions:</p> <p>4. How many times is the processor of a modern computer faster than the computer you searched for on Europeana portal?</p> <p>5. After comparing old computers and computers of the present, do you think Mr. Moore was right? Explain why you think he was right or wrong.</p>	
6. Work on the presentation	<p>Students choose which digital tool to use to present their research. Students can use Word Online, PowerPoint Online, Google Slides, Piktochart, Sway... Students make a presentation.</p>	20
7. Teamwork presentation	<p>One team member presents their research using a digital tool. Each team has 5 minutes to present their work.</p>	15
8. Peer evaluation, self-assessment	<p>Each team will evaluate the presented research of other teams using the Microsoft Forms tool. Results will be published after all the presentations are presented and evaluations have been made. Links to peer evaluation: Team 1 evaluates Team 2 and 3, Team 2 evaluates Teams 1 and 3, Team 3 evaluates Team 1 and 2. Students perform a self-assessment using Kahoot quiz.</p>	10
9. Additional task (if time remains)	<p>Investigate the power of computers used in spacecrafts flying to the moon (Apollo missions).</p>	

Assessment

Students perform a self-assessment using [Kahoot](#) quiz. Correct answers are marked with a green tick.

1 - Quiz
I am Apple Macintosh 128 K. For the first time I saw the world

 20 sec

	60 years ago.	✗
	37 years ago.	✓
	3 years ago.	✗
	I don't exist.	✗

2 - Quiz

The picture shows a 1993 Macintosh Color Classic. The computer had a



- 1 MHz processor. ✗
- 16 MHz processor. ✓
- 2 GHz processor. ✗
- 6 GHz processor. ✗

3 - Quiz

The picture shows Power Mac G5. It was produced from 2003 to 2006. It had a processor power of



- 0.2 - 0.5 MHz ✗
- 100 - 500 MHz ✗
- 500 MHz - 1 GHz ✗
- 1.6 - 2.7 GHz ✓

4 - Quiz

The figure shows an IBM computer from 1983 that had



- 512 KB of RAM. ✗
- 1 KB of RAM. ✗
- 64 KB of RAM. ✓
- 200 MB. ✗

5 - Quiz

91 / 5000 Translation results The picture shows a 1987 Toshiba computer. What was the price of th...



- US\$6,499 (equivalent to \$14,626 in 2019) ✓
- US\$499 (equivalent to \$2,626 in 2019) ✗
- US\$99 (equivalent to \$626 in 2019) ✗
- US\$9 (equivalent to \$26 in 2019) ✗

6 - Quiz Moore's law is the observation that the number of transistors in a dense integrated circuit (IC) d...	
<input type="checkbox"/> half a year.	✗
<input type="checkbox"/> year.	✗
<input checked="" type="checkbox"/> two years.	✓
<input type="checkbox"/> three years.	✗
7 - Quiz The trend (of Moore's Law) begins with the invention of the integrated circuit in	
<input type="checkbox"/> 1950	✗
<input checked="" type="checkbox"/> 1958	✓
<input type="checkbox"/> 1960	✗
<input type="checkbox"/> 1965	✗

***** AFTER IMPLEMENTATION *****

Student feedback

[Mentimeter](#) can help assess the understanding of student activities and help to improve teacher's work.

Given explanations are:

1. I didn't understand what my role in the team was. I don't think I did very well.
2. I understood everything I had to do, but there was not enough time to complete the tasks.
3. I understood everything what I needed to do and it wasn't hard. More, please! 😊



Teacher's remarks

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About the Europeana DSI-4 project

[Europeana](#) is Europe's digital platform for cultural heritage, providing free online access to over 53 million digitised items drawn from Europe's museums, archives, libraries and galleries. The Europeana DSI-4 project continues the work of the previous three Europeana Digital Service Infrastructures (DSIs). It is the fourth iteration with a proven record of accomplishment in creating access, interoperability, visibility and use of European cultural heritage in the five target markets outlined: European Citizens, Education, Research, Creative Industries and Cultural Heritage Institutions.

[European Schoolnet](#) (EUN) is the network of 34 European Ministries of Education, based in Brussels. As a not-for-profit organisation, EUN aims to bring innovation in teaching and learning to its key stakeholders: Ministries of Education, schools, teachers, researchers, and industry partners. European Schoolnet’s task in the Europeana DSI-4 project is to continue and expand the Europeana Education Community.

Annex

Apple Mac(intosh) – old computers (Europeana)				
Number	Year of manufacture/ introduction	CPU speed	Amount of RAM memory	Price
1				
2				
3				
Modern (present) computers – web search				
1				
2				
3				

Table 1. Table for comparison of Europeana search (Macintosh) and web search

IBM – old computers (Europeana)				
Number	Year of manufacture/ introduction	CPU speed	Amount of RAM memory	Price
1				
2				
3				
Modern (present) computers – web search				
1				
2				
3				

Table 2. Table for comparison of Europeana search (IBM) and web search

Toshiba – old computers (Europeana)				
Number	Year of manufacture/ introduction	CPU speed	Amount of RAM memory	Price
1				
2				
3				
Modern (present) computers – web search				
1				
2				
3				

Table 3. Table for comparison of Europeana search (Toshiba) and web search