TEACHING UNIT 6

Introduction to Sustainability, Ethics and Legal Aspects of AI

DEVELOPING AN ARTIFICIAL INTELLIGENCE CURRICULUM ADAPTED TO EUROPEAN HIGH SCHOOLS

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1. INTRODUCTION

Artificial intelligence will affect many aspects of society in the coming years, because we will be surrounded by, and will interact with, devices that will show an intelligent behaviour, similar to our human species. As any other social revolution, it will open ethical and legal questions that must be faced by the governments in order to ensure a fair and ordered transition to a new society. We are now in the process of formalizing such questions, so current high school students will be one of the first generations that will be affected by new regulations. Hence, it is very important that these students know about such open questions and reflect on them. This is the main objective of this teaching unit, which is **focused on the consequences that AI will have in the society**, specifically, in terms of **sustainability, ethics and legal aspects** (SEL). We have included sustainability of AI as a third key issue in this topic due to the huge consequences that an uncontrolled usage of AI could have in terms of data storage, computational resources, etc.

Therefore, this teaching unit will not imply that students develop a smartphone app as the previous, but a more non-technological product, in this case, an **infographic** including their thoughts about SEL after investigation about it. In addition, the current teaching unit finishes the first application block of the AI+ curriculum, focused on intelligent Smartphone Apps. In this sense, we have included a small task related to consider the SEL aspects of the two apps they have developed in the previous teaching units.

2. CONTEXT

In order for the students to adequately meet the learning objectives of this TU, they must have finished the previous teaching units, from TU1 to TU5. This way, they have an introductory idea of the main topics of AI (perception, actuation, representation, learning and artificial collective intelligence), so they can start thinking about their consequences from a more realistic perspective.

3. LEARNING OBJECTIVES

Once students have finished this TU, they will have acquired the following knowledge:

SPECIFIC	• Initial ideas about the implications of using AI systems in terms of sustainability, ethics and legal aspects
TRANSVERSAL	• Improve their synthesising skills. • Improve their ability to empathise (thinking about the consequences of actions in others) • Improve their presentation and debating skills. • Improve their investigation skills on the internet

4. CONTENTS

In this unit, the contents are directly the three topics to be dealt with:

Fig. 1 Specific contents

5. TIMELINE

This TU is the last one of six focused on introduction to AI. Remember that, after the completion of the previous TUs, students have seen the fundamentals of perception, actuation, representation, reasoning, learning and artificial collective intelligence on AI, which are required to properly understand the implications of AI systems in SEL. The next TU will be the first of the application block focused on intelligent robotics, where all the topics discussed in this TU are very important.

The estimated time for this TU is **4 teaching hours**.

6. NECESSARY RESOURCES

The following hardware elements are required to carry out this TU:

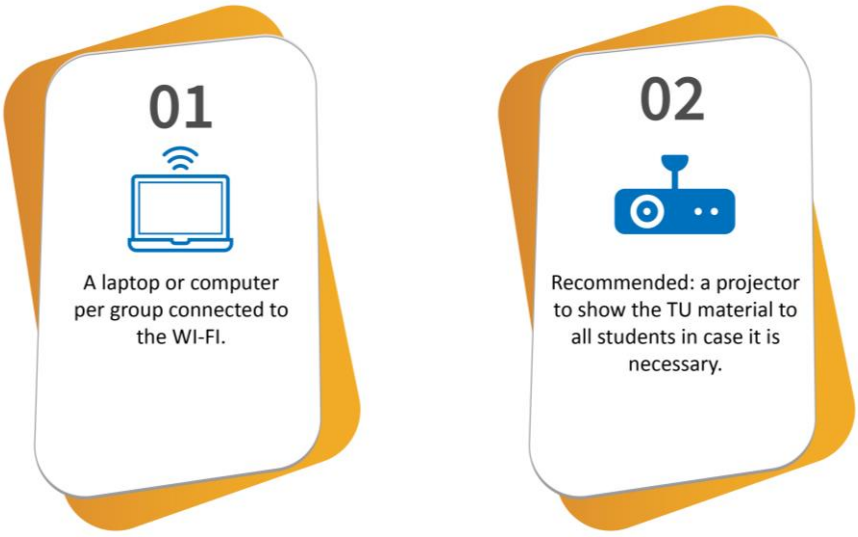

Fig. 2 Hardware elements required to carry out this TU

7. BIBLIOGRAPHY

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8. GROUPS

The project has been designed to be carried out in groups of 3 students. Each member of the team will have one role: a time manager, a researcher and content creator.

Following the indications of the TU0 and taking into account the activities of the unit, the purpose of each role is:

1. *Time Manager:* Controls that the different stages of the TU are carried out in an orderly manner and on time according to the time frames commented by the teacher. He/she is the group manager and is responsible for speaking with the teacher if necessary and He/she is in charge of documenting the steps of the work.
2. *Researcher:* Focused on searching reliable and trustable information sources on the internet about the real implications of AI. It is important to be aware of fake news or non-rigorous opinions about AI, very common in social media.
3. *Content creator:* Captures the information the researcher finds in the infographic in a clear, creative and easy-to-understand way.

The roles should be changed at least four times during the TU, so that every student performs every role.

9. UNIT MATERIAL

This unit has extra documents, which are available at:

https://drive.google.com/drive/folders/1nnjRvUHZobfL77IHbOby22XyLqMCBe92?usp=sharing

These documents are:

- Current document, with Teaching Unit 6 (TU6_SEL.pdf)
- Feedback document for teachers (teacher_feedback_TU6.docx)
- Students' work (TU6_Students_work.pdf)
- SEL questions (SEL_questions.jpg)
- Example of infographic (SEL_infographic.jpg)
- Infographic´s rubric (Rubric_infografic_TU6.docx)

10. CHALLENGE / PROJECT

10.1 FINAL OBJECTIVE

WHAT TO DO?

Students have been trained in the fundamentals of Artificial Intelligence in the previous teaching units, from the technical perspective of the AI developer. But they must be aware of the consequences and implications of the AI systems they create. The aim of this teaching unit is to investigate about SEL (Sustainability, Ethics and Legal Aspects of AI) and create an infographic about the risks and myths of AI in terms of SEL.

10.2 ACTIVITIES

In this TU, we consider only one activity, which has been organized in 3 tasks, as shown in Fig. 3.

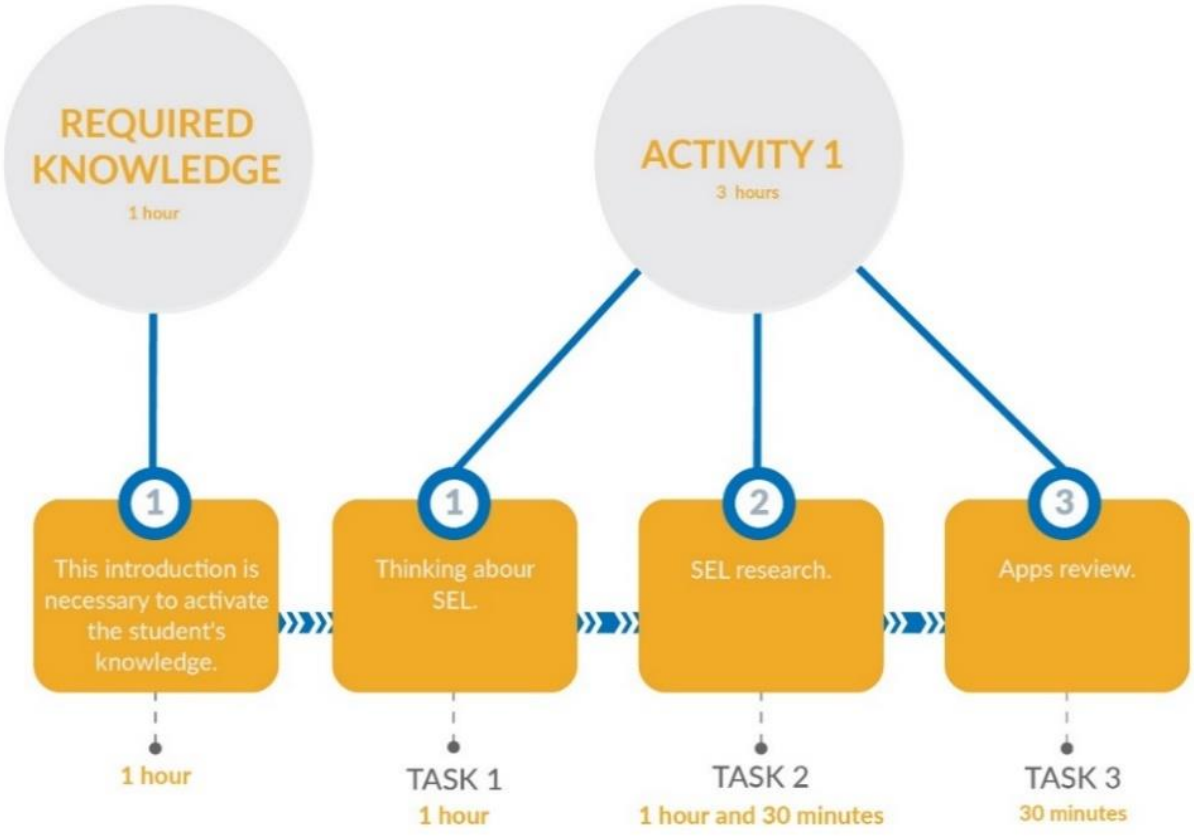


Fig. 3 Flowchart of the application development process

Required knowledge

This introduction is necessary to activate the student's knowledge

1 hour

Required knowledge to be introduced to students:

Before starting with the unit, every student must answer the following questionnaire in order to have an idea of their previous knowledge about SEL:

https://forms.gle/AyWHA2JyfG6Jkk5QA

Today, AI is a part of everyday life throughout society, but few people are aware of how far-reaching it can be. At the end of 2019, the Mozilla foundation surveyed people around the world to find out what they know and how they feel about AI (link). They found that the most common responses were concerned (32%), curious (30%) and hopeful (27%). In other words, most people have no hope about the benefits of AI. This high percentage is largely due to misinformation on the topic and the myths that circulate about it.

It is true that the impact of introducing AI in different aspects of future societies will bring up new problems that must be faced, some of them of high relevance, and students must be aware of them. But if we take a closer look, we will realize that such problems are not different as others faced in the past with previous revolutions. And, as in those cases, new opportunities will arise that cannot be anticipated now, and our society will adapt to them.

To provide students with a first approach towards the real impact of AI in society, three broad topics will be considered: legal aspects, ethics and sustainability. The objective is that they can create their own opinion about AI implications, based on real information.

Before starting the tasks of the activity, we recommend teachers to provide a basic definition of the three topics that make up the TU:

- *Sustainability:* it is the quality of causing little or no damage to the environment and therefore able to continue for a long time. This video may be useful for a better understanding: https://bit.ly/3errGvb
- *Ethics:* the field of ethics involves systematizing, defending, and recommending concepts of right and wrong behavior. For a more detailed explanation, check this reference: https://bbc.in/3vRmK8z
- *Legal Aspects:* system of rules usually enforced the state or institution.

Teachers can provide examples of these three topics in other fields, so students understand the global context before starting to work in AI. For instance, sustainability in modern building construction, ethics in animal care, and the legal aspects of traffic can be familiar to them.

Finally, as a more specific introduction to ethics in AI, it is proposed to watch the following video in the classroom (all together): https://bit.ly/33kQfUj

Activity 1

Create an infographic with the SEL risks and myths

3 hours

Activity 1 – Task 1

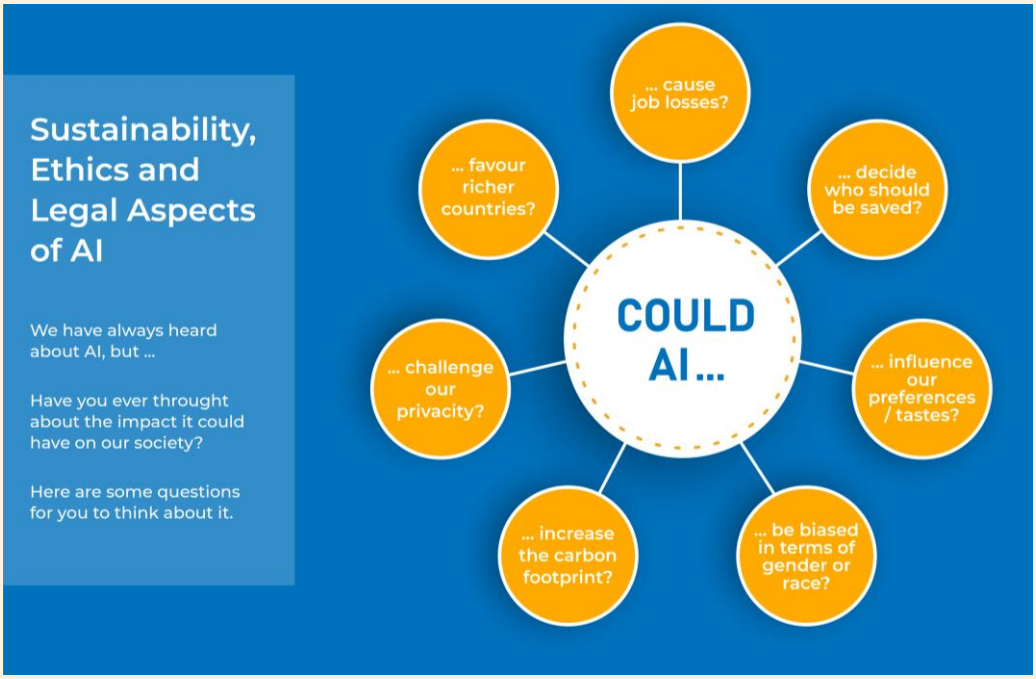
1

Thinking about SEL

1 hour

Student´s work:

This topic covers many issues, as many as the applications of AI. In this first approach, it has been decided to start discussion based on the 7 questions shown in the image below:



It is proposed to have a brainstorming session in class in which you and all your classmates should discuss your ideas on the proposed issues. Moreover, if you consider that more relevant questions should be included, now is the time to say so and add them.

1 Hour

Teachers' solution:

There is not a specific solution for this task, because students must express their opinion about these questions. But we can provide some ideas on how to chair the session.

First, students should discuss into each group for 20 minutes about the 7 questions shown above. Then, **it is proposed to have a brainstorming session with all the class (other 20 minutes).** This brainstorming will be guided by the teacher and all proposed points should be discussed by students. The objective is to determine the students' perceptions on the subject. Finally, the teacher can provide a more rigorous answer to these questions, based on his/her own experience and on these considerations:

… cause job losses?

One of society's biggest concerns about AI is that it will eliminate jobs. But the truth is that thanks to AI, physically demanding or low-skilled jobs will be eliminated and new, more creative jobs, will be created for both educated and uneducated people.

… influence our preferences/tastes?

AI can influence our tastes for both good and bad. Recommendation systems like youtube's are very useful. They allow us to save time in our searches and discover channels focused on our tastes. But at the same time, intelligent recommendation systems can be used with interested purposes, to modulate our opinion or to create unreal necessities.

… decide who should be saved?

Future AI systems could be applied to cases where human lives could be involved, like autonomous driving or rescue. In these cases, complex situations where the system has to decide if a person or other should survive, could arise. The AI developers should not include any subjective aspect when taking such decision, as age, race or gender, but others like maximizing the options of saving all lives. It is important that students think about what happens nowadays in these cases where humans are responsible of these decisions, for instance, in traffic crashes. Do humans have any bias in extreme situations or is it just a matter of ability? Would AI systems then be "fairer"?

… challenge our privacy?

Nowadays, our data (daily routine, photographs, personal information...) can be easily captured by intelligent systems. It is very important to be aware of this risk and to take it into account when using the systems and accepting their privacy policies. This issue is related to the second one, because our preferences can be modified from analyzing our customs. There are many commercial interests behind controlling our lives.

… be biased in terms of gender or race?

Nowadays, there are many biased intelligent systems, that provide recommendations or predictions that are not complete neutral. This bias is caused by the data on which the models are trained. Hence, this means that AI systems are biased because the humans who develop them introduced such bias. However, this is something that cannot be allowed, and it is one of the AI features that must be improved in the future.

… favour richer countries?

Rich countries have greater accessibility to technology and, consequently, to AI, so it is probable that they obtain the AI benefits earlier. But governments and international entities as UNESCO are working on decreasing such gap. In this sense, the emergence of AI can help to improve less developed countries in many different ways. An example of this is that AI can bring quality education to everyone, without the need to travel.

… increase the carbon footprint?

Every day, billions of data are generated, transferred and stored in the cloud. Then, AI devices consume millions of MWh. So yes, AI is not as sustainable as it should be and increases the carbon footprint of our planet. Specific measures are required to face this major issue.

NOTE: If the students propose other relevant questions, they should be added to the discussion and, of course, to the research they will do in task 2.

Test:

There is no explicit assessment for this task, but it will be assessed using the rubric that assesses the ongoing students work during the TU.

Activity 1 – Task 2

2

SEL research

1 hour and 30 minutes

Student´s work:

The aim of this task is to create, in groups of 3 students, an infographic about the current state of AI in terms of SEL. So, it is time to research and delve deeper into the topic.

To this end, here are some videos on each of the questions posed in the previous task. These videos, and the information you can search on the internet, can help you to clarify your ideas about SEL in AI.

Could AI…

- cause job losses?
  - https://youtu.be/tavZPHIIxZw
- influence our preferences/tastes?
  - https://bit.ly/3b6UNSm
- decide who should be saved?
  - https://bit.ly/2RBv25F
  - https://bit.ly/2QTcUVe
- challenge our privacy?
  - https://bit.ly/3f3Wf9p
  - https://bit.ly/3f31CFB
- be biased in terms of race or gender?
  - https://bit.ly/3bKF3Fi
- favour richer countries?
  - https://bit.ly/3eou7hV
  - https://bit.ly/3nUjqa9
- increase the carbon footprint?
  - https://bit.ly/3eoK6ws

Once you have a more reliable opinion on all the topics, it's time to create the infographic. We encourage you to include on it everything you think society should know about AI. A possible organization of the infographic is to shown MYTHS (preconceptions) and TRUTHS (reality) about the previous 7 questions, but others are welcomed. The idea is not only to highlight the AI benefits, but its potential risks. What it is relevant is to provide an informed conclusion.

Check out the information you find and make sure that you only get it from reliable websites. Also, if you can think of more SEL topics and open questions than the 7 mentioned above, find out and include them in your infographic.

For the design of the infographic, you can use any design program you like such as Crello, Genial.ly, Canva, Infogram, Desygner…

1 hour and 30 minutes

Test:

This task will be evaluated by the students according to the rubric of the **Annex I: Infographics´** rubric, as indicated in Evaluation section.

Teachers' solution:

After watching the videos and looking for information, students should produce an infographic in which they add their opinion on each of the points they have to research. An example infographic based on Myths and Truths about AI is shown below. Please note that **the students' infographics DO NOT HAVE TO BE THE SAME as that of** Fig. **4**. Each group of students should inform themselves, analyse the information gathered and draw their own conclusions. For instance, they could organize the information by showing the pros and cons of AI, or simply the warnings of what they consider most important from the 7 questions displayed above.

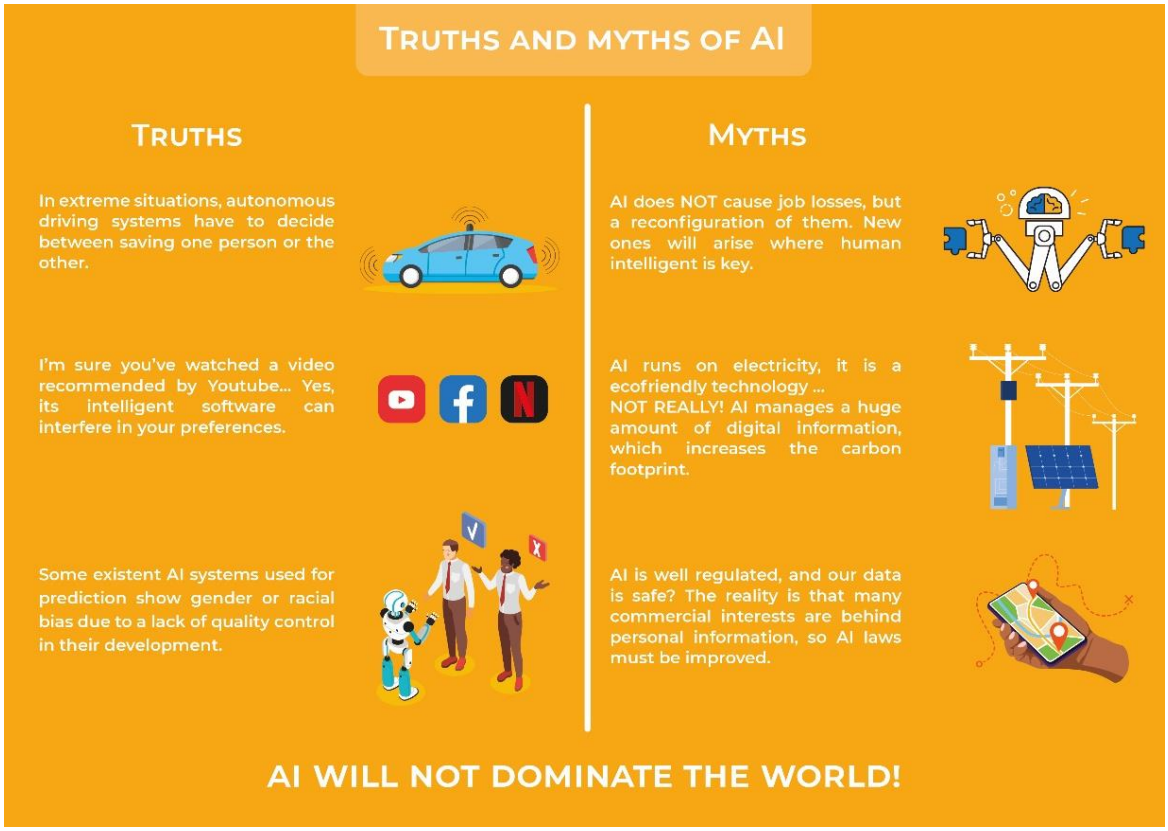


Fig. 4 Example of infographic

Activity 1 – Task 3

3

Apps review

30 minutes

Student´s work:

If you have arrived here, it is because you are already a SEL expert! To finish this TU, and this block of the curriculum focused on Smartphone apps, it's time to look back at the two apps developed in the previous units: School Path Guide and Capture it!. **Discuss with your group if there is something you should change on them** in terms of ethics and legal aspects, or to consider regarding sustainability in order to improve them.

Once you have thought about it, discuss it in a general way in class and you will surely find all the answers together. It is not necessary that you modify the apps, just take it into account for future developments.

20 minutes

After the unit, each student should answer the following questionnaire again, to find out what they now think of SEL:

https://forms.gle/AyWHA2JyfG6Jkk5QA

Teachers' solution:

In this task, students should analyze the apps developed in the previous units: School Path Guide and Capture it. Each group should discuss if there is something they should have taken into account or modified in the apps in terms of ethics and legal aspects, or something to take into account regarding sustainability to comply with the ideas and recommendations seen in the TU.

Once they have thought about it, all groups should present their conclusions to reach a common agreement. In what follows, we provide some of the most important improvements to carry out:

- Both apps are mainly correct in terms of ethics. The only problem they might have would be if the model of the *Capture it* application had some bias. For example, if a student decided to train a model in which one of the detected objects was a person, and it was

trained with pictures of people with the same skin colour. This would be a biased and, therefore, unethical application. The same could happen in terms of gender or weight. So, students have to think about the ethics behind people recognition, that should be applicable to the different features of human race.

- Thinking about the legal aspects, the *School Path Guide* app could have two problems. On the one hand, this app is designed for a school and in many schools, it is not allowed to take photos. If this is the case, permission would have to be sought from the school management. Not only to take photographs but also to create the app, or there could be legal consequences against the developers. On the other hand, special care should be taken to ensure that the images used for mapping do not show any person, as it is not allowed to use images of people without their permission.
- In terms of sustainability, the biggest problem is that we are generating a lot of data with the development of these apps. Photos are taken and probably stored in several places; several App Inventor projects are created for the same application... To avoid this, it would be necessary to establish an organization for the storage of all the data we have. In such a way that we would avoid duplicating (or even tripling the information) and it would never get lost.

Test:

This task will be evaluated by the teacher following the rubric of the **Annex II: Theorical concepts rubric**. As indicated in the Evaluation section, the grade will be the same for the whole group.

10.3 FINAL REMARKS

Once the teaching has been completed, students have a clearer idea about SEL in AI. Obviously, this is only a first approach to this topic, but it will help them to start thinking a little differently when developing and/or using intelligent systems.

11. EVALUATION

As established in the introductory TU, three evaluation methodologies are proposed to this TU. The score of the will be calculated on 100 and the weights of each of the evaluation methodologies will be:

Assessable activity	Score
1- Infographic	75
2- Theorical concepts	10
3- Individual rubric	15
TOTAL:	100

1. *Final test of the program:* the final TU product is an infographic. We propose the evaluation to be carried out only by the students, following a cooperative evaluation system. The idea

is to randomly distribute the infographics to the groups (making sure that no one gets theirs). Every group should review minimum 2 infographics. Then following the rubric of the **Annex I: Infographics´ rubric,** each group will evaluate them. The total score will be 70 (out of 100 for the unit). **The final score of each infographic will be the arithmetic mean of the marks you have received** (the teacher will be in charge of averaging)**.** Moreover, this evaluation will be done in the classroom (the time for it is already included in task 2).

Once the assessment has been completed, **all groups should give the teacher the rubrics covered** and, if the teacher wishes, he/she can select the one with the highest mark to be displayed in the classroom/center.

2. *Final test of theoretical concepts*: in task 3, students should determine together the problems that the apps created in the previous units could have in terms of SEL. It is therefore a matter of applying the theoretical concepts learned to two real cases. **The teacher must award a joint mark to the whole class for this part.** The maximum mark will be a 10 (out of 100 for the unit) and will be marked according to the rubric of the **Annex II: Theorical concepts rubric**.
3. *Ongoing work during the TU*. This methodology is very important, and it will be evaluated using an individual rubric that the teacher must fill for every activity (**Annex II: Ongoing students work rubric**). The work of each of the students will be evaluated under this rubric. There are a total of 5 fields in this rubric and each of them will be worth a maximum of 6 points (the score that each student will take depending on the level he or she achieves is established in the table). The student who achieves the expert level of each of them will reach the maximum score for this part: 15 points.

12. COMPLEMENTARY ACTIVITIES

The following improvements to the program are proposed, mainly for groups that finish the main goal before others, or for teachers that consider that an extra evaluation can be proposed to students:

1. ANALYSE INTELLIGENT SYSTEMS IN TERMS OF SEL

Once SEL has been explored in depth, it is time to analyze the smart systems we use to check that they are sustainable and comply with ethical and legal standards.

13. ANNEX

ANNEX I: INFOGRAPHICS´ RUBRIC

The following table contains a rubric to be completed by students to evaluate their classmates' infographics.

Level (score) / Aspects to be evaluated	**Expert** (15 points)	**Competent** (10 points)	**Partially competent** (7 points)	**Not yet competent** (0 points)	**SCORE**
Design (eye-catching, well organized...)	It is attractive to readers and it can be read comfortably (colours are well chosen, not too much text…)	It is attractive for the readers but it cannot be read comfortably (because of the chosen colours, too much text...)	It is not very attractive for the reader but it can be read comfortably	It is not attractive and it cannot be read comfortably	
Concept clarity (Anyone with no knowledge of the subject could understand this)	Everything that is explained is easily understandable	Most of what is explained is easily understandable	Almost nothing of what is explained is easily understandable	Nothing of what is explained is easily understandable	
Spelling, punctuation, writing and grammar	There is no failure	There are at most 4 failures	There are between 4 and 6 failures	There are more than 6 failures	
Contents	All issues mentioned in the unit are included	One of the issues mentioned in the unit is not included	Two of the issues mentioned in the unit is not included.	More than 2 of the issues mentioned in the unit are not included.	
Theoretically correct	Explains all issues correctly, demonstrating a mastery of all of them	Explains almost all the issues correctly, demonstrating sufficient mastery of all of them	Few issues are correctly explained, without demonstrating that they are correctly understood	The issues are not explained correctly, demonstrating that they do not understand them correctly	
				TOTAL:	

ANNEX II: THEORICAL CONCEPTS RUBRIC

Level (score) / Aspects to be evaluated	**Expert** (10 points)	**Competent** (7 points)	**Partially competent** (4 points)	**Not yet competent** (0 points)	**SCORE**
Concepts achieved	They have succeeded in identifying all the problems that the applications created could have	They have been able to identify almost all the problems that the applications created could have	They have only been able to identify one of the problems that the applications created could have	They have not been able to identify any of the problems that the applications created could have	

ANNEX III: ONGOING STUDENTS WORK RUBRIC

Level (score) / Aspects to be evaluated	Expert (3 points)	Competent (2 points)	Partially competent (1 points)	Not yet competent (0 points)
Adequate selection of information (Websites used, critical thinking...)				
Time management (the student is aware of deadlines and progress…)				
Design and construction of the solution (understanding the purpose and reliability of the infographic)				
Creativity (autonomy and improvement of the basic solution)				
Teamwork (organization)				