Skills & Achievements Framework

Introducing the 5 Big Ideas in Artificial Intelligence using Internet of Things in STEM education

T4.2 Educator's Manual and Skills & Achievements Framework Development

AI4STEM Skills & Achievements Framework

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1.Introduction

The design of a skills and achievements recognition framework will be based on the Open Badges (openbadges.org) framework and will be used for informal recognition to students that successfully complete a AI4STEM Lesson through the achievement of a predefined score in a relevant assessment test. The framework will be integrated into the learning environment checking conditions and awarding AI4STEM badges.

The main aims of the AI4STEM Skills & Achievements Framework are:

- To design the ecosystem where Open Badges will identify, recognize and validate certain skills of students.
- To set the quests/challenges for each of the AI4STEM Badges to be gained for each main module of the curriculum.
- To promote the use of innovative multi-level tools in the form of e-resources and hands-on material for educational play.
- To implement all technological actions to link the Open Badges Framework to the learning portal in terms of participating in quests/challenges, issuing and exhibiting Open Badges on students' and teachers' profiles.
- To initiate the creation of synergies between schools, institutions, STEM centers, NGOs, the labor market, and other stakeholders for the endorsement and accreditation of the AI4STEM Curriculum and the hard and softs skills of students.

This document provides detailed information regarding the following:

- Theoretical background of the methodology used.
- Description of the ecosystem in relation to the structure, criteria and description for issuers, graphic design, technological integration and endorsement procedure of Open Badges.
- Practical guidelines for issuing an Open Badge by using the learning portal developed.

The final Skills & Achievements Framework will be integrated into the Learning Portal which will check conditions and will award the AI4STEM Badges.

Open Badges

Open Badges are a digital representation of skills, learning outcomes, achievements, or experience such as:

- Hard skills: knowledge, competences, etc.
- Soft skills: critical thinking, communication, etc.
- Participation and community involvement
- Official certification
- Authorization

An Open Badge is an innovative system used in the USA and many EU countries for the validation and recognition of learning, using the OB technology offered as an open educational resource. It is a technology which promotes open access and participation of all stakeholders involved in badges process, while allowing the creation of synergies between the learners-earners (i.e. young people, students), the issuers (i.e. schools, stakeholders, enterprises, NGOs including trainers/ volunteers as facilitators) and the badge consumers (i.e. formal education, public authorities, official bodies, (potential) employers). This will lead to the endorsement process leading to a transparent, transferable, valid and credible validation of a body of skills and knowledge related to a set of competences for students and teachers.

The Open Badges system is a very inclusive solution: it enables anyone to get actively involved in designing, testing, implementing, and promoting the learning outcomes and achievements. This is what major European documents on Recognition are calling for, as well as Erasmus+ in emphasizing the "transparency and recognition of skills and qualifications to facilitate learning, employability and labor mobility: priority will be given to actions promoting permeability across education, training and youth fields as well as the simplification and rationalization of tools for transparency, validation and recognition of learning outcomes. This includes promoting innovative solutions for the recognition and validation of competences acquired through informal, non-formal, digital and open learning" (Horizontal Priorities).

An Open Badge is visual verified evidence of achievement. It has a visual part (image) and meta-data, which is encoded in the image. Each digital badge must comply with the required standard data fields, such as: issuer, date of issue, description of the badge, link to assessment criteria, link to evidence of what a badge owner is claiming, link to a specific competence framework and tags, which puts an Open Badge in relation to specific context.

Some of the benefits of Open Badges are presented below:

- Badges can demonstrate a wider range of skills and achievements of a learner acquired through formal, non-formal and informal learning methods and activities.
- Badges are portable and verifiable digital objects. All this information may be packaged within a badge image file that can be displayed via online CVs and social networks.
- Each Badge includes the description of the achievement: i.e., it describes the path a learner undertook for his or her achievement, accompanied by the evidence to support the badge award.
- Each Badge includes information about the earner's identity, a link to information about the issuer and a link to a description of what a badge represents.
- Badges can be used to unlock learning and career pathways. They can be used to support individuals to achieve learning goals, to provide routes into employment, and to nurture and progress talent within organizations.
- Badges can represent personal attributes that matter to employers (digital skills and soft skills).

- Badges can be used in a professional or educational context. Thousands of organizations, including non-profit organizations, major employers or educational institutions, issue badges in accordance with the Open Badges Specification.

Key Elements

Issuer

- The issuer defines a competence that could be acquired by a user, designs the learning material for it and assesses the users with regards to the acquisition of the competence. The issuer then creates a relevant badge and makes it available for earning by any user. For each badge, the issuer should make available details of the criteria that an earner must meet to be awarded the specific badge. The reviewer of an assessment compares the evidence provided by the earner against the specific badge criteria.
- Any individual or organization can create an Issuer profile and begin defining and issuing Open Badges. This is done by a diverse range of organizations and communities, including:
- Schools and universities
- Employers
- Community and non-profit organizations
- Government agencies (including NASA)
- Libraries and museums
- Event organizers and science fairs (Including Intel)
- Companies and groups focused on personal development (such as the AI4STEM partnership)

An entity that can be described with a name, a description, a URL, an image, and an e-mail address is a potential candidate to become an issuer. Furthermore, it needs a technology platform that supports the Open Badges Framework to issue Open Badges.

Badge issuing platform

Many companies have badge issuing platforms, compliant with the Open Badges Framework. They provide a wide range of services which allow non-technical users to issue Open Badges credentials. The platforms used for issuing Open Badges offer a variety of custom services including online badge designers, badge discovery, issuing, assessment workflow, display, user profiles, social sharing and tools to integrate with existing learning systems. All Open Badges issuing platforms allow recipients to export their badges to other online options. This allows users to stack and share their badges earned on different platforms and to choose their own spaces to establish their identity on the web.

Earner

Open Badges help recognize skills gained through a variety of experiences, regardless of the age or background of the learner. They allow earners to get awards for following their interests and passions, and to unlock opportunities in life and work by standing out from the crowd. Earners have to register on the organization's platform and can claim a badge when the pre-defined criteria have been met during the evaluation phase.

Evaluation

There are different options for the assessment process:

- Asynchronous assessment: learners seek out the assessment when it is convenient for them instead of being required to take an exam at a pre-determined time.
- Stealth assessment: assessment and awarding badges can happen automatically and provide immediate feedback.
- Portfolio assessment: work samples, projects, and other artefacts the learner has produced can be used as evidence for claiming a badge.

Displayer

Open Badges are designed to be shared. By sharing them, individuals exhibit their achievements to others and turn them into a valuable currency to unlock new opportunities. Displayers can utilize the Displayer API for retrieving earner badges from the Mozilla hosted Backpack. Mozilla set up the first Backpack in 2011. Most issuing platforms provide users with the ability to connect and store their badges to this Backpack. When retrieving badges form the earner's Mozilla Backpack (using the account connected to the email address), the displayer will only be able to access those badges that the earner has chosen to be public.

Badges can also be shared:

- On blogs, websites, e-Portfolios, and professional networks
- In job applications
- On social media sites - Twitter, Google+, Facebook, LinkedIn
- In an e-mail signature

Technical Aspects

An earnable badge is defined as a badge class, using a variety of data items including descriptions, criteria and information about the issuing organization. When an issuer decides to award that badge to a specific earner, he or she creates a badge assertion. A badge assertion describes the data for an awarded badge. It includes the earner's identity and a link to the generic badge class, which in turn is linked to information about the badge issuer. All the data for the badge is defined using JSON structures. To award a badge to an earner the issuer creates a badge assertion in JSON.

The image for a badge should be a square PNG (or SVG). The file size should be a maximum of 256KB and should not be smaller than 90 px square.

Things you can verify and explore in a badge:

- Details about the organization issuing the badge.
- What the individual has done to earn the badge.
- The criteria that the badge has been assessed against.
- That the badge was issued to the expected recipient.
- The badge earner's unique evidence (optionally included).
- When the badge was issued and whether it expires.

Open Badges for AI4STEM

Open Badges provide portable and verifiable information about various skills and achievements. Students can unlock opportunities by sharing collections of badges representing desired skill sets in a dynamic, evidence-based way. Open Badges represent legitimate, authenticated achievements described within the badge and linked to the AI4STEM project.

Main characteristics of the AI4STEM Skills & Achievements Framework include:

The AI4STEM partnership has designed the AI4STEM Curriculum - learning material for the following modules (which are presented in WP2) based on the teachers' feedback, targeted to the needs of students, as well as on partners' suggestions based on their expertise and experience in the field:
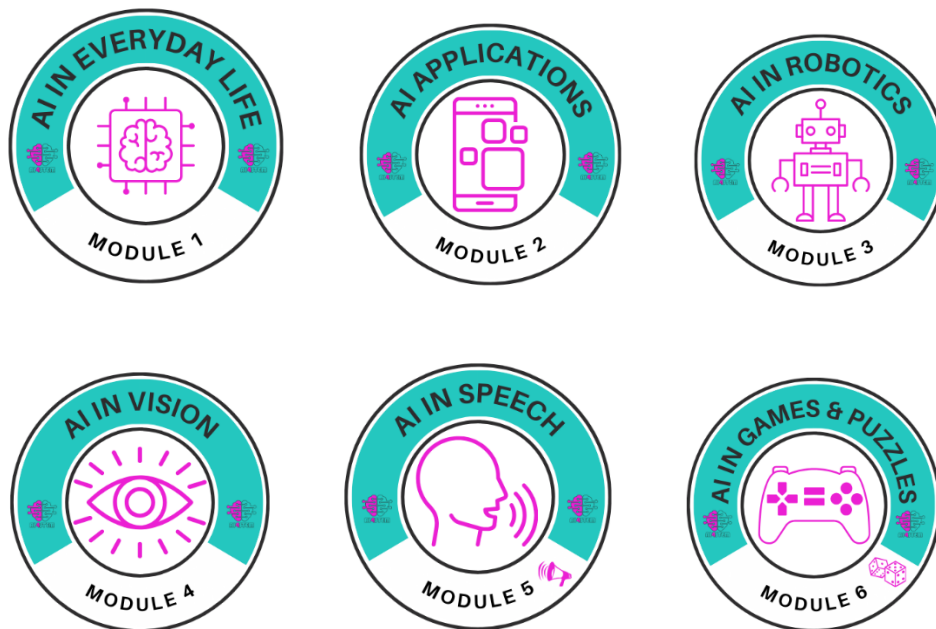
- Introduction to AI & Application of AI in everyday life
- AI in Robotics
- AI and applications (i.e chat GPT, Dall-e, etc..)
- Application of AI in Speech
- Application of AI in Vision
- Application of AI in Games & Puzzles

The AI4STEM partnership has created the corresponding badges for each of the modules.

Upon completion of all the modules and the developed activities, the students will be awarded the corresponding AI4STEM Badge, if they achieve a mark of 80% or higher on each of the assessments. These badges are made available for earning via the learning portal, which has been designed specifically for the learning and assessment purposes of the AI4STEM project.

- Students are invited to register in the learning portal and complete the AI4STEM Curriculum.
- The learning portal specifies to students the criteria for earning each of the badges shown below. These criteria will be elaborated in the following section.
- Students must provide evidence to meet the badge criteria to claim a specific badge. This process is done automatically on the learning portal.
- The badges will be awarded automatically through the learning portal based on certain criteria, which are presented in the next section.

AI4STEM MODULE BADGES

AI IN EVERYDAY LIFE — MODULE 1

AI APPLICATIONS — MODULE 2

AI IN ROBOTICS — MODULE 3

AI IN VISION — MODULE 4

AI IN SPEECH — MODULE 5

AI IN GAMES & PUZZLES — MODULE 6

AI4STEM OVERALL BADGE

AI4STEM MASTER — AI4STEM MASTER

Students may achieve a badge for each of the modules in the AI4STEM Curriculum. The AI4STEM Expert badge (overall badge) will be awarded to students once they have completed all the topics and activities. Completing all the modules automatically rewards the student with the corresponding AI4STEM overall badge. Thus, in total 7 Open Badges will be developed and awarded (6 for the modules + 1 Overall).

Each Open Badge consists of the below:

1. Name: The name of the Open Badge is comprised by the name of the Module and the description of the level of difficulty
2. Learning Outcomes: A list of the learning outcomes to be acquired.
3. Design of Open Badge: The Visualization (image) of the Open Badge for each Module
4. Main Objective: A description of the Open Badge related to the main objectives.
5. Assessment Criteria: The criteria to be used to assess whether the learning outcomes have been achieved and whether the set of skills and competences of all modules have been acquired by the students. The criteria and the assessment methods that must be followed to receive a badge are described in the following sections.
6. Evidence: The proof and the evidence of the acquired skills i.e., quiz grades, etc. This process is fully automatized on the learning portal where the assessment tests are automatically graded.
7. Issued by: In this section the issuer of the Open Badge is specified, which in this case is the AI4STEM Partnership.
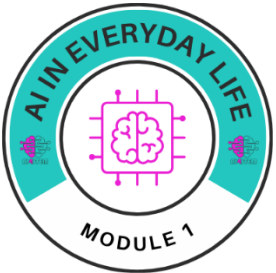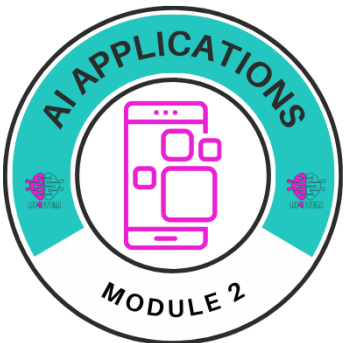
Awarding Criteria

AI4STEM offers 6 module badges and 1 overall completion badge. The specific criteria for these nineteen badges are presented below:
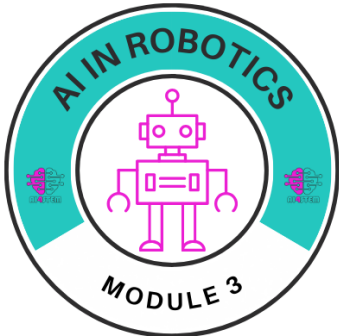
- Introduction to AI & Application of AI in everyday life badge, the student needs to complete all activities of the "Introduction to AI & Application of AI in everyday life?" module and score a minimum grade of 80% in the assessment quiz.
- AI in Robotics badge, the student needs to complete all activities of the "AI in Robotics" module and score a minimum grade of 80% in the assessment quiz.
- AI and applications (i.e chat GPT, Dall-e, etc..) the student needs to complete all activities of the "AI and applications" module and score a minimum grade of 80% in the assessment quiz.
- Application of AI in Speech the student needs to complete all activities of the "Application of AI in Speech" module and score a minimum grade of 80% in the assessment quiz.
- Application of AI in Vision the student needs to complete all activities of the "Application of AI in Vision" module and score a minimum grade of 80% in the assessment quiz.

- Application of AI in Games & Puzzles the student needs to complete all activities of the "Application of AI in S Games & Puzzles" module and score a minimum grade of 80% in the assessment quiz.
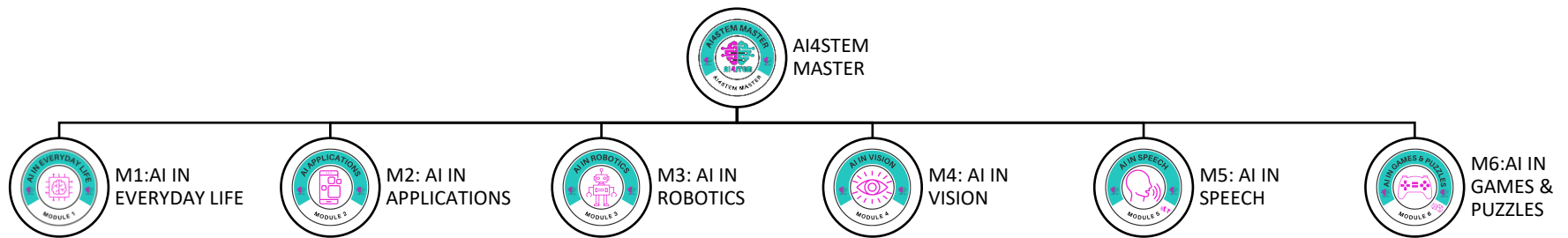
Name of OB	Learning Outcomes	Design of OB	Assessment criteria	Evidence	Issued by
Introduction to AI & Application of AI in everyday life	Module 1: AI IN EVERYDAY LIFE		Complete the Assessment with an overall mark of 80%	The proof and the evidence of the acquired skills are the grade marks. This process is fully automatized on the e-tool where the assessment tests are automatically graded.	AI4STEM Partnership
AI and applications (i.e chat GPT, Dall-e, etc..)	Module 2: AI IN APPLICATIONS		Complete the Assessment with an overall mark of 80%	The proof and the evidence of the acquired skills are the grade marks. This process is fully automatized on the e-tool where the assessment tests are automatically graded.	AI4STEM Partnership

| AI in Robotics | Module 3: AI IN ROBOTICS | | Complete the Assessment with an overall mark of 80% | The proof and the evidence of the acquired skills are the grade marks. This process is fully automatized on the e-tool where the assessment tests are automatically graded. | AI4STEM Partnership |
| Application of AI in Speech | Module 4: AI IN VISION | | Complete the Assessment with an overall mark of 80% | The proof and the evidence of the acquired skills are the grade marks. This process is fully automatized on the e-tool where the assessment tests are automatically graded. | AI4STEM Partnership |

| Application of AI in Vision | Module 5: AI IN SPEECH | | Complete the Assessment with an overall mark of 80% | The proof and the evidence of the acquired skills are the grade marks. This process is fully automatized on the e-tool where the assessment tests are automatically graded. | AI4STEM Partnership |
| Application of AI in Games & Puzzles | Module 6: AI IN GAMES AND PUZZLES | | Complete the Assessment with an overall mark of 80% | The proof and the evidence of the acquired skills are the grade marks. This process is fully automatized on the e-tool where the assessment tests are automatically graded. | AI4STEM Partnership |

AI4STEM OPEN BADGE STRUCTURE

AI4STEM MASTER

M1:AI IN EVERYDAY LIFE

M2: AI IN APPLICATIONS

M3: AI IN ROBOTICS

M4: AI IN VISION

M5: AI IN SPEECH

M6:AI IN GAMES & PUZZLES

Conclusion

This document presented the theoretical background of the Open Badges framework, in addition to its benefits and endorsements. Most importantly the AI4STEM ecosystem of Open Badges was presented, with a detailed analysis of the benchmarks required to achieve each one.

By using the Open Badges system, the AI4STEM project will not only help students validate the skills they will acquire through this project, it also introduces them to the innovative practice of the Open Badges, which can be used throughout their lives to log their achievements, and potentially open new pathways for them in career and education.