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Informatics

How Machines Learn (Intro to Machine Learning Concepts)

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1. TITLE

How Machines Learn (Intro to Machine Learning Concepts)

2. GRADE LEVEL

- ☐ ISCED Level 2 – Lower Secondary Education (ages 12–15)
- ☒ ISCED Level 3 – Upper Secondary Education (ages 15–18)

3. SUBJECT AREA

- ☐ Sciences
- ☐ Environmental Studies
- ☐ Geography
- ☐ Economics
- ☒ Computer Science
- ☐ Mathematics
- ☒ Technology and Design
- ☐ Arts and Music
- ☐ Social Studies
- ☐ History
- ☐ Languages

4. TYPE

- ☒ Lesson Plan
- ☐ Project

5. DURATION

Select the one format that fits the lesson/Project:

- ☒ 1 x 40-50minute class



- 1 x 60-minute class
- 1 x 80-100-minute block
- 2 x 45-minute classes
- 2 x 60-minute classes
- Double session (2 × 60 minutes) optional project-based homework.

6. LEARNING OBJECTIVES

O1 — Students will explain the basic principle of machine learning (learning from data, identifying patterns, improving predictions).

O2 — Students will simulate a simple machine-learning process by manually “training” an algorithm using example data.

O3 — Students will evaluate strengths and weaknesses of data-driven decision-making and identify at least one ethical concern (bias, fairness, transparency).

7. Key Competences Developed

- Literacy
- Multilingual competence
- Mathematical competence and competence in STEM
- ✗ Digital competence
- Personal, social and learning to learn competence
- Citizenship competence
- Entrepreneurship competence
- Cultural awareness and expression competence

8. Prior Knowledge / Prerequisites

None required.

Basic algorithmic thinking (if/else) is helpful but not mandatory.

9. Lesson/Project Outline



Phase 1 – Introduction (Engage & Contextualize)

The teacher asks students how machines make decisions.

Activities:

- Short animation/video (1–2 min): “What is Machine Learning?”
- Class brainstorm:
“What do computers need in order to learn?”
(Typical answers: data, patterns, examples → teacher structures them)

Resource (name)	Link (to the folder on Teams)

Phase 2 – Exploration (Investigate & Compare)

Students “train” a machine-learning model manually using prepared paper cards.

Activities:

- The teacher gives each group (2–3 students) a set of training cards, e.g.:
- Fruit classification (size, color, shape → apple/pear)
- Email spam detection (keywords → spam/not spam)
- Weather prediction (temperature, humidity → rain/no rain)

Task:

- Students sort cards into categories.
- They write down the rules they think the computer would learn.
- Teacher reveals the “correct” model afterwards.

Resource (name)	Link (to the folder on Teams)

Phase 3 – Application (Hands-On Practice)

Each group chooses one real-world classification problem, e.g.:



- Detecting fake reviews
- Sorting waste for recycling
- Classifying job applications
- Identifying dangerous vs. safe online content

Activities:

Groups complete the following tasks:

- Define the inputs (data/features).
- Define decision rules (if/else logic).
- Test the classifier on 5–6 sample cases (provided by teacher).
- Improve the classifier by refining the rules.

This simulates training → testing → improving, without coding.

Resource (name)	Link (to the folder on Teams)

Phase 4 – Reflection & Consolidation (Present & Connect)**Activities:**

- Groups briefly share their classifier (1 min per group).
- Teacher leads a discussion:
 - “What happens if the data is incomplete or biased?”
 - “Can machines make fair decisions?”

Each student completes a short ethical reflection.

Resource (name)	Link (to the folder on Teams)



10. Assessment Criteria

Manual “Training Game” Output

- correct identification of patterns
- clarity of extracted decision rules
- accuracy of categorization

Group Classifier Mini-Project

- logical structure of decision rules
- clarity of features chosen
- testing & improving the model
- teamwork
- ability to justify decisions

Ethical Reflection

- identifies at least one meaningful benefit
- identifies one relevant risk (bias, privacy, fairness, errors)
- includes one guideline for responsible ML use

Resource (name)	Link (to the folder on Teams)

11. Teaching Materials

Name	Type (Developed/Existing)	Link	Role in the lesson

12. External Resources and References

Resource (name)	Link (external or to the folder on Teams)