MODULE 3: DESIGN AND MATHEMATICS.

LESSON PLAN

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Contents

1. Design and Mathematics.

1.1 General Information

Mathematics is a discipline almost as old as mankind itself. However, advances in research, big data and data analysis using algorithms mean that our needs are gradually changing. As a result of this completely natural evolution for society, many changes are proposed, such as, for example, the link between design and some methods of this discipline.

1.1.1 Brief description

This Lesson Plan aims to raise awareness of the importance of design and to learn about the unusual relationship between mathematics and design. By completing this lesson plan, you will be able to understand the links between these two disciplines and learn how to implement this knowledge through the following activities.

1.1.2 Learning objectives and IP topics

The learning objectives of this lesson plan are as follows:

- To understand the basic theory of intellectual property.
- To learn what is the function of design.
- How this part of intellectual property can be applied to mathematics, as well as to implement critical thinking about whether such implementation is the most appropriate.

1.1.3 Links to curriculum

This instructional exercise can motivate youngsters actively investigate and examine current technology breakthroughs and uses, with a focus on Mathematics. It improves cognitive (thinking) and affective (social/emotional) learning and is related to:

- Science
- Technology
- Arts
- Mathematics

1.1.4 Duration

The estimated time to complete this lesson plan will be approximately two hours, in a classroom of 20-25 students.

1.1.5 Extra materials required

To carry out this lesson plan, you will not need any extra materials in addition to those you would normally find in a normal classroom. The use of a screen and a projector will be necessary in order to use presentations to explain the content and activities.

1.2 Step-by-step instructions

First, in order to have defined activities, the class will be divided into groups of 5 people. The composition of the groups is fundamental for the development of the activities. The teacher must create the groups, which will carry out **three activities** related to critical thinking, the fundamental bases of **intellectual property**, the use of **design** in our days and its application, in this case, to **mathematics**.

Once the three activities have been completed, a whole class discussion will take place to engage students in reasoning and most importantly, to enhance their learning about this topic.

1.2.1 Introduction or orientation

In this Lesson Plan, three activities will be carried out on the chosen topic, which aim to:

- To develop critical thinking skills among the students.
- To argue about whether mathematics should or should not be patented.
- To take advice from experts in mathematics.
- To learn about the limits of intellectual property and design.

The three questions to be discussed in groups of 5 students will be as follows:

a) Why is it necessary to register designs? In this way, students should reflect on why this topic, which may be unknown to them, is fundamental to the functioning of society.

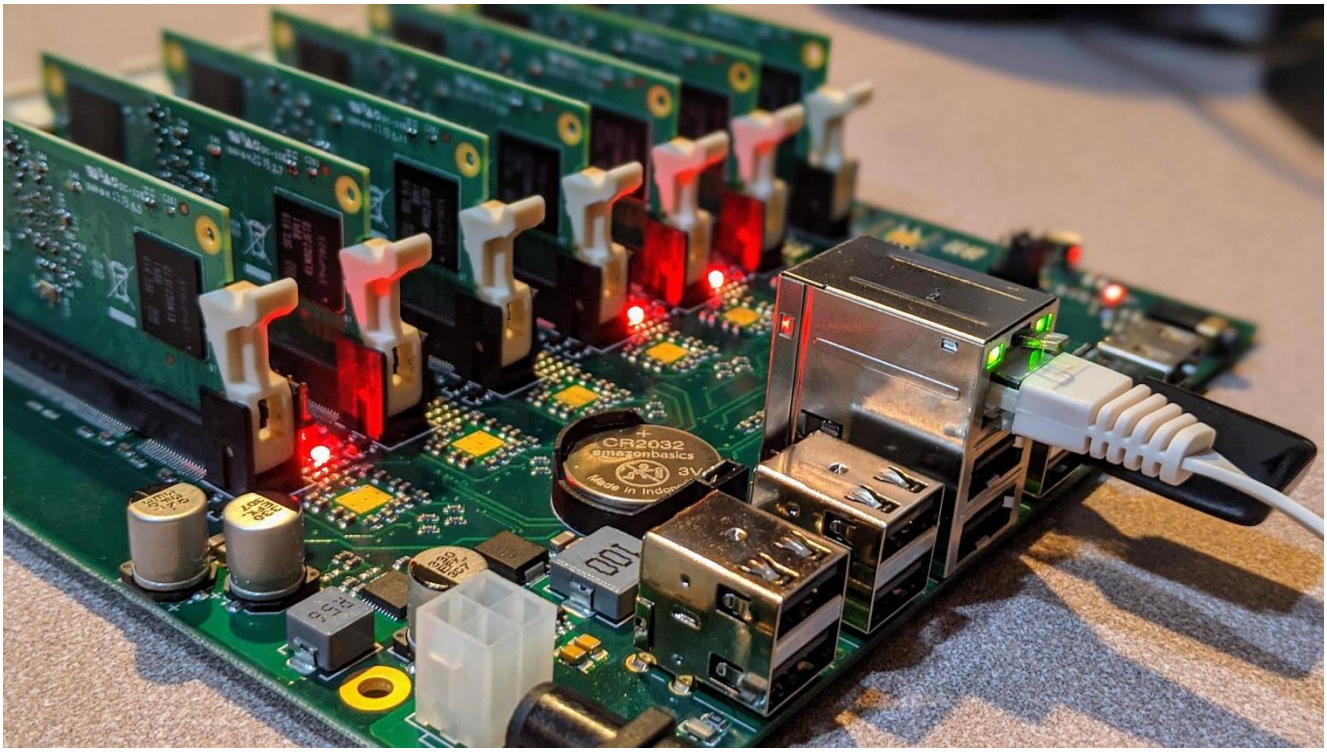
b) Mathematics is part of our society, and therefore, it is also part of the design process, therefore, it also participates, in one way or another, in its registration. Would you consider it appropriate that the mathematical procedures used also form part of the design?

c) Finally, students should reflect on whether the use of geometry should be regulated in designs and establish geometries that can only be used for registered designs and others that cannot.

1.2.2 Preparation or conceptualization

To prepare for this activity there will be two main topics related to mathematics. In this phase, students will have to warm up their critical thinking with the two topics presented below.

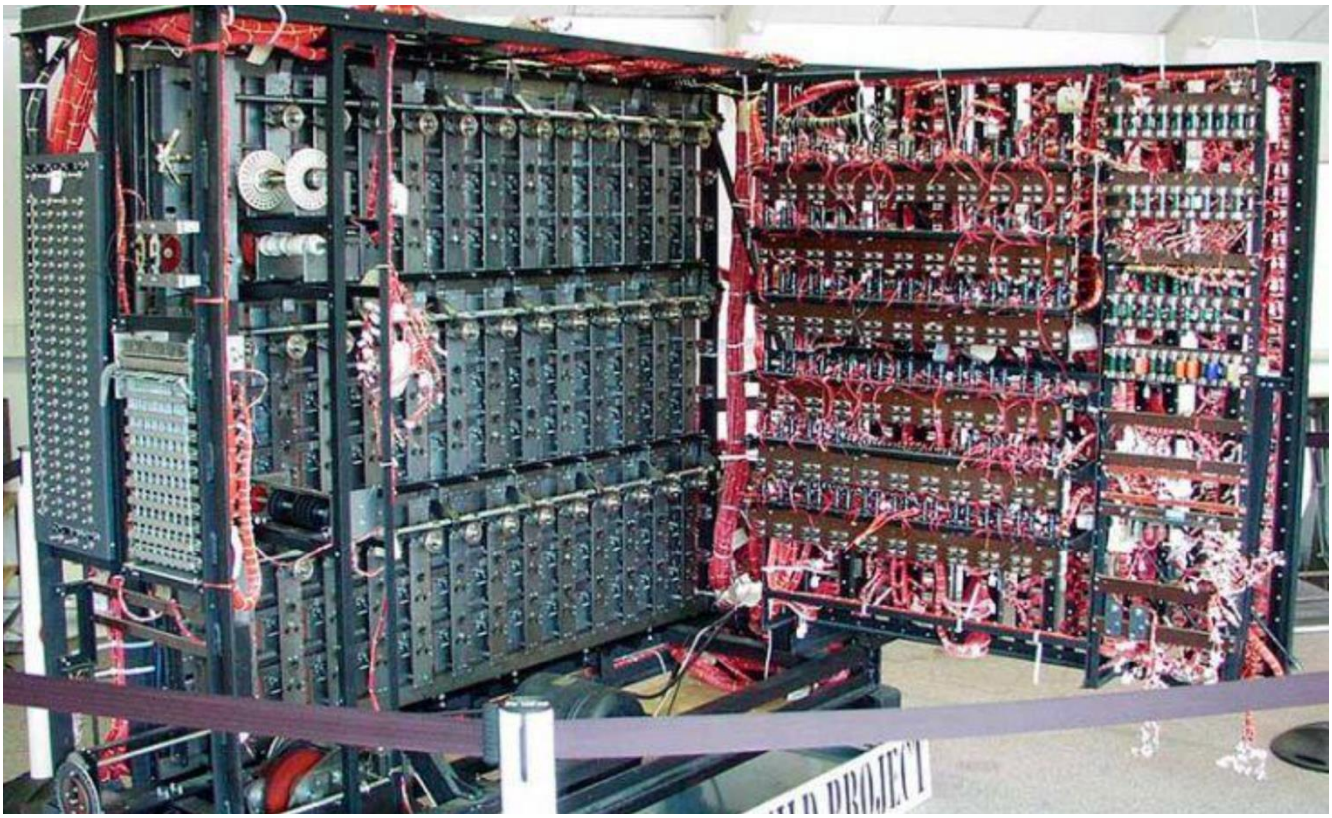
Firstly, the specific case of the Turing machine present in the modules.



Source: Pixaby

- Students will have to research about the Turing machine and how it has been modified over the years. They should also select some of its applications. To do this, they will need access to the internet.

Secondly, they will have to draw a parallel between the Turing machine and the Enigma machine, both created by Turing.



- Students should reflect on whether, if the enigma machine had been registered as a design, it would have had the same utility as when it was first used.

1.2.3 Investigation

During this phase:

1. Students should do some individual research on the concepts of design, Turing Machine and Enigma.

2. The teacher will divide the students into groups of 5. It is also possible for the students to agree among themselves to divide themselves into the different groups.

3. Once you have split up, you will have to focus on the three general questions in section 1.2.1 and come to common conclusions on the two proposed themes. All in relation to the two previously proposed topics related to the Turing machine and the Enigma machine.

Against this background, we propose the following two scenarios:

3.1. Now a new Turing machine project is created that includes all the previous modifications, but to develop the project, the rights to the previous modifications must be acquired. What alternative would you propose to gain access to these modifications without resorting to piracy?

3.2. The Enigma machine was a breakthrough not only in mathematical terms, but also in historical terms. He cites several hypothetical applications of this machine, but in a modern-day context.

4. After discussing the above scenarios, the students will have to answer the three initial questions and argue their answers in front of their classmates. At this stage, they should prepare a couple of slides to make their presentation more complete.

5. Once all the presentations of the classmates have been completed, a class discussion will be opened in which they will have to put all their ideas on the table. Afterwards, they will have to come up with a common idea or solution for each of the two scenarios proposed.

1.2.4 Conclusion

The aim of this activity is that through design and mathematics, students can learn more about the real world, implement creativity, make this subject more enjoyable and above all, use critical thinking and healthy debate to reach conclusions.

1.3 Key questions for knowledge testing

The lesson plan can be accompanied by a short quiz of about five key questions that can be used to check the learners' knowledge acquisition. Correct answers in multiple choice questions can be marked in bold.

Question 1: The registration of industrial designs belongs to intellectual property.
[True] [False]

Question 2: What is industrial design?
Any design made by machines
An industrial design constitutes the ornamental or aesthetic aspect of an article.
Both are correct

Question 3: How are industrial design rights enforced?
Industrial design rights are free and can be used by anyone.
Industrial design rights are enforced in a court of law, usually at the initiative of the right holder.

Question 4: What happens if I do not protect my industrial designs?
You have a serious problem
That the design can be used by everybody
Nothing, it doesn't matter whether it is registered or not.

1.4 References or additional resources

- https://d1wqtxts1xzle7.cloudfront.net/31049780/699-nordic-research-in-mathematics-education-with-cover-page-v2.pdf?Expires=1643974311&Signature=VmcI645xJ1KgL0D-U~NeSe3FY0cS3MbWuSjF23rbJl2gwC-PkzxjTPa0om-q3TKNurdt1HNjTAWflLNx-FKNiSV9A-dOEuvtqcUWRrYf9WgHrxLKa2TlVPLzf51NcmNHN~JdzGaZ8juROHLdKF3ZtJcug9mSMAMt9exOSt6lkvI2jDrp7o2s2E4yqoA-Ctrv3JkxOQyu7bolwyjGPBxxaqvhRkC7hrFlC5vvabAMnMydaLVuED8vV9gNdvLHbvtEXfmBbHQPOjRJ-iNZYrSKjEdS09jw~pJb1q3sfes9s-kbrH5OReRZIK-s3oSMkrSBW7o~dtoPMJUJHHG8WEvRTA__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA#page=18

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- https://es.scribd.com/document/341676978/Diseno-de-Una-Maquina-de-Turing-Scriven-Bratt
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