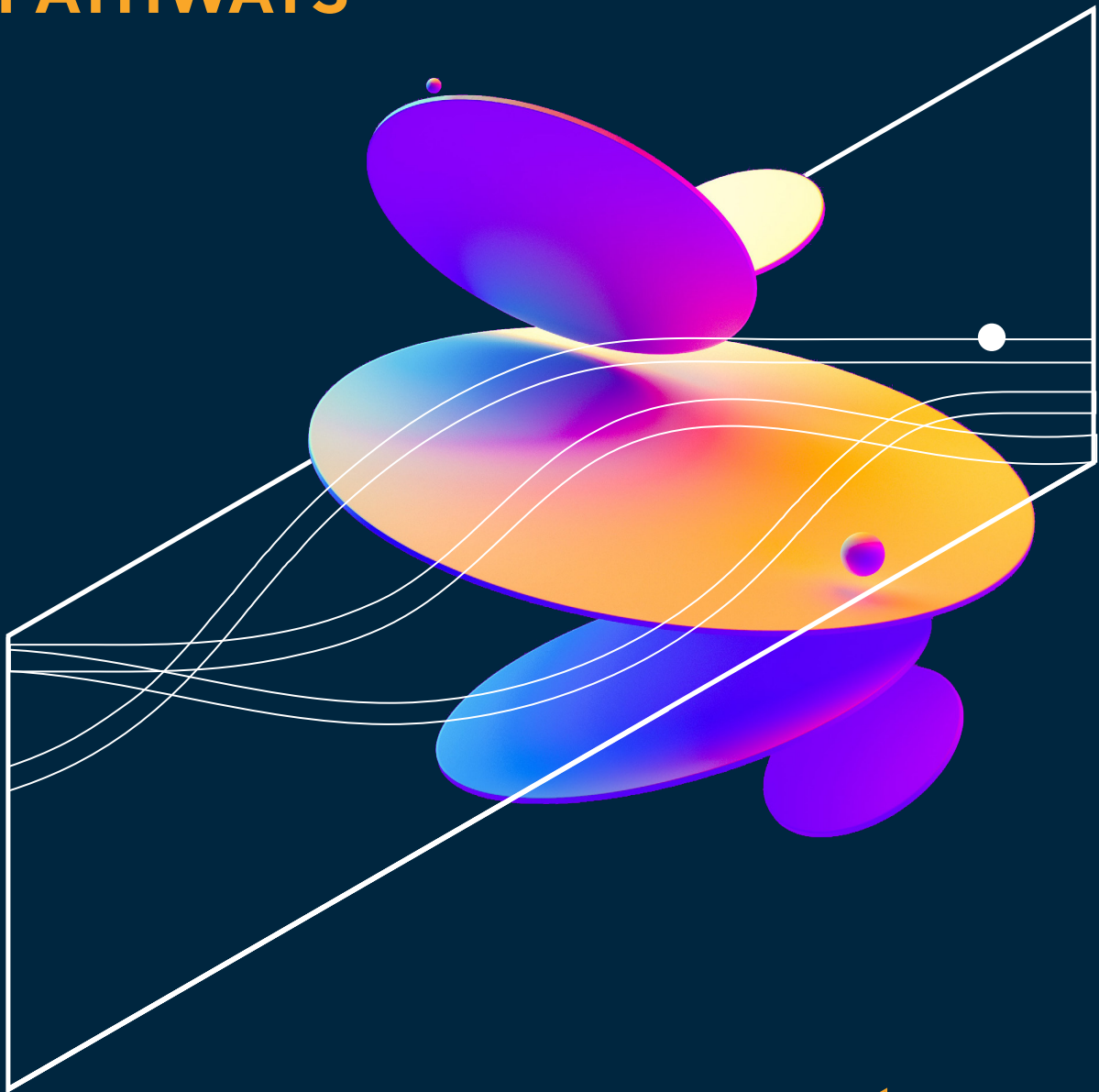# Moving Forward and Beyond in Education: Concept of **FLEXIBLE LEARNING PATHWAYS**

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EXECUTIVE SUMMARY

Flexible Learning Pathways serves for the acquisition of knowledge in a flexible and personalised approach when the learner can adapt their learning journey based on their needs, interests, and circumstances at different stages of life. This report at hand sets out the key elements of the Flexible Learning Pathways (FLP) concept, summarised according to the different elements within the system: needs for the FLP, the elements of the FLP, and the implementation of the FLP. The report encompasses all aspects of the FLP ecosystem.

The concept development was undertaken between February 2020 and October 2022 and involved multiple strands of ideation, data collection and analysis of stakeholder needs, reflections and validation.

The FLP concept and model are grounded in personalisation and inclusiveness. The individual learning pathway is designed to deliver flexibility to the learner while providing a structure to the learning based on the competences and interests of the learner. It is meant to simultaneously give the freedom of choice. Learners can build their learning path from different sources of knowledge, and different subject fields, while including different forms of learning. The FLP offers learning experiences of a variety of lengths depths, depending on what skills and competences the learner actually wants to acquire. Learners can thus tailor the set of challenges and micro-modules they like to build their personalised pathways, while allowing each learner to choose a personalised learning path independently of their previous background with the possibility of changing the learning direction along the way – according to each involved individual's needs (desired skills and qualifications).

The FLP serves as a future-proof learning model, which, if implemented successfully, will revolutionise educational offering throughout Europe and beyond. Learning as such will not finish after graduating from a traditional university as the FLP allows exploring and learning new skills and competences through life-long learning, thereby uniting business, learners, and academic institutions.

1. INTRODUCTION
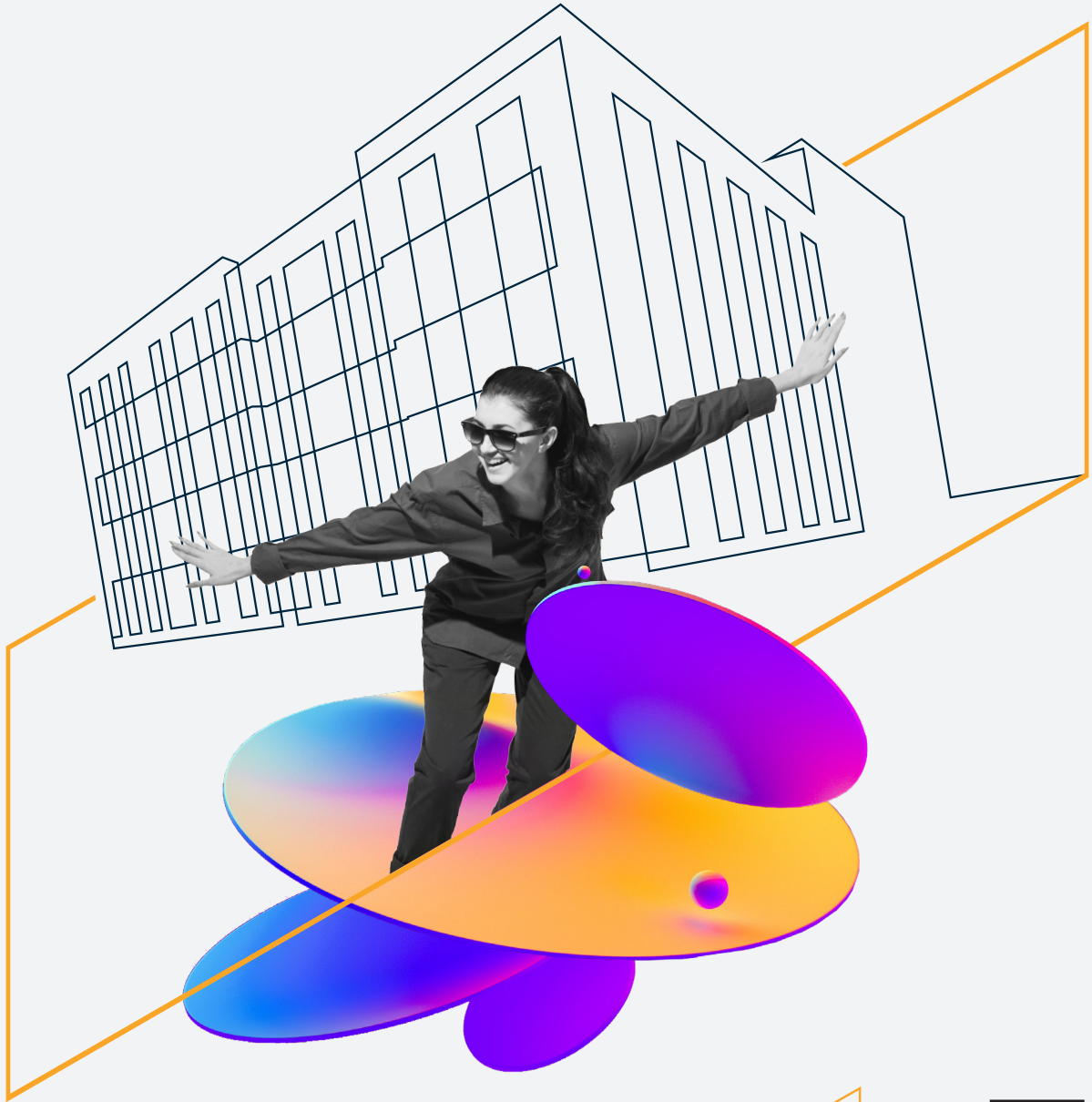
Responding to social changes rapidly has always been a challenge for **higher education institutions**. The current COVID-19 pandemic, on the other hand, has had a quick and dramatic influence on higher education. More flexible higher education systems are better positioned to respond to crises and at least retain if not improve learning while also supporting fairness and lifelong learning, as the situation has demonstrated. Flexible learning and micro-credentials in higher education[1] are topics that have been subject to many studies and have been researched from different angles and perspectives in recent years. As mentioned in the renewed EU agenda for higher education and recommendations for effective European higher education cooperation[2], national governments of the EU Member States are facing the need to modernise their higher education systems so that they are better prepared for meeting the future economic and societal challenges and able to meet the ever-increasing demands coming from the society around employability, skills, widening participation/inclusion and integration in the innovation environment of the Union member countries. In addition, the COVID-19 pandemic has placed unprecedented pressure on both public budgets and the already scarce public funds available to higher education, alongside the need for rapid changes in the way higher education is delivered to learners.

Furthermore, the increasingly interconnected world alters conventional higher education learning and working environments. Higher education systems must accommodate increasingly diverse learners, including part-time and returning learners returning to upskill and reskill. The critical question that national and institutional policymakers must address today is how to respond to these challenges.

The European Commission's **Communication on Strengthening European Identity through Education and Culture**[3] (2017) and **Communication on achieving the European Education Area by 2025**[4] (2020) proposed a **new vision of a European Education Area**, contributing

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[1] European Commission (2017) Communication on Renewed EU agenda for higher education

[2] COM (2022) 17

[3] European Commission (2017) Communication on Strengthening European Identity through Education and Culture

[4] COM (2020) 625

towards Europe's resilience. In this context, the ECIU University[5] team[6] has been working to move closer "towards truly European universities, which will be enabled to network and cooperate seamlessly across borders and compete internationally." The European Universities Initiative[7] aims to contribute to lifelong learning and bring "together a new generation of creative Europeans able to cooperate across languages, borders and disciplines to address societal challenges and skills shortages faced in Europe." To achieve these goals, the steps were taken towards a modernisation with the Flexible Learning Pathways model being at the forefront of these efforts and at the core of ECIU University. The Education 2030 Agenda supports flexible, learner-centred higher education provisions which enable learners to follow various types of learning.

Employers need a wide range of employees with diverse and evolving skills as well. Having a career requires people to upskill continuously: job qualification, education and experience are interlinked and shouldn't be decoupled. It is clear that the content-centred approach is no longer enough to satisfy the learners' lifestyles and needs.

Responding to the challenges listed above, ECIU University develops a highly innovative and unique **Flexible Learning Pathways model based on challenge-based learning**. This model allows learners to customise their learning and have complete control of their learning records. Learning happens in little pieces of education (micro-modules) tailored into the learning pathways.

[5] The ECIU University is an initiative of the European Consortium of Innovative Universities (ECIU Alliance) that creates a ground-breaking and innovative educational model on a European scale. Through the initiative, ECIU Alliance creates the ECIU University with an open and flexible system, an entirely new concept of the European University for the future. The project is a response to the 2019 call under the Erasmus+ action European Universities and supports the European Education Area agenda for 2025. The ultimate goal of the ECIU University project is to establish a true European University where learners, researchers, business, public organizations and citizens are enabled to create relevant innovative solutions for real life challenges with real societal impact.

[6] Team of Work Package 3 at the ECIU University project were working on Challenge-based learning, thereby creating final deliverable: the concept of Flexible Learning Pathways

[7] The official website at: https://ec.europa.eu/education/education-in-the-eu/european-education-area/european-universities-initiativeen.

2. FLEXIBLE LEARNING PATHWAYS MODEL

2.1. THE CONCEPT

The **Flexible Learning Pathways** is an innovative educational model where learners, researchers, businesses, public organisations, and citizens are enabled to create relevant, innovative solutions for real-life challenges with real societal impact.

The Flexible Learning Pathways (FLP) is a learner-centred model allowing each learner to choose a personalised learning path independently of their previous background with the possibility of changing learning direction along the way – according to each individual's needs (desired skills and qualifications).

The FLP allows each learner to understand his/her current skills (through self-assessment), engage with the ECIU community, receive personalised mentoring, support and track progress, choose a personalised learning pathway, assess learning and competences for the competency passport (Learner wallet), collect digital credentials for successful completion of challenge solving and micro-modules and gain specific skills and experience to meet the ever-changing labour market needs.

The FLP offers learning experiences of various lengths and depths. Each learner can choose to complete micro-modules only, get acquainted with the offering through the Sneak Peeker track, investigate through the Explorer track, dive deeper through the Pioneer track and achieve the heights with the Trail Blazer path.

The FLP uses a challenge-based learning (CBL) method where the learner chooses specific real-life challenges and solves them via different CBL routes with micro-module support (see Figure 1).

Learners together with stakeholders engage in challenge-based learning to solve the emerging societal problems together.

1   In the long run, the learners can access and search for micro-modules which would give them micro-credentials (skills, competences and knowledge-based). Therefore, it is much easier to concentrate on the journey and reach the learning goals with a clearly defined roadmap. For this reason, the FLP suggests adjusting the sequence of learning to fit the learners' own needs. It is like an 'education playlist' that helps the learners make sense of scattered micro-credentials and decrease their search time.

2   Once the learner is satisfied with the learning options, he/she enters the Learning Pathway. Learning Pathway could be formalised by adopting Smart Certificate which would enable multiple parties to transact with each other with certainty that a transaction will be performed as agreed. Alternatively, the validation of the competences could be processed by external stakeholders.
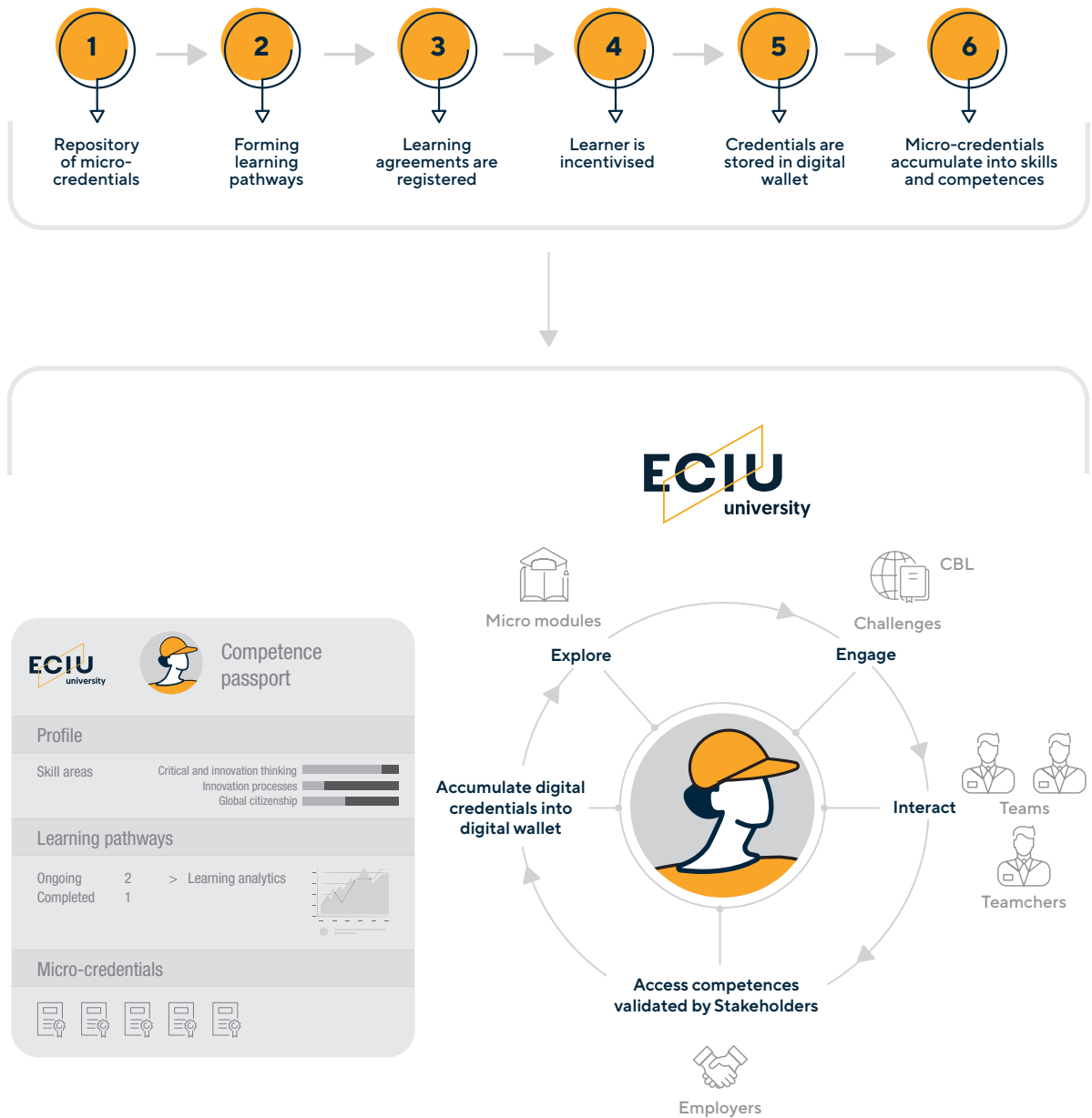
Figure 1. Flexible Learning Pathways architecture

Source: WP3.4

3   As learners progress with learning, they are incentivised and get rewarded for the achieved milestones.

4   At the core of the Flexible Learning Pathway model, there is the blockchain-secured digital passport for learning records. It allows learners to get credentials from multiple ECIU University institutions in recognition of their learning. In this way, the learners can carry their learning data anywhere they go, accessing it at any time. It is fully learner-owned.

5   The learners can study micro-modules as standalone elements or can combine them with other micro-modules. In this way, they can build more robust competences or stack them to a certificate or a full degree. By combining all these elements, the Flexible Learning Pathway model brings learning back into the hands of the learners.
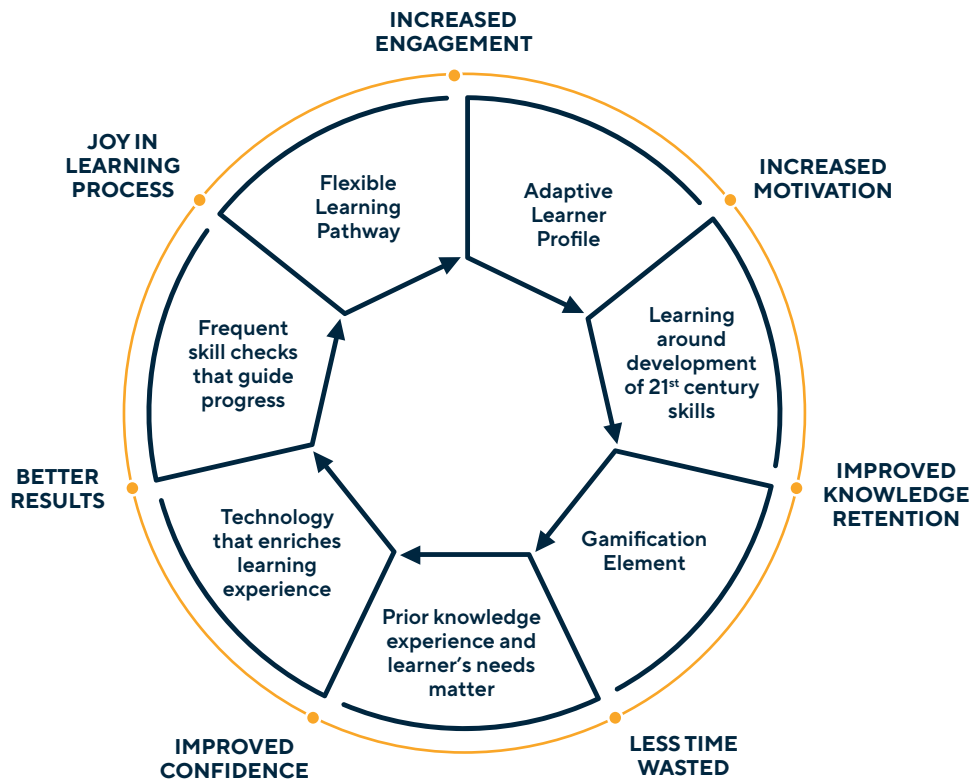
Figure 2. Added Value for the Learner

Source: WP3.4

This concept emphasises the need for the recognition of previous competencies in allowing the learners to progress to more advanced levels of learning. This earning model creates a lot of value for the learner (see **Figure 2**). It has been developed by involving analysis of different learning innovations throughout Europe and the world (see Annex I – Good Practices).

2.2. ELEMENTS AND PARTICIPANTS OF THE MODEL

As for the **creation of the Flexible Learning Pathways model**, the assumption is that the ECIU University is not an entity composed of multiple study programmes, but it is a unique structure where learners are not locked into learning at specific institutions or in one mostly predefined study programme.

This is accomplished by an infrastructure that enables Flexible Learning Pathways by offering the learners a choice of micro-modules from ECIU member universities. The principle in how the FLP is formed involves several networks:

- A learner gets invited and enters the ECIU platform. A learner takes a self-assessment test and engages with the ECIU community. After completing self-assessment, a learner gets a digital competence passport (Learner wallet) generated so that to compare the already existing skills with their desires and goals. This step is accompanied by receiving personalised advice and support for future planning. After choosing the learning opportunities, a profile comparison within the ECIU community is bound to be made, and the learner can link up to the ECIU community.

- The ECIU Member Network provides micro-modules and challenges that will form the basis for the Flexible Learning Pathways model. Both challenges and micro-modules must be tagged with the skill information and the expected learning outcomes. Then, the learner chooses and confirms the selected personalised learning pathway, starts planning activities, sets learning goals, and activates the Smart Certificate.

- These offerings, drawn from all the members forming ECIU, are collected in the ECIU Flexible Learning Pathways repository. Based on the tags for each micro-module, AI groups the micro-modules and assigns them to challenges.

- Learners choose offerings based on their skill gaps. They are assisted by AI which guides them through the selection process, thereby ensuring that learners make an informed decision about their skill progression.
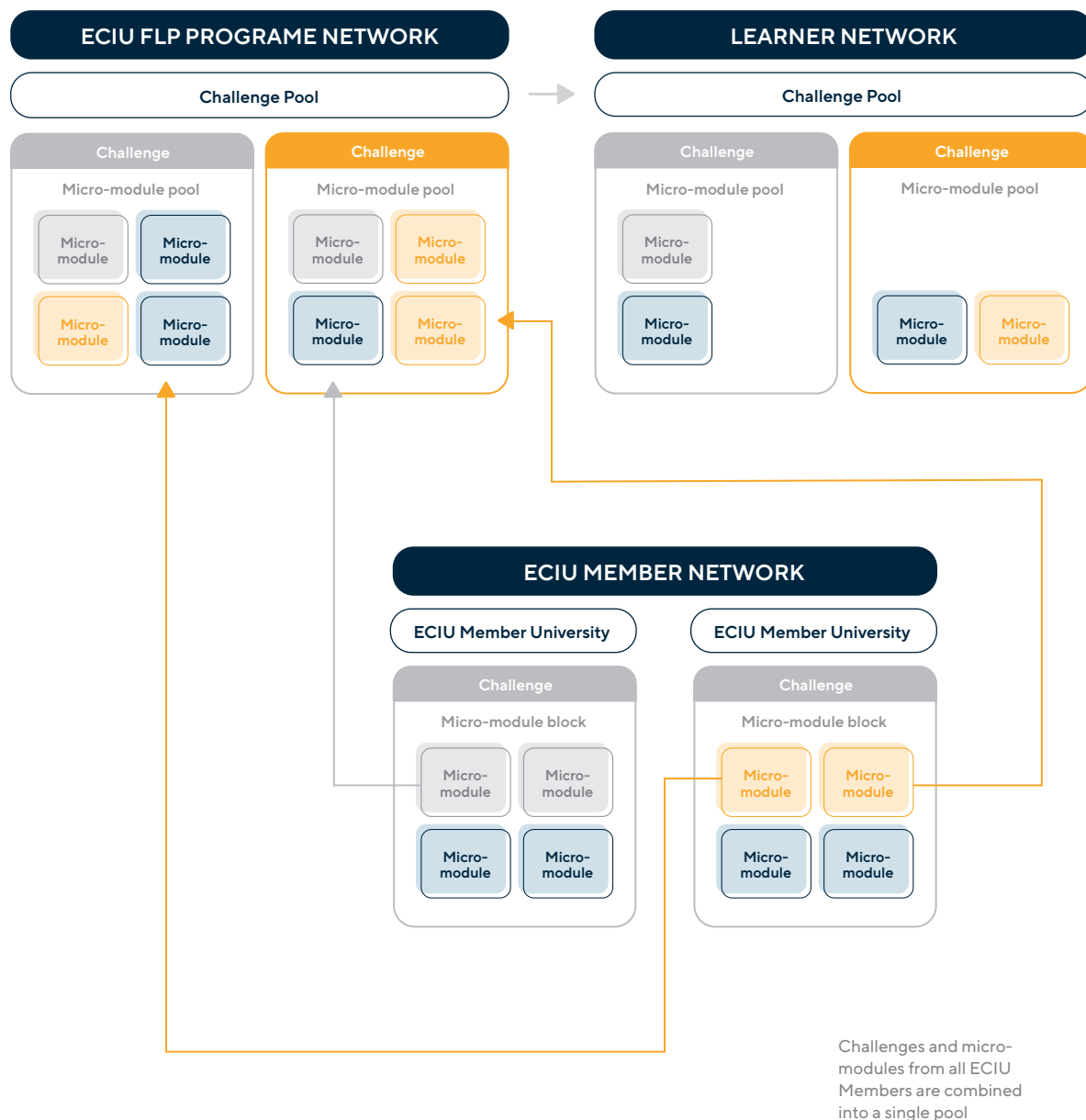
Figure 3. Flexible Learning Pathways linkages with ECIU players

Source: WP3.4

As a result of the learning approach, the ECIU Flexible Learning Pathways model is grounded in personalisation and inclusiveness. As a result, learners can tailor challenges and micro-modules they like to build their personalised pathways.

2.3. TECHNOLOGY ROLE IN THE MODEL

Technology plays a major role in the FLP execution. Accordingly, the FLP concept builds on AI, blockchain, data analytics, semantics, and gamification technologies to disrupt how learning and educational credentials are managed, shared, and validated. With this in mind, FLP strives to create value for learners and stakeholders across many aspects of the complex education and employment ecosystem while addressing their reciprocal impacts and dependencies. AI is crucial to this process as it is responsible for grouping micro-modules with challenges and providing learners with information based on their input. The '*Invisible to the learner*' data supplied by the ECIU Members allows AI to match the challenges to the micro-modules and then match the challenges to the learner knowledge, interests, and expectations.

To see how the process functions from the learners' perspective, it is essential to look at the learning pathway example of the fictional learner Learner A (see **Figure 5**). We note that, in the given example, fictional learner Learner A (let us call him John) is choosing challenges with micro-modules. There is an option to select micro modules without the challenges.

- Learner A begins by accessing his learner dashboard, where he provides input about his past academic and personal achievements, interests and expectations.
- Learner A completes self-assessment, and the ECIU platform generates a digital competence passport (Learner wallet) addressing his current skills and competences.
- Learner A gets personalised advice, chooses the learning opportunities he wants to pursue, and his profile is compared with the ECIU community in order to start building the ECIU community network.
- With that done, Learner A can access the pool of challenges (drawn from the offerings of the ECIU Member Network), where he can freely select which challenges to solve. In our example, Learner A would like to solve the Challenge related to New Paradigms, Technologies and Applications for Sustainable Development. When he makes his challenge selection, there are two possibilities.
- The first possibility is that Learner A decides to solve the challenge horizontally. He wants to develop a wide range of different skills (in our example, he could study micro-modules
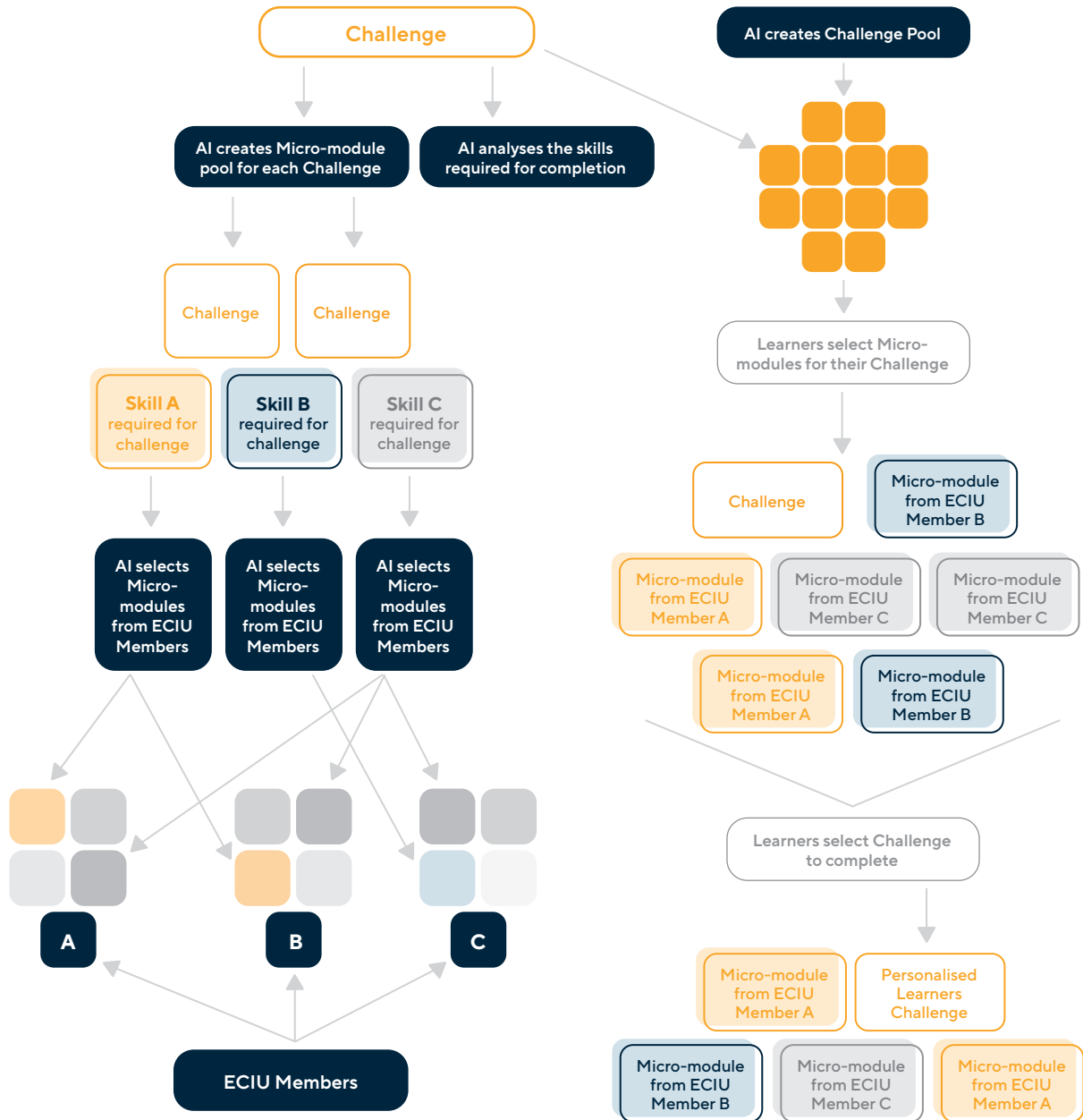
Figure 4. Flexible Learning Pathways linkages with ECIU players

Source: WP3.4

- for Data Science; Wind Turbines; Software Quality Assurance and Digital Marketing).

- Another possibility for Learner A is to choose the vertical selection which is a deep dive into specific skills (in our example, he could study micro modules for Data Science; Data Storage Technologies; Scientific Computing; AI).

- The main point is that it is Learner A's choice which pathway to pursue and which skills to develop. As he finalises his selection, Learner A begins his learning pathway. These culminate in the completion of the challenge, after which, Learner A earns microcredits. He can then proceed to the next challenge to continue his learning path.

- Whichever choice he makes, the microcredits are available to Learner A through certification, thereby enabling him to prove he has gained specific skills through his learning, and also enabling him to benefit from them in the labour market immediately.

When Learner A was making his selection in the above example, his decision making was supported by AI functionality. To see the AI functions, it is essential to look at the journey of the fictional learner Learner A, but, this time, we follow his choices from the perspective of how AI supported his learning pathway (see **Figure 6**).

In his learner dashboard, Learner A lists his academic competences (his BA degree in Energy Engineering), his professional competences (work with NGOs, work in circular economy) and his interests, the desired competences (Learner A wants to start his company – specifically, to become an entrepreneur in renewable energy technologies). Learner A is communicating with the ECIU Flexible Learning Pathways model AI which will guide Learner A's choices thereby ensuring the flexibility of choice while giving a solid structure to maximise the knowledge gain.

- Based on Learner A's profile, AI communicates with the centralised Challenge pool. It selects those Challenges that match Learner A's academic and professional competences as well as his expectations. This is the intelligent profiling functionality which tailors the Challenge options to the profile of learners. Learner A is then presented with the Challenges that would suit his interests, and he can make his selection. In the above example, he selects New Paradigms, Technologies, and Applications for Sustainable Development, as it conforms to his entrepreneurial interests.

- With Learner A's Challenge selected, AI moves to prepare a pool of micro-modules. While there would be many micro-modules to choose from, intelligent profiling helps to present the micro-modules that optimally fit Learner A's competences, interests and expectations. Learner A is then able to select the micro-modules that are of interest to him and would help him achieve the selected Challenge.
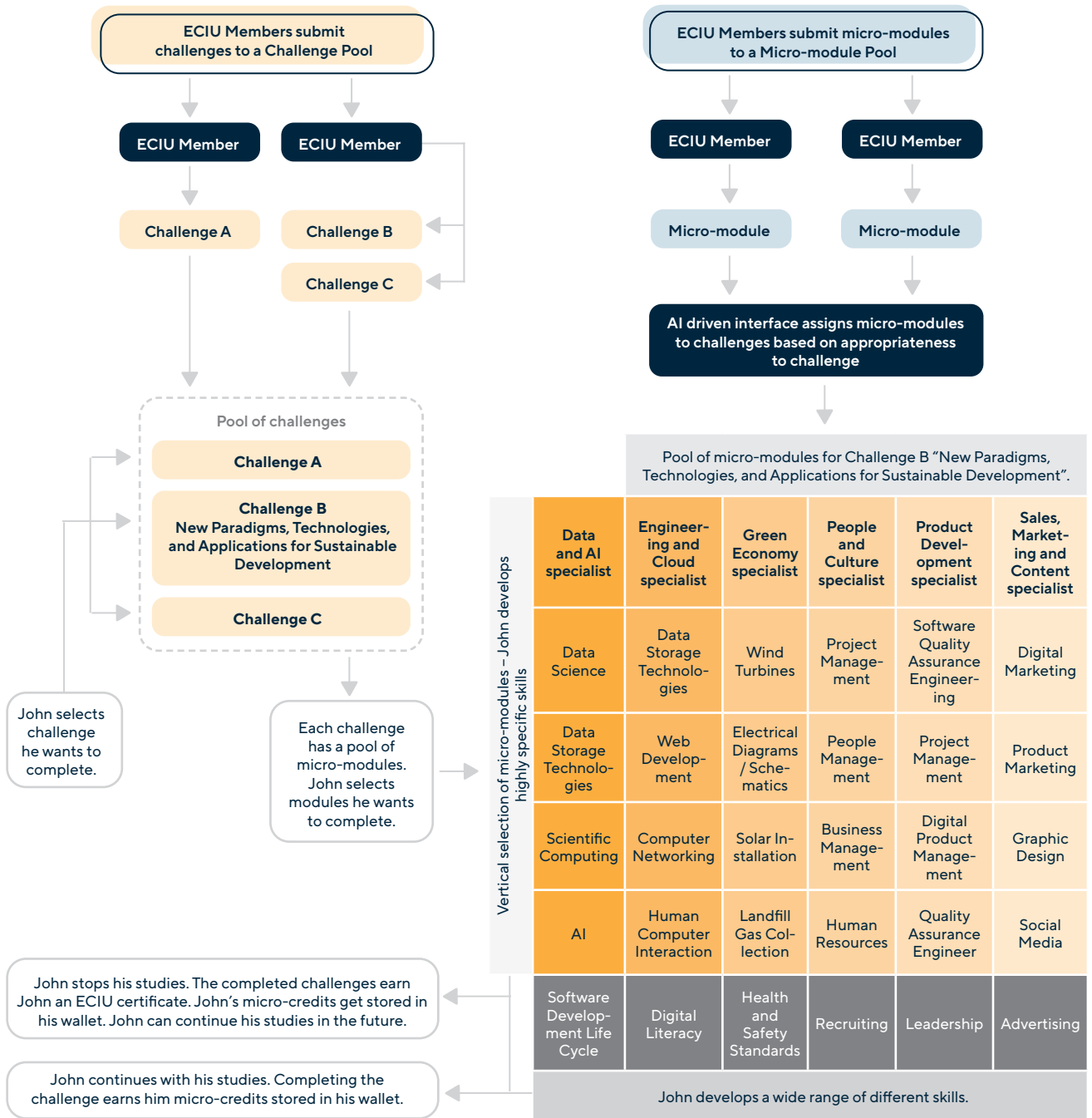
Figure 5. Flexible Learning Pathways linkages with ECIU players

Source: WP3.4

John brings his competences, interests and expectations. These help form the selection of Challenges

John holds a Bachelor in Energy engineering, but he had modules related to management

John worked in an NGO that focused on circular economy

John is interested in starting his own company which would develop renewable energy technologies

AI creates Challenge pool based on John's competences, interests and expectations

POOL OF CHALLENGES

Challenges selected for John	Challenges excluded for John
Circular Material Use by SMEs	Designing Cloud Solutions for Business Development
Engineering Quality Assurance for SMEs	How Cultural Trends Affect Green Lifestyles
New Paradigms, Technologies, and Applications for Sustainable Development	Use of AI in Large Solar Plants

AI creates Micro-module pool based on John's competences, interests and expectations

Pool of micro-modules for "New Paradigms, Technologies, and Applications for Sustainable Development." AI removes Micro-modules (crossed out) that do not fit John's competences, interests and expectations

Data and AI specialist	Engineering and Cloud specialist	Green Economy specialist	People and Culture specialist	Product Development specialist	Sales, Marketing and Content specialist
Data Science	Data Storage Technologies	Wind Turbines	Project Management	Software Quality Assurance Engineering	Digital Marketing
Data Storage Technologies	Web Development	Electrical Diagrams / Schematics	People Management	Project Management	Product Marketing
Scientific Computing	Computer Networking	Solar Installation	Business Management	Digital Product Management	Graphic Design

Figure 6. AI functionality for the Flexible Learning Pathways model

Source: WP3.4

- We note that there is an option for Learner A to choose only Micro-modules without solving any challenges. When that happens, Learner A chooses micro-modules personally by picking them from the AI-provided Micro-module pool profiled from Learner A's competence passport to expand Learner A's competences, interests and expectations.

The learning pathway is designed to offer learner's flexibility while providing a structure to the learning pathway that is based on the competences and interests of the learner. It is meant to simultaneously give freedom of choice while negating the likelihood that learners make the wrong choice and ultimately get dissatisfied with the outcomes of their studies.

2.4. FLEXIBLE LEARNING PATHWAYS CONSTRUCTION

2.4.1. Key participants in the learning process

Life-long learning needs an ecosystem where every learner is regularly motivated and encouraged throughout his/her learning journey. The approach is flexible to handle diverse demands and individual needs, where the learner gets the full support whenever needed. To understand the ecosystem of the FLP, we need to understand the main players:

| A student | Life long learner | External stakeholder |
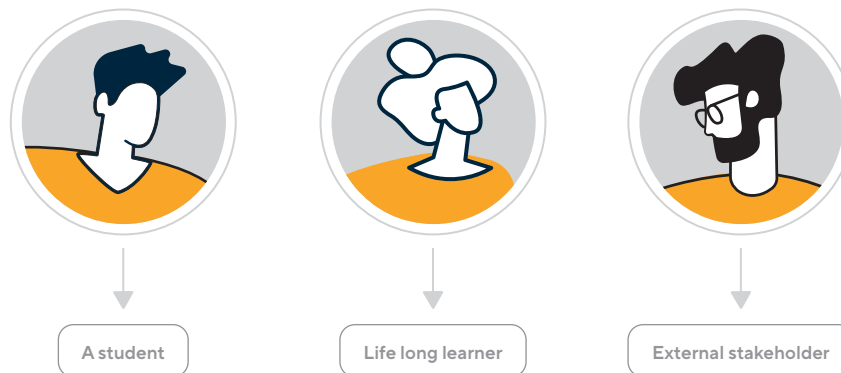
ECIU LEARNER: an active individual who is either employed or is a graduate and, therefore, is interested in the skills and competences development. It could be either:

- **A student** from one of the 14 ECIU University member institutions; enrolled in a Master's degree programme or studying in the final year of a Bachelor's degree programme; having

completed 120 ECTS of higher education studies at the undergraduate level; having B2 (or higher) level of English language proficiency.

- **Life-long learner** – a professional or a newly graduated learner who is eager to upskill/ reskill, to make a contribution to the European society and transform the way he/she learns, having acquired a Bachelor's degree with at least 120 ECTS; having B2 (or higher) level of English language proficiency; being a resident of one of ECIU member's countries.

EXTERNAL STAKEHOLDERS:

- **ECIU Members:** European Consortium of Innovative Universities, a network of 14 universities united by a profile of shared beliefs, interests, and mutual trust.

- **Industry/society/community representatives:** These are the people who validate and suggest challenges, observe or get actively involved in the learning path and in the entirety of the process, communicate with Teamchers, as well as provide additional relevant information.

- **Teachers:** They carry the traditional role of a university lecturer who supports and facilitates learning, assesses and validates the learner's progress and development, encourages the learner to continue skill and competence development as well as disseminates the newly gained knowledge.

- **Teamchers:** They take part in the pre-project meetings with the challenge provider and describe how the FLP process will be carried out and prepare to set off the actual FLP process by introducing the pedagogical underpinnings of the team FLP together with the local FLP experts. The Teamcher also facilitates the team's work during the FLP process together with the challenge provider and the teacher.

- **Researchers:** They explore the opportunities in ECIU, develop an international research network, solve challenges together with other stakeholders, develop research questions emerging from these challenges, access data sets for research purposes, prepare and complete the required activities, and disseminate the results.

2.4.2. Key components in the learning process

ECIU Flexible Learning Pathways invites learners to join a unique learning experience and engage in solving challenges while working in multidisciplinary and international teams, join micro-modules and fill in the skill and knowledge gap in a particular area, collect and stack micro-credentials in a digital competency passport (Learner wallet). Moreover, it opens the

border for various individuals with the Bachelor's degree to progress with new skills and competences, thereby allowing to get full recognition in their home country. The sections below shall explain all of these components in more detail.

- **Competence passport (Learner wallet) and development**. The digital competence passport (Learner wallet) will serve as a repository for micro-credentials by accumulating and organising the learner's academic knowledge, skills, and competences across European offers. The digital competence passport (Learner wallet) keeps track of the learner's abilities and competences as they acquire micro-credentials and record them in the competence passport (Learner wallet). The competence passport (Learner wallet) is a dynamic document which combines schooling and life-long learning certificates into one stackable and continuously updated document. The CBL FLP digital competence passport (Learner wallet) will be integrated with European-level quality assurance. It is a lean quality assurance method which is bound to alleviate administrative costs at the level of individual Member States. The CBL FLP will foster a sustainable micro-credentials movement in higher education across Europe, and its framework for automatic recognition of studies will establish new norms for the agility, flexibility, and customisation of higher education in the spirit of life-long learning. By collaborating on multidisciplinary problems with diverse stakeholders in the society or by gaining knowledge, skills and competences via micro-modules using new pedagogies, learners will earn micro-credentials which shall explicitly demonstrate their abilities and competences.

- **Challenges**. A challenge is a specific real-life problem that needs to be solved via a specific CBL route and by using micro-module support. Challenges come in various forms and are generated in different ways (e.g. directly through discussions between Teamchers and challenge providers, rendered collectively through Local Partnership Arenas or submitted directly to a challenge coordinator, etc.). Each chosen study path will have different difficulty challenges offered.

- **Micro-modules.** Micro-modules are short or long transparently assessed learning experiences provided by (but not limited to) ECIU Member Universities. They are taken by the learners together with the challenge or separately. Micro-modules can be SDG theme-related and/or supporting (e.g. Fostering transversal, language skills). Each micro-module is valued with a different amount of learning workload measure (such as ECTS) and finishes with assessment. Successful completion of micro-module assessment rewards learners

with micro-credentials. This study employs the ECTS standard to simplify the measuring workload of learning, but this choice can be revised with alternative measuring units at the later stages.

- **Micro-credentials**. Each challenge will feature suggested micro-modules that will provide the subject and supporting information to pass the assessment(s).

- For each successfully completed assessment, learners will receive micro-credentials which will be stored in the digital competence passport (Learner wallet).

- **Mobility**. When discussing mobility in higher education, it is understood that individuals need to be provided with the right set of knowledge, skills and competences from the lifelong perspective. Learner mobility programs in higher education mainly consist of exchanges through the Erasmus programme. But it comes with its limitations. ECIU University understands the importance of the movement of inquiring minds that are looking for new knowledge, new experience and new relations in the general sphere of higher education. Creating a mobile, multicultural and digital society is one of the ECIU University visions. Going forward, ECIU envisions an ecosystem where learners, researchers, educators, and other stakeholders unite to solve real-world challenges in transnational teams, while being physically or virtually mobile and working without the comfort of their familiar cultural setting.

- **Recognition of Flexible Learning Pathways**. ECIU Flexible Learning Pathways is a unique learning method. Up until now, there is no unified model of micro-module recognition in Europe, and only a proposal of how to approach micro-credentials for lifelong learning and employability has been drafted[8]. To recognise the FLP, one needs to understand how partner institutions in different countries organise study accreditation processes, how national frameworks regulate the capacity of the involved institutions to self-accredit programmes. The shared understanding of these differences between partner universities will allow to unify the course to a level where the FLP can be recognised across Europe.

[8] For further information, see: Proposal for a Council Recommendation on a European approach to micro-credentials for lifelong learning and employability hosted at https://data.consilium.europa.eu/doc/document/ST-9237-2022-INIT/en/pdf

2.4.3. Knowledge for professional and lifelong learners

The FLP programme offers the opportunity for advanced study in natural, technological, social sciences and humanities and allows the flexibility to create a personalised learning path through the selection of challenges, micro-modules, vertical or horizontal learning, individual development plan, and knowledge building. The combination of studying the micro-modules and solving the challenges creates a unique opportunity for the learner to develop domain/disciplinary (deepening understanding), transversal and preparatory (broadening understanding) competences. A possible example of what an individual who has chosen to learn through the FLP would be able to do:

- Learn to work in interdisciplinary groups
- Handle contracts within the group
- Develop good practice through exchanging views and experiences with other professionals
- Develop critical understanding of theories and principles
- Acquire updated knowledge in relevant areas of expertise and skills, and also other areas within a subject
- Convey key subject matter through the appropriate forms of expression
- Reflect on ethical issues within the discipline
- Perceive a topic in a broader context from the societal perspective
- Write a business plan
- Identify and research markets, brainstorm and evaluate ideas
- Organise the finances for a new venture
- Present their idea, learn how to sell
- Solve a challenge/create a prototype/solution demonstrating mastery and innovation.

The FLP allows each learner to create an individual 21st century competences development and/or strengthening plan and provides full support while achieving it. Each of the learning paths (Sneak Peeker, Explorer, Pioneer, Trail Blazer) and micro-modules allows the learner to gain specific competences in a different depth. Depending on the selected number of credits and the path chosen, a learner will go from merely getting introduced to a certain skill or competence to mastering it.
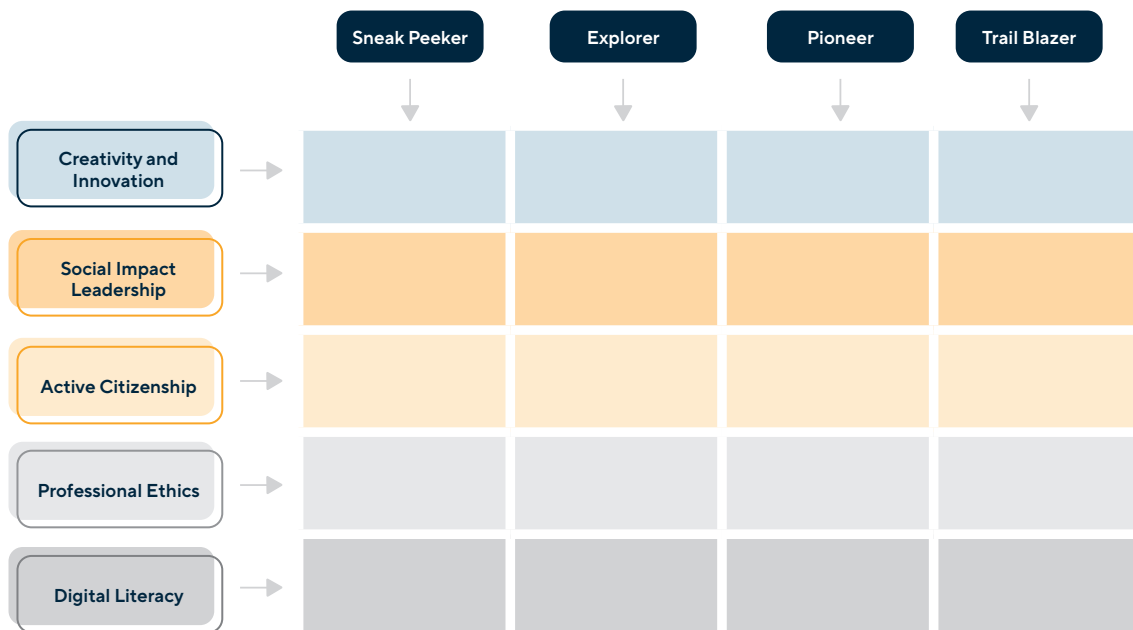
Figure 7. Example of FLP competences by different FLP levels

Source: WP3.4

FLP micro-modules allow gaining specific competences in different depths. It is important to note that ECIU Flexible Learning Pathways enables learners to choose pathways according to their skills, experience, knowledge, or the other way around, on the grounds of knowing which competency they want to master (see **Figure 8**). Suppose, Learner A wants to become an Engineering and Cloud Specialist, but only has some level of skills in Software Development, Data Science, Social Media, People Management and Scientific Computing.

All learning outcomes align broadly with the three main contributors/participants in CBL. Therefore, in deciding on how to assess a learner's performance in CBL, appropriate emphasis should be placed on each of the three elements discussed below:

- **Process** – learners engaged in a programme of the FLP will benefit most from the creative process of the FLP itself and gamification elements. Aside from the subject content knowledge, they will gain additional insights into the machinations, advantages and pitfalls

John's skills (prior knowledge):

SOFTWARE DEVELOPMENT	DATA SCIENCE	SOCIAL MEDIA	PEOPLE MANAGEMENT	SCIENTIFIC COMPUTING
Problem Solving Skills	Information Literacy	Creativity	Communication Skills	Technology Skills

John wants to become an engineering and cloud specialist.
Additionally to his current skills, he needs to gain competences in:

DATA STORAGE TECHNOLOGIES	COMPUTER NETWORKING	HUMAN-COMPUTER INTERACTION	DIGITAL LITERACY

Micro-modules John needs to take

Relational Database (SQL)	Relational Database (SQL)	Relational Database (SQL)	Relational Database (SQL)
SQL queries	SQL queries	SQL queries	SQL queries
Data Optimisation	Data Optimisation	Data Optimisation	Data Optimisation

After each micro-module, John will need to take an **ASSESSMENT**

Competences gained:

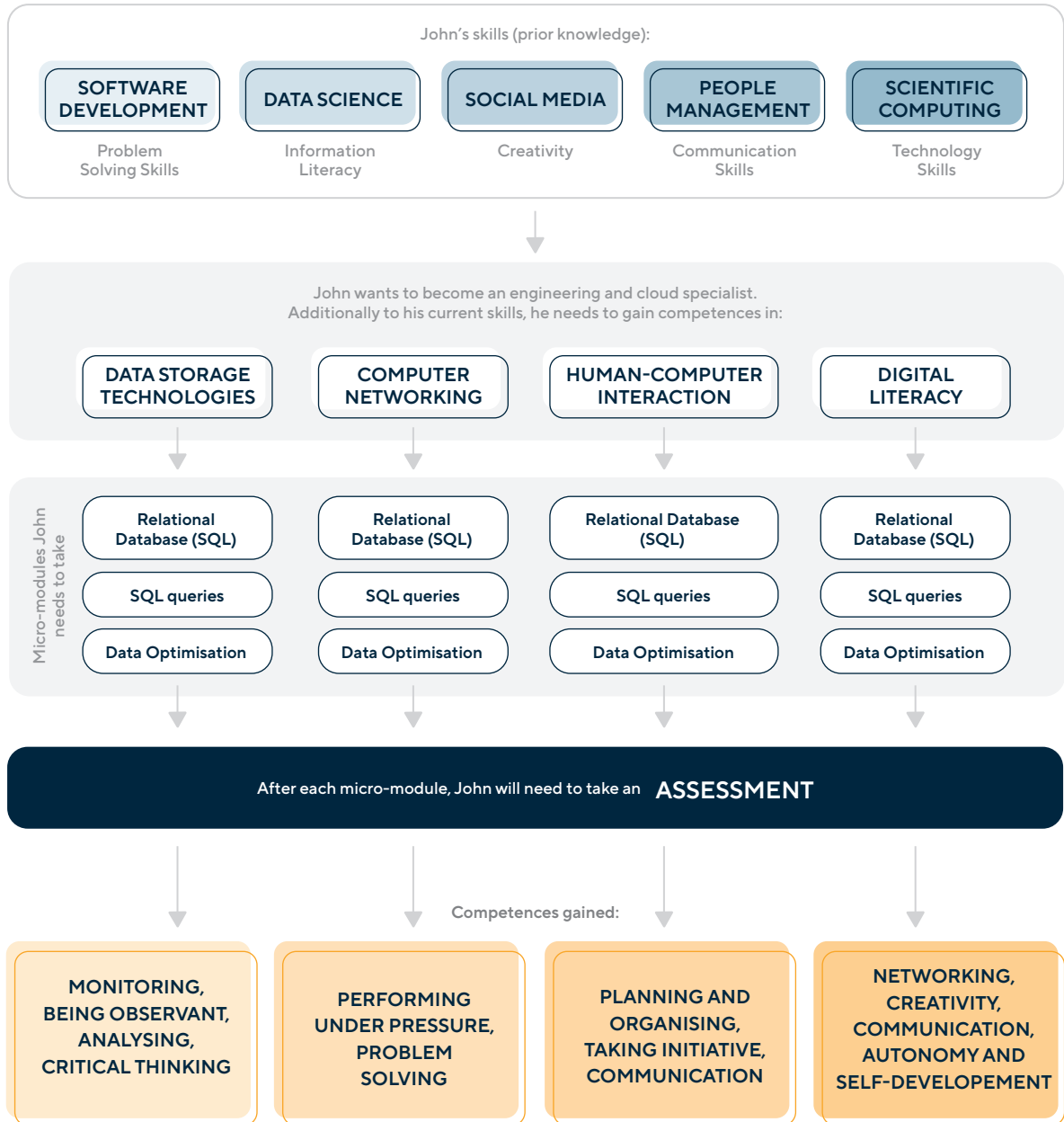| MONITORING, BEING OBSERVANT, ANALYSING, CRITICAL THINKING	PERFORMING UNDER PRESSURE, PROBLEM SOLVING	PLANNING AND ORGANISING, TAKING INITIATIVE, COMMUNICATION	NETWORKING, CREATIVITY, COMMUNICATION, AUTONOMY AND SELF-DEVELOPEMENT

Figure 8. Micro-module linkages to skills and competence

Source: WP3.4

of teamwork while learning from communication with other learners, facilitators and stakeholders. Learners will also build personal experience and a sense of ownership over their work and the results. Communication inside and outside of the team will provide valuable insights into how different stakeholders see the challenge and how to develop a common language which would be understandable to a general audience without a specific technical background. Reflection by the learners about what they have learned from the process (i.e. how they have achieved the learning outcomes related to the process) is an integral part of the FLP and should be part of the evaluation.

- **Content** – content knowledge in predefined discipline areas can be selected and fine-tuned by academics/facilitators according to the latest knowledge of science. This should be done in the early stages of challenge selection. Upon the completion of a course, the learner's knowledge coverage and depth attained during the FLP can be evaluated/tested.

- **Product** – stakeholders providing a challenge hope to benefit from the product/solution created during an FLP course. They will expect a specific improvement for various global organisations or businesses within clearly defined parameters by providing a challenge. Stakeholders can support and provide funding to the learners, and the final product should impact SDG11. At the end of the course, they should evaluate how good and effective a product/solution is from their point of view.

2.4.4. Learning paths and possibilities

Learners will have the flexibility to choose the learning pathway from 10 to 90 ECTS, depending on the challenges selected (mini, standard, strategic) and the ECTS collected. It could be a self-paced (the Sneak Peeker path) or partly self-paced (the remaining paths with Teamcher involvement and guidance) course, with the maximum period to complete learning in three years. If a learner fails to complete the learning pathway within this timeframe, they can only obtain a reward certificate for the completed micro-modules.

The FLP allows a learner to choose a personalised learning pathway, the direction (horizontal or vertical), and collect stackable micro-credentials – see **Figure 9**.

When knowing the competences and skills a learner wants to learn and/or the amount of ECTS needed to collect a specific award, learners firstly choose the challenge group they are interested in. After completing self-assessment, the learner is offered particular challenges and micro-modules (by following a logical sequence from the easier ones to the tougher
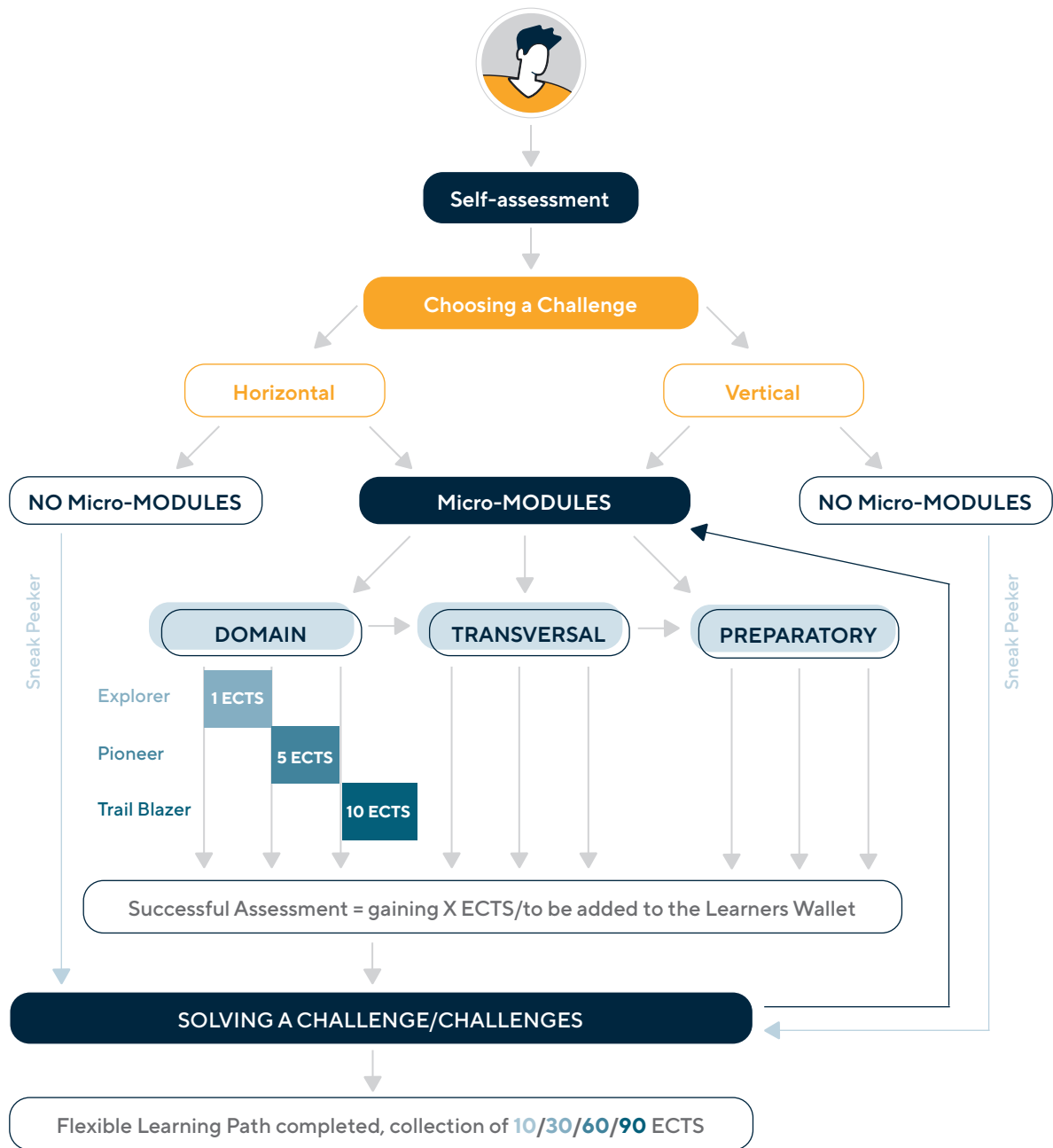
Figure 9. Learner's study path and choices

Source: WP3.4

ones, depending on the individual's experience, knowledge, and interests) and is grouped with other learners into a team. Each team member will choose to continue their learning journey solving challenges with the help of micro-modules or without them (only the Red Digital Credential Level). Micro-modules are divided into disciplinary micro-modules and transversal skills micro-modules. All micro-modules will be suggested according to the learning path chosen by the learner.

To complete each of the paths, a learner will have to collect ECTS consisting of challenges and micro-modules:

- At the **Sneak Peeker Digital Credential (DC)**, the learner will need to collect a total of 10 ECTS, and it could be done by solving two challenges (worth 5 ECTS each), or by solving one challenge (worth 10 ECTS) without any micro-modules.

- At the **Explorer DC**, learners will need to collect 30 ECTS, including 10 ECTS from challenges and 20 ECTS from micro-modules. Possible choices will be the following:
  - Two challenges (worth 5 ECTS each) + various micro-modules (worth 20 ECTS)
  - One challenge (worth 10 ECTS) + various micro-modules (worth 20 ECTS)

- At the **Pioneer DC**, the learner will need to collect a total of 60 ECTS, including 20 ECTS from challenges and 40 ECTS from micro-modules. Possible choices will be the following:
  - Two challenges (worth 5 ECTS each) + One challenge (worth 10 ECTS) + various micro-modules (worth 40 ECTS)
  - Two challenges (worth 10 ECTS each) + various micro-modules (worth 40 ECTS)

- At the **Trail Blazer DC/Smart Certificate level**, the learners will need to collect 90 ECTS, including 30 ECTS from challenges and 60 ECTS from micro-modules. Possible choices will be the following:
  - Two challenges (worth 5 ECTS each) + One challenge (worth 10 ECTS) + various micro-modules (worth 40 ECTS)
  - One challenge (worth 30 ECTS) + various micro-modules (worth 60 ECTS)
  - Two challenges (worth 10 ECTS each) + various micro-modules (worth 70 ECTS)
  - One challenge (worth 10 ECTS) + One challenge (worth 15 ECTS) + various micro-modules (worth 65 ECTS)

An FLP example learning plan is illustrated below (**Figure 10**).

In the below given example, the learner chooses a challenge group URBAN TRANSPORT. Knowing that Trail Blazer Digital Credentials consists of 90 ECTS, the learner decides upon
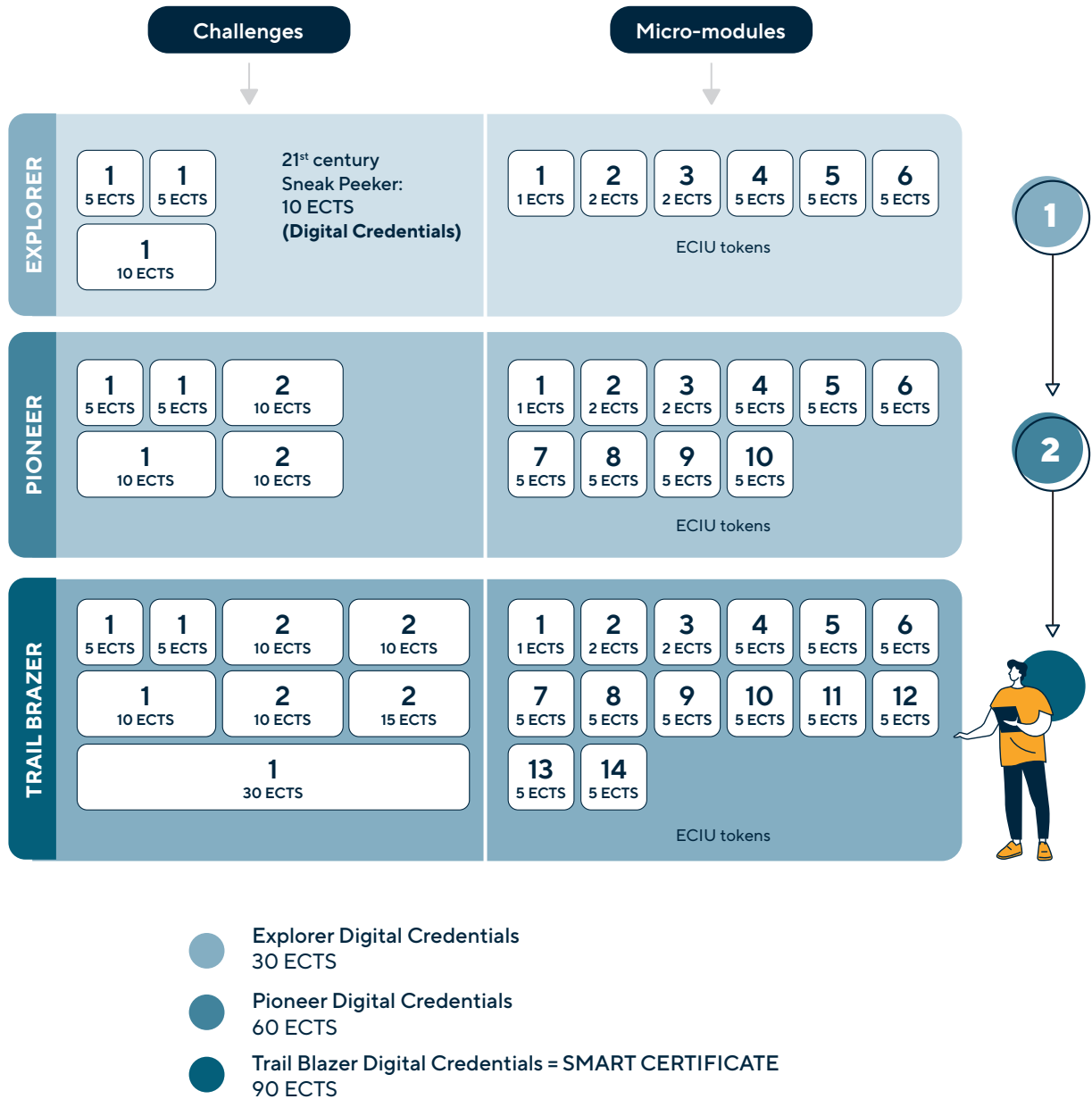
Figure 10. Example of possible FLP learning plans

Challenge group: URBAN TRANSPORT

SNEAK PEEKER

10 ECTS
Digital
Credentials

EXPLORER

30 ECTS
Digital
Credentials

PIONEER

60 ECTS
Digital
Credentials

TRAIL BLAZER

90 ECTS
Digital
Credentials

Challenge #1

Challenge #2:
Environmental
impact and
efficiency

10 ECTS

Challenge #3

Challenge {...}

Micro-
module 1

{...}

Common
ticketing
system for
whole country

2 ECTS

Micro-
module 2

{...}

Non-
polluting
transport

2 ECTS

Micro-
module 3

{...}

Pollution
Management

5 ECTS

{...}

{...}

{...}

{...} ECTS

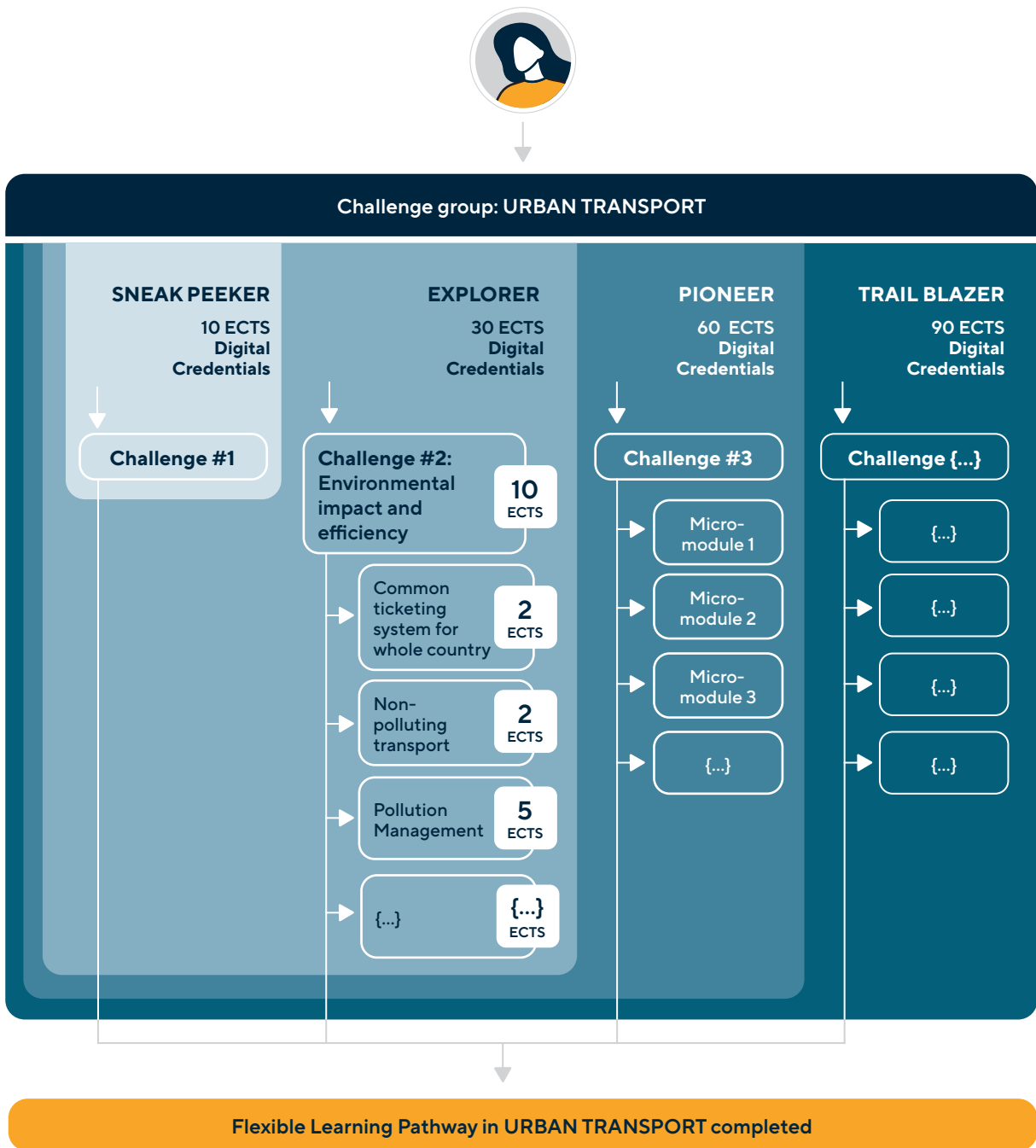**Flexible Learning Pathway in URBAN TRANSPORT completed**

Figure 11. Example of a Smart Certificate – completed FLP in Urban Transport

Source: WP3.4

the specific challenges and supporting micro modules to reach the needed amount of ECTS. Given the example, the learner chose Challenge 1 (worth 10 ECTS) Environmental impact and efficiency which comes with three micro-modules worth 9 ECTS in total. Thus, the total achievement of ECTS will be 19 ECTS. To achieve the Smart Certificate, the learner will still need to choose a further:

- Challenge (worth 10 ECTS) + micro-modules (worth 61 ECTS)
- Challenge (worth 15 ECTS) + micro-modules (worth 56 ECTS)
- Challenge (worth 30 ECTS) + micro-modules (worth 41 ECTS)

2.4.5. Rewards

Every learner will have the flexibility to choose their path, from the challenges and the type (mini, standard, strategic) to micro-modules and their depth. Each challenge and the supporting micro-modules will have a specific ECTS score. Therefore, every learner will know what type of accomplishment they will get at the end of the course. With every completed step throughout the learning journey, learners collect digital credentials to their competence passport (Learner wallet). The learners choosing a path with a challenge and micro-modules upon successful completion will be rewarded with the chosen path Digital Credentials, depending on the amount of ECTS collected. Trail Blazer Digital Credentials or a combination of a few paths Digital Credentials, equalling or exceeding 90 ECTS, will appear as a Smart Certificate in the learner's competence passport (Learner wallet).

- **Sneak Peeker Digital Credentials (DC).** Shortest learning that can be completed without micro-modules, equal to 10 ECTS.
- **Explorer DC.** Learning of up to 30 ECTS that should be completed within a year.
- **Pioneer DC.** Learning of up to 60 ECTS that should be completed within one to two years.
- **Trail Blazer DC.** Learning beyond the Bachelor's degree worth 90 ECTS should be completed within one to three years.

Smart Certificate. A 'living' document which proves that a learner has taken and successfully completed their chosen flexible learning path. It is a lifelong online digital passport constantly changing with new skills and achievements being added to it.

3. IMPLEMENTATION OF FLEXIBLE LEARNING PATHWAYS

The primary objective of the Flexible Learning Pathways model is to alter and rebuild the traditional curricula while seeking and providing more personalised learning that interacts with various players, e.g. the labour market, policymaking, the public sector, and the more prominent socio-economic actors. The ECIU University strives to create value for learners and stakeholders across many aspects of the complex education and employment ecosystem while addressing their reciprocal impacts and dependencies. The present Section 3 is the last in a sequence of the report delivering a condensed version of assessments and needs for the implementation of the FLP model.

3.1. LEARNER PATHWAY CONSTRUCTION

Constructing a learning pathway is the process of organising a series of units of learning and planning how learning will take place, including getting to know the learner. These elements are significant in the design of the FLP. This sub-chapter discusses how to construct learning activities and organise learning pathways.

Source: WP3.4
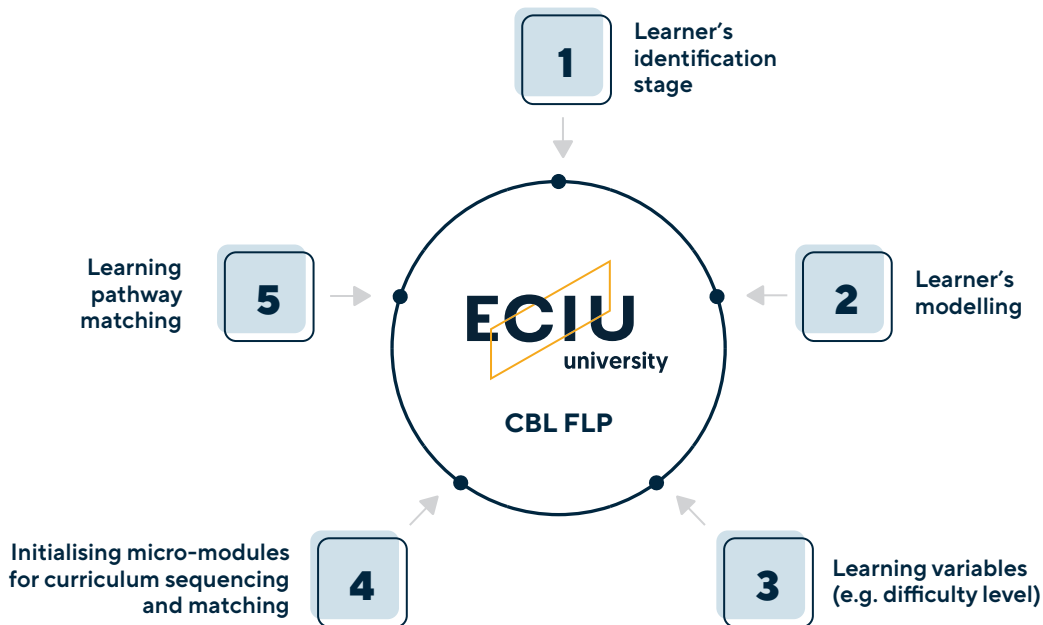
3.1.1. Learner's identification stage

Personalised learning transforms learners' roles from being only the customer of education to co-producers and collaborators in their learning journey. Personalised learning immerses the learner into the learning process, which results in enhanced learning outcomes and learning experiences. Learners take an increasingly active part in choosing their own education route as they go along while being held more responsible towards their learning achievement.

The first step of a learner's identification is to design a suitable structure and schema for the profile. A learner's profile contains all the information necessary to determine whether the individual is qualified to match the learning offerings. This includes references to credentials, the educational background, job experience, and any other information included in a CV. The structure identifies the parts that are usually included in a curriculum vitae as well. Several different parts of the structure are depicted in the figure below (**Figure 12**).

This information shall be utilised to identify the most suitable learning pathways for the learner or to recommend suitable micro-modules.

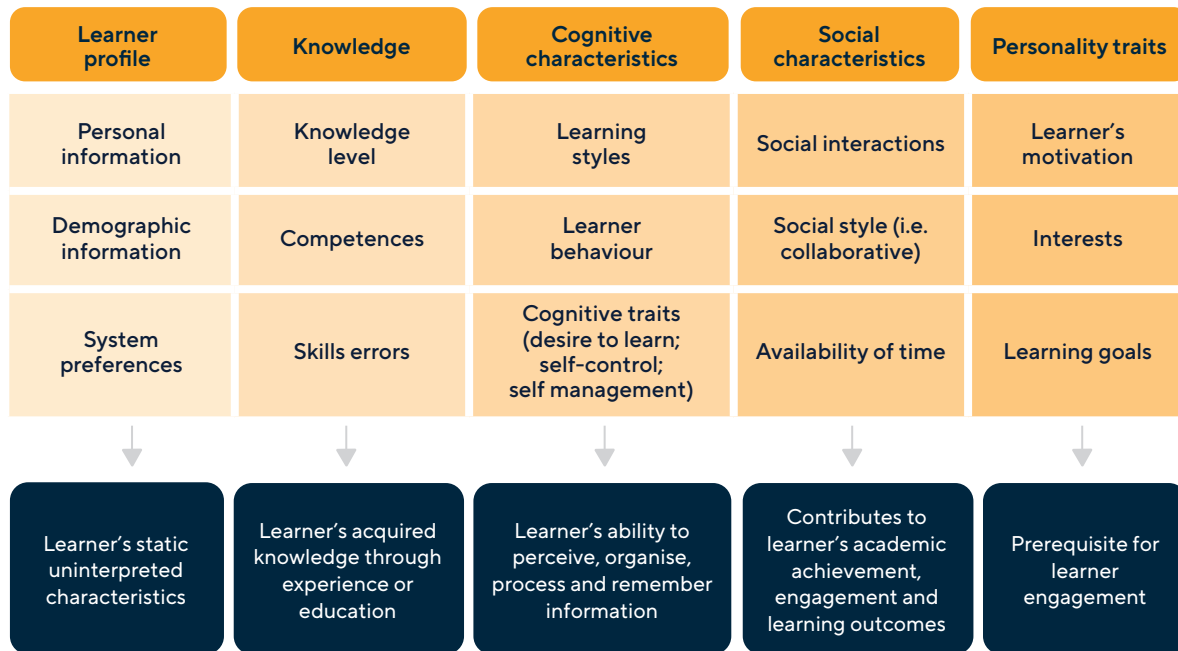| Learner profile	Knowledge	Cognitive characteristics	Social characteristics	Personality traits
Personal information	Knowledge level	Learning styles	Social interactions	Learner's motivation
Demographic information	Competences	Learner behaviour	Social style (i.e. collaborative)	Interests
System preferences	Skills errors	Cognitive traits (desire to learn; self-control; self management)	Availability of time	Learning goals
Learner's static uninterpreted characteristics	Learner's acquired knowledge through experience or education	Learner's ability to perceive, organise, process and remember information	Contributes to learner's academic achievement, engagement and learning outcomes	Prerequisite for learner engagement

Figure 12. Characteristics for the learner profile

Source: WP3.4

3.1.2. Learner's modelling

Learner's modelling is designed to enhance the learning process and enable the development of tailored learning pathways. The 'learner's modelling' is defined as the process of onboarding the learner and collecting knowledge about the learner by analysing the learner's characteristics and behaviour.

Learning modelling refers to the prior experience of the learner, the learning material and its delivery method as well as interaction with the FLP, along with any extra learning assistance. This can ensure that learners are on a route that suits their interests and learning methods,
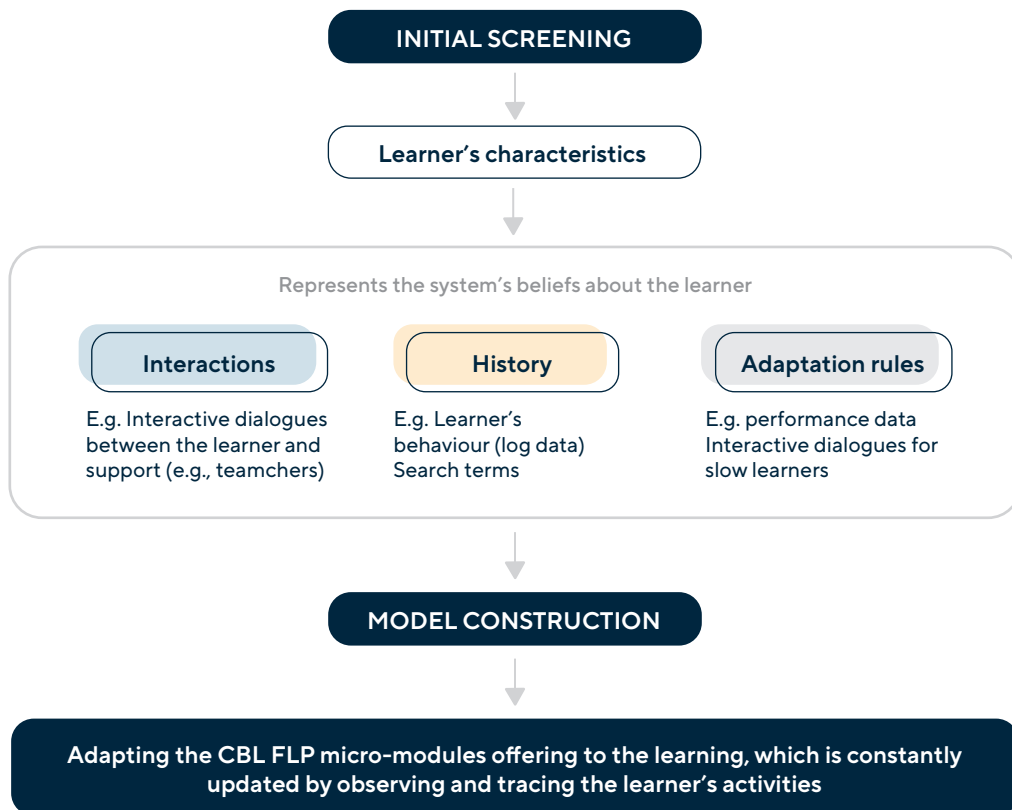

Figure 13. Learner's modelling scheme

Source: WP3.4

and that they are being provided assistance in overcoming any obstacles they encounter, and their actual requirements are taken into consideration. The learner modelling approach relies on the FLP system records to track the learner's behaviour, thus eliminating the need for any additional direct data gathering, such as filling out forms, surveys, or questionnaires. It creates routes by triangulating data from various sources.

3.1.3. Initialising micro-modules for curriculum sequencing and matching

FLP needs to develop its own ontology for micro-modules to express the information contained, such as the type of instruction, the mastery level, education details, skills, certification, and other relevant information. In addition, it helps to standardise the micro-module structure. The format is divided into many parts (the majority of which are optional), including the following as shown in **Figure 14**.

The focus of the ontology is on modelling the competencies, the format of learning, and the skill levels required to identify the most suitable micro-module for the Flexible Learning

Personalisation	Measures	Learning	Technologies
Self-paced	Mastery level	Assigned to specific SDG	1:1
Individualised instruction	Competence requirement	Scaffolding of themes	Cloud-based
	Assessment terms (benchmark, formative, etc.)	Mentoring/ supervision	Responsive
	Credit/non-credit bearing	Learning outcomes	Smart contract for learning agreement
	Length		

Figure 14. Classes and properties for micro-module classification

Source: WP3.4

Pathways. The attributes in Figure 14 are suggested to create a modular ontology and to supplement the descriptions with the missing concepts and attributes of the already existing ontologies, such as ESCO:

Style as a **Class** to model the learning styles of a learner, with the following subclasses:

- Self-paced as a Style linked to the independent learning style
- FLP-paced as a Style linked to the tailored and guided learning style

Measures as a **Class** to model the delivery characteristics of micro-modules:

- Mastery level as a Measure that builds on skills recognition
- Competence requirements as a Measure that builds on ESCO qualification class, which represents the official or formal certification of one or more acquired skills or competences
- Assessment as a Measure that refers to the evaluation of accomplishments
- Credit-bearing as a Measure linked to verification
- Length as a Measure related to delivery

Learning as a **Class** to model thematic delivery of the micro-module:

- Assigned to specific SDG as Learning is linked to the challenges
- Scaffolding of the themes as Learning refers to the thematic architecture of the micro-module
- Mentoring as Learning linked to the support mechanism
- Learning outcomes as Learning built on ESCO qualifications

Technologies as a **Class** to model delivery modes:

- Content-type as Technologies for eLearning technology used for micro-learning
- Scripting as Technologies linked to eLearning technology in use

The FLP micro-module ontology shall be built iteratively and modified as required.

3.1.4. Framework for automatic recognition

The work is inspired by the ambitious aim to have the European Education Area which envisions "a Europe in which learning, studying, and doing research are not constrained by borders"[9] by 2025. Spending time in another Member State and learning online has become the norm. The

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[9] http://ec.europa.eu/eurostat/documents/3217494/8113874/KS-EZ-17-001-EN-N.pdf

Member States are supported to amplify and accelerate the collaboration in the flexible higher education area building on lifelong learning, all age groups, on-demand learning, and community and industry included.

 It offers closer and deeper collaboration across higher education institutions, industry and communities, which results in a collaborative curriculum and shared courses, and which facilitates the learners' transitions between education systems in different countries, thereby developing a pan-European skilled talent in various disciplines and technologies, such as artificial intelligence, sustainable development, transport. Automatic recognition comes into the foreplay to have the results of learning recognised in any other Member State. To have complete uptake of truly flexible, personalised and border-less education based on micro-credentials, strict norms designed for formal education institutions must be released and reformulated to open up for creativity that micro-credentials may provide. Until the European Commission connects micro-credentials to the European Credit Transfer and Accumulation System (ECTS) and encourages the Member States to include micro-credentials within their national qualification requirements, ECIU attempts to define the prerequisites and elements for automatic recognition of micro-credentials, as well as suggest the criteria for the constituent parts of micro-credential recognition. WP3.4 sets the initial framework for automatic recognition, which will be further reflected by WP4 and WP6.

The framework for automatic recognition of learning outlines the conditions to be met to assure the consistency and quality of the FLP based on micro-credentials and challenge-based pedagogy. A typology of possibilities is included in the text to assist institutions with the implementation. In the same vein, the next portion of this chapter consists of a proposed checklist to assist with the recognition of micro-credentials and quality assurance. There are five categories to recognise and/or offer micro-credentials (**Figure 15**).

Inevitably, the implementation of the Flexible Learning Pathways model based on micro-credentials implies an administrative process through which the credential can be awarded to individual learners. In addition to the awarding procedure, other administrative procedures must be considered, for instance, organisational routines in quality assurance processes as well as accreditation procedures (including even most mundane questions of the differing academic calendars among different consortium members in different Member States). However, it is essential to avoid a situation where additional bureaucracy is created for little added value. In Europe, the degree awarding powers are currently located within higher education institutions or other bodies, such as qualifications agencies designated by national

Strategy	Design	Curriculum	Implementation	Support mechanism
Personalised flexible learning alignment to ECIU 2030 Vision	Students as self-directed learners	Micro-modules repository	Blockchain infrastructure	Teamchers
Learning agreement/ Recognition options	Micro-modules driven	Flexibile student populations across different institutions	Digital tools and environments	Mentoring
European policy instruments: ESCO, EDCI (Europass Digital Credentials Infrastructure), Digital Education Action Plan (2021-2027)	Stackability	Online and offline alignment	Verification of learning	Media-supported interaction
GDPR compliant	Learning pathways	Innovative pedagogy, challenge-based learning	Internal/external quality assurance	Learning analytics

Figure 15. Dimensions for automatic recognition of micro-credentials

Source: WP3.4

authorities. Furthermore, the issued degrees are related to a national qualification framework (NQF) and have a national legal basis.

Inter-institutional and international transferability of the learning outcomes calls for the fluid transfer of the learning outcomes between/among ECIU consortium institutions in different European countries, which necessitates aligning the process of learning recognition, while especially recognising the outcomes as they are acquired. The 2017 framework for European qualifications recommends the elements for the electronic publishing of education resources as an EQF. These data fields may be considered as the foundational data that must be present for a certification to be transparent, comparable, and portable. Recent work on a European approach to micro-credentials offers several building blocks that are also applicable for its automatic recognition.[10] The elements to be considered for automatic recognition will be further discussed in the following chapter.

[10] Andersen, Tine & Shapiro, Hanne (2020): Background paper for the first meeting of the Consultation Group on Micro-credentials, 26 May 2020, European Commission, DG EAC

STRATEGY. The political commitment has been to use education and training as the engines of economic development and social harmony. The promotion of upskilling and reskilling should be central to different interlinked strategies, such as Erasmus+ European University partnerships; Digital Education Action plan; ECIU 2030 Vision and many others. In that regard, micro-credentials are seen as a strategic tool for enhancing relationships with the surrounding ecosystems.

DESIGN. The learner-centred approach creates opportunities for new kinds of learners to achieve high-level abilities. Short learning options guarantee a varied set of learners the flexible possibilities for developing, expanding, and upgrading their skills at any given time of their careers.

CURRICULUM. Just-in-time flexible content and modular learning opportunities accelerate immediate skills and competences development.

IMPLEMENTATION. Increased openness is necessary to ensure that learners place a high value on micro-credentials. By facilitating the transfer and recognition of micro-credentials across borders, learners will be able to extend their job options and engage in life-long learning.

SUPPORT MECHANISM. Strategic advice for learners contributes to the goals of flexible and inclusive learning. Central focus should remain on the skills and competences intelligence and draw on real-time learning data to identify and meet the individual learner needs.

ECIU offers established principles and a structure for recognition and quality assurance to stimulate institutional and industry collaborations and to be used to identify both vertical and transversal skills and competence. In addition, when combined with in-depth learning achieved in an area of study, micro-credentials may be utilised to provide a more holistic perspective of an individual's talents and accomplishments.

4. CONCLUSION
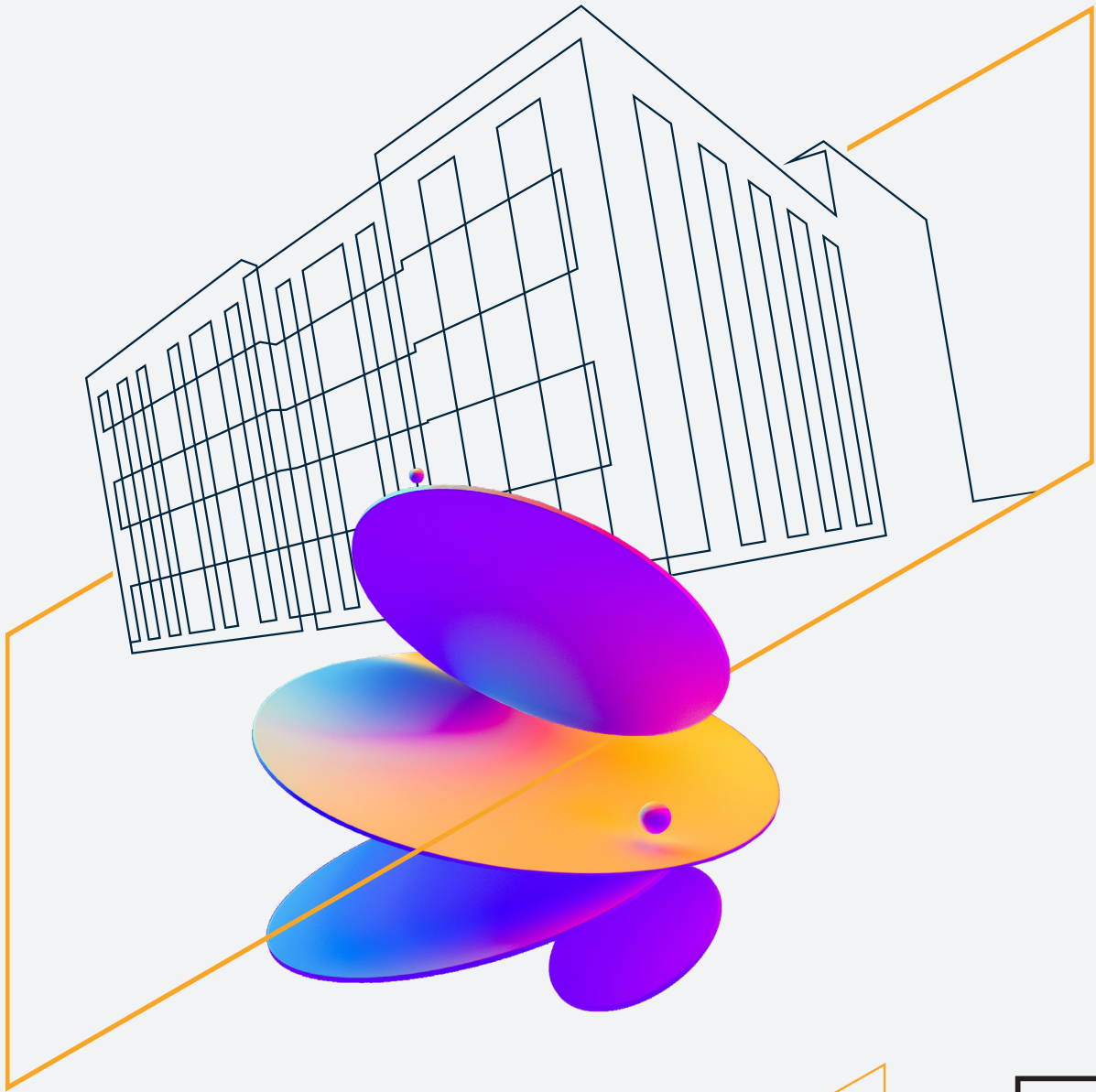
The COVID-19 epidemic wreaked havoc on several aspects of daily life, particularly those that require the actual presence of individuals to be completed. The learning process was significantly delayed by the lack of a dedicated ICT infrastructure and the fact that degrees and other kinds of certification continue to need lengthy processes and are only produced/ published mainly in the paper form. Moreover, during the pandemic, learners began taking more online courses as a supplement to classroom instruction and took advantage of the exploited options offered by numerous open institutions that operate online. While such courses do give formal qualifications upon completion, students in this instance end up with a fragmented collection of various heterogeneous qualifications. What they lack is the ability to demonstrate such credentials in a professional profile while also giving evidence of their legitimacy.

As is evident from the above, the COVID-19 highlighted and stressed even further some issues that the ECIU University has noted from the start of the project. As the ECIU University is ahead of the curve when it comes to challenge-based and personalised learning, while pandemic is disappointing in its whole, it gives further opportunity for the ECIU University to increase the FLP model's relevance to the learners. Given the uncertainties, a new inventive solution in the flexible learning format must be further developed to solve the issues that occur because of this scenario.

ANNEX A - GOOD PRACTICES

Key observations and a diverse range of different learning innovations have been observed across the EU and the world (ECIU partners are listed in **Figure 16** below) while creating the FLP concept.

Innovative approach	Description	ECIU Partner/ Country
Sprint Innovation Festival	Online festival created for solving SDG-related challenges from companies and other organisations; linking pioneering research and innovation; seeing through multiple angles in order to solve iniquitous problems; generating unique expertise in industrial and public-sector implementation.	**Tampere University**, Finland
CDIO framework	CDIO framework – an ongoing dialogue with industry and society. It comprises four sections: the 1st section is devoted to disciplinary knowledge while the 2nd, 3rd and 4th sections deal with engineering skills. CDIO is a conscious move towards greater emphasis on students' skill development rather than a focus on knowledge.	**Linköping University**, Sweden (University of Twente is also a partner in the CDIO iniciative)
Self-Directed Learning (SDL) approach	SDL approach puts the learning of every individual student central. It gives the individual student real responsibility for their development, starting with Personal Development Plan at the beginning of each semester, finishing with study support (workshops, tools) and a personal mentor.	**University College Twente**, Netherlands
Triple helix approach	It is an active interaction among University, industry and the government in order to foster economic and social development via *Valdeska Forum*.	**University of Stavanger**, Norway
Adaptive learning didactic strategy to self-directed content modules	This strategy allows learners to advance at their own pace within a time frame and follow an individual learning path. A flexible, interactive and technology-enhanced course where learners solve real challenges from the beginning of their academic program and until the last semester is offered.	**Tec de Monterrey**, Mexico

Figure 16. Innovative approaches to higher education learning and curriculum

Source: WP3.4

The above mentioned good practices are being integrated into the Flexible Learning Pathways, thus ensuring that the innovative study model is of high quality and strongly desirable.

It is important to highlight that, with studying via the Flexible Learning Pathways, ECIU allows to share, and learners are allowed to develop the best skills and competences for life in the field of data and digital literacy, intercultural awareness, social impact leadership, creativity and innovation, professional ethics, sustainable cities and active citizenship.

Case studies demonstrate that ECIU members have taken steps to challenge the standards and push the boundaries of university education. They also show that such steps are not without their barriers to be overcome, of which some of the major ones are getting the members of the faculty on board to take a step into the unknown. In many ways, ECIU will present one such step – developing the FLP across multiple European universities, with numerous unknowns and few certainties. Case studies also represent the rewarding experience of taking such steps and changing the paradigms of higher education.