



Education in small doses brings big opportunities

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Abstract

This paper presents the experience of SIGMA AIE in integrating micro-credential management into SIS SIGMA, a Student Information System (SIS) for Spanish higher education institutions. It explores the challenges, decisions, and roadmap established in the absence of a predefined model. Promoted by the European Commission as part of the European Skills Agenda (2020), micro-credentials aim to enhance employability and lifelong learning through flexible and modular training.

They certify short and specific training activities, enabling professionals and students to acquire targeted skills for an evolving labour market. SIGMA AIE's project to integrate micro-credentials into SIS SIGMA was structured into three phases. The first phase enabled the export of micro-credential data for manual upload to EUROPASS. The second phase, currently under development, will integrate SIS SIGMA with CERTIDIGITAL, ensuring end-to-end traceability and improved credential management. The third phase will expand micro-credential eligibility to include coursework within long-term academic programs. Key challenges include the lack of a unified definition for micro-credentials across Europe, evolving regulations, and funding uncertainties for digital certification platforms. The study concludes that while the tools for micro-credential management exist, clearer guidelines and pragmatic implementation strategies are essential for their successful adoption in the European education and employment landscape.

1 Introduction

This paper describes the experience of SIGMA AIE, a developer of a Student Information System (SIS) for higher education in Spain, in integrating micro-credential management into SIS SIGMA. We lay out the dilemmas encountered, decisions taken, and the roadmap established, as well as our journey in an environment and context with many aspects yet to be defined and with no previous experience to serve as a model.

Inevitably, the first step in this journey was to clearly define the meaning and role of what we call a micro-credential and the needs universities using our Student Management Solution must meet to manage it.

In this sense, the first question was why have micro-credentials become an unavoidable topic of discussion when we meet with universities? What does this new type of credential offer?

As part of Europe's strategy to modernise and adapt its education and training proposals to the current context, the European Commission has promoted the development of micro-credentials. In 2020, the **European Skills Agenda** initiative was launched to promote the acquisition of skills through flexible and accessible learning programmes.

Thanks to these initiatives, proposals such as micro-credentials have emerged as a response to the challenges posed by the currently highly competitive European labour market. The creation of a common framework that organises and regulates these micro-credentials in Europe will help guarantee their quality and recognition, thus facilitating student and worker mobility between EU countries. Therefore, the regulation must ensure the validity and recognition of this type of credential throughout Europe, as it is fundamental for the creation of a European education area.

Micro-credentials have emerged as an innovative response to the changing demands of the labour market and the need for workers to complete ongoing training. In a nutshell, micro-credentials are certifications of the results of short, specific training activities that allow both students and professionals to acquire very specific skills and competences, refresh their knowledge, and stay up-to-date on the most innovative aspects of their field. This facilitates their insertion in the labour market and much more precise adaptation to the specific profiles required by companies and employing institutions.

Micro-credentials are certifications that recognize the specific competences acquired through short training programmes. This makes them a fast, agile and flexible tool for acquiring knowledge and skills in high demand in today's European labour market. For those wishing to reorient their careers, improve their employability, or adapt quickly to specific job profiles, micro-credentials can be particularly helpful.

Public and private institutions and universities must successfully integrate micro-credentials into their educational offer to remain relevant in a field of work where the technology and skills required of its professionals are constantly changing and are often highly specific.

Micro-credentials are usually digital. This makes them easier to validate, store and share. They can be issued by a university, a vocational training centre, an online learning platform, or even by a company. Micro-credentials are expected to play a key role in improving employability and lifelong learning in Spain and Europe

2 The Spanish context

In line with the European strategy, Spain has been a pioneer in integrating micro-credentials into its education and training system. Several universities and training centres have already developed specific micro-credential programmes in areas such as digitalisation, sustainability and artificial intelligence.

As for the workplace, there have been initiatives to integrate micro-credentials in higher education and lifelong learning programmes in cooperation with private companies and public administrations. As a result, micro-credentials are gaining recognition among companies and professional sectors, especially in technological and emerging fields.

In this context, the Spanish Ministry of Universities has established the Micro-credentials Plan to promote the adoption of micro-credentials by Spanish universities, thus facilitating access to more modular and flexible training. The Plan aims to create a homogeneous framework for recognizing micro-credentials within the European Higher Education Area (EHEA), facilitating their integration into university curricula and recognition and valuation in the labour market. Its main objectives include

- Developing a catalogue of micro-credentials that respond to the needs of the labour market.
- Ensuring the interoperability of digital credentials.
- Encouraging cooperation between universities and companies in the design of training programmes.

We understand the need, but what tools are available?

To facilitate the adoption of micro-credentials by the institutions and entities that need to generate them, the EU has made a digital platform for storing and managing micro-credentials available to all citizens. It is called EUROPASS and is based on the European Digital Credential (EDC) standards and infrastructure. It will provide issuing institutions with mechanisms to define micro-credentials, seal them, and send them to citizens. The platform is not exclusively limited to this type of credential but is more broadly open to any digital certification. However, micro-credentials are perfectly suited to this type of solution. In addition, EUROPASS offers learners the possibility of using a digital wallet where they can store and share the digital credentials they have acquired with other stakeholders, such as employers. It should be noted that this platform is limited in its ability to integrate with other external information systems, which makes it less attractive to use, and always requires direct user intervention to issue credentials (manual action).

In light of this, in Spain, a group of public higher education institutions decided to use NextGenerationEU funds to finance the development of a new independent platform that would offer more ambitious and powerful digital certification management. This platform would stay in line with European standards and initiatives so that the resulting certifications remain compatible with other platforms based on the EDC standard, such as EUROPASS. This is how CERTIDIGITAL was born, to provide a digital certification service for the Spanish higher education system within the European EHEA. In short, this new technical infrastructure aims to allow Spanish higher education institutions to issue digital certifications based on the European Learning Model (ELM). Issuing certifications from the CERTIDIGITAL platform is therefore aligned with the EDC standard, as well as with the European Blockchain Services Infrastructure standard in future versions. It can also store the resulting certificates in the digital wallet of the EUROPASS platform. From the point of view of a developer of a Student

Information System (SIS), one of the main advantages of the CERTIDIGITAL platform compared to EUROPASS is the availability of a complete catalogue (API) of integration services with third parties. This enables the complete lifecycle management of micro-credentials without the need to leave SIS SIGMA. Thus, SIS SIGMA users can control the definition of the micro-credential, student enrolment, assessment, and achievement, and the sealing and sending of the resulting micro-credential to students. CERTIDIGITAL also offers full traceability of the credentials issued, both by the platform users and the SIS integrated through its API services.

With this integration, the entire micro-credential management process can be validated and audited from start to finish. This provides a high level of trust in the system.

3 Project definition for integrating micro-credential management into SIS SIGMA

Taking all this into account, we asked a series of questions when defining the project to integrate micro-credential management into SIS SIGMA. These questions helped us gain a clear vision of the solution and project phases.

When will the CERTIDIGITAL solution be available in a production environment?

The participating institutions completed the CERTIDIGITAL project in December 2024. Given the interest that the implemented solution has aroused in the rest of Spanish universities, it must be deployed within an infrastructure with the necessary resources to cover all the universities involved. The infrastructure chosen for this purpose is RedIRIS (the Spanish academic and research network that provides advanced communication services to the national scientific and university community. It is funded by the Ministry of Science, Innovation and Universities and included in its map of Singular Scientific-Technical Facilities). The solution is expected to be deployed on RedIRIS during the first quarter of 2025 and will be available to the institutions.

Which universities will be able to use CERTIDIGITAL?

SIGMA AIE serves 38 public and private Spanish institutions, not all of which form part of the consortium of universities that established and funded the CERTIDIGITAL project. Therefore, before finding a solution for integrating micro-credential management into SIS SIGMA, we needed to know which institutions would eventually use the CERTIDIGITAL platform and when. Initially, only the universities participating in the project may use the CERTIDIGITAL platform. Other public institutions will be able to join at a later stage.

Given this scenario, SIGMA AIE decided to define a roadmap to offer an initial solution to as many of the institutions it works with as possible. Since our institutions' most urgent need is to start issuing micro-credentials, we decided to divide the project into several phases. The first phase focused on developing specific features for managing micro-credentials, leaving the option to manage and issue other types of digital credentials for future phases and adopting an initial approach that did not require the use of the CERTIDIGITAL platform.

To help define the solution, we asked several SIGMA AIE client universities, as the sponsors of our project, how they approached micro-credential management in their respective institutions and what strategies they used.

The survey results can be summarised as follows:

- All the institutions wanted to focus their efforts on issuing micro-credentials for short non-formal training courses, as they better fit the definition of micro-credentials, which must be under 15 credits in Spain.
- The aim of these short in-house courses is the acquisition or improvement of the skills, competences, and knowledge of the participants. Lifelong learning courses.
- All institutions wanted to certify the micro-credentials issued through the EUROPASS platform.
- Only some of them had participated in the CERTIDIGITAL project. Therefore, they were not all able to use it initially.

Lastly, we established three phases.

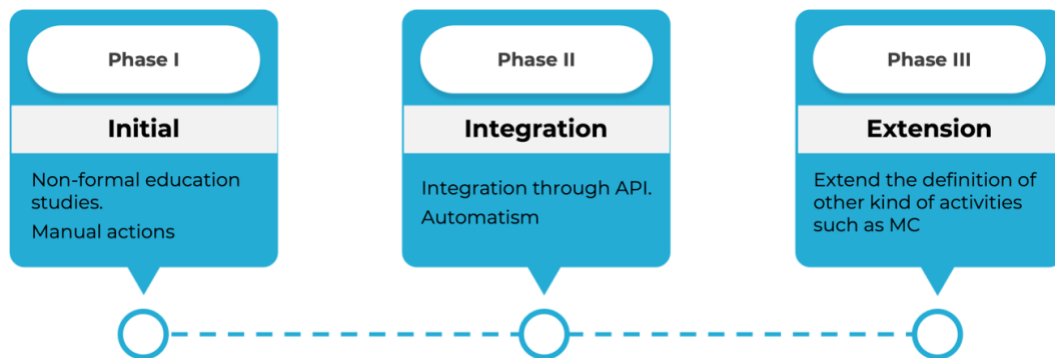


Figure 1. SIGMA AIE project roadmap.

This first phase consisted of adapting SIS SIGMA so it could obtain all the information required to issue micro-credentials, completing the information on short courses with the additional information required for issuing micro-credentials, as established by the European Union and Spanish legislation.

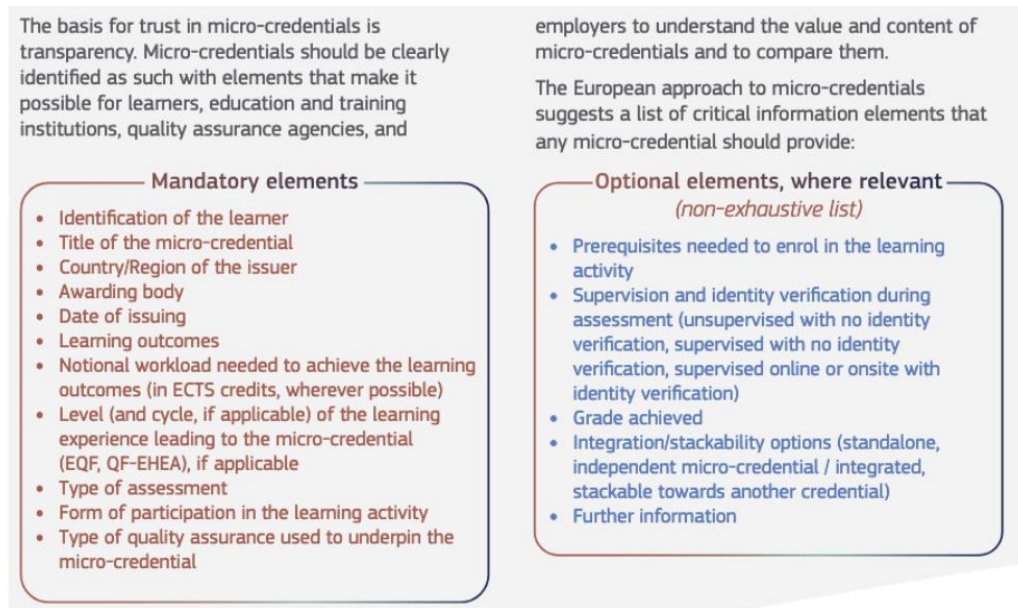


Figure 2. Mandatory and optional elements of Micro-credentials

SIS SIGMA already offers the option to post short courses. It also manages student enrolment and evaluation.

During the first phase, was also possible to include automatic mechanisms that allow the definition of micro-credentials to be used to obtain a list of students who have completed the required training and who therefore need to be certified for the corresponding micro-credential.

For this first phase, we decided to implement an interaction with the EUROPASS platform that does not require the use of the CERTIDIGITAL API, since not all the institutions using SIS SIGMA will be able to use the CERTIDIGITAL platform in the short term. Therefore, we decided to include in the SIS SIGMA solution the possibility of exporting all the details of the micro-credential obtained by the student in a JSON file (structured according to the ELM model). This file must be downloaded from SIS SIGMA and manually uploaded to the EUROPASS platform. From there, it will be sealed and available in the interested party's wallet.

With this first version of the SIS SIGMA micro-credential management solution, the institutions using it will be able to manage and generate these downloadable files in EUROPASS from SIS SIGMA, with all the micro-credential details and, thus, bypass the need to manually enter a large amount of data in the EUROPASS platform's forms. They will only need to seal and send them from the platform. This first-phase solution is already in production.

However, this solution has some weak points. One is the lack of traceability of whether the micro-credentials already assigned to students have been sealed and sent to them, since this part of management takes place outside SIS SIGMA in EUROPASS. It should be noted that from within SIS

SIGMA, it is only possible to track whether the JSON file of students who have passed the course has been generated and downloaded. The system cannot determine what happens to this file once it has been downloaded from SIS SIGMA. Another negative aspect for Spanish institutions is that EUROPASS cannot issue micro-credentials in languages other than the official languages of each country. This means that, in Spain, certificates cannot be issued from EUROPASS in the co-official languages also used in education.

These weaknesses will be addressed in the second phase of the project, when SIS SIGMA will be integrated with the CERTIDIGITAL platform. The latter has an API for integration services with third parties that allows for total management of issuing certificates, including sealing and sending. It therefore ensures traceability of who issues the micro-credentials, which micro-credentials have been issued, which have been revoked, etc.

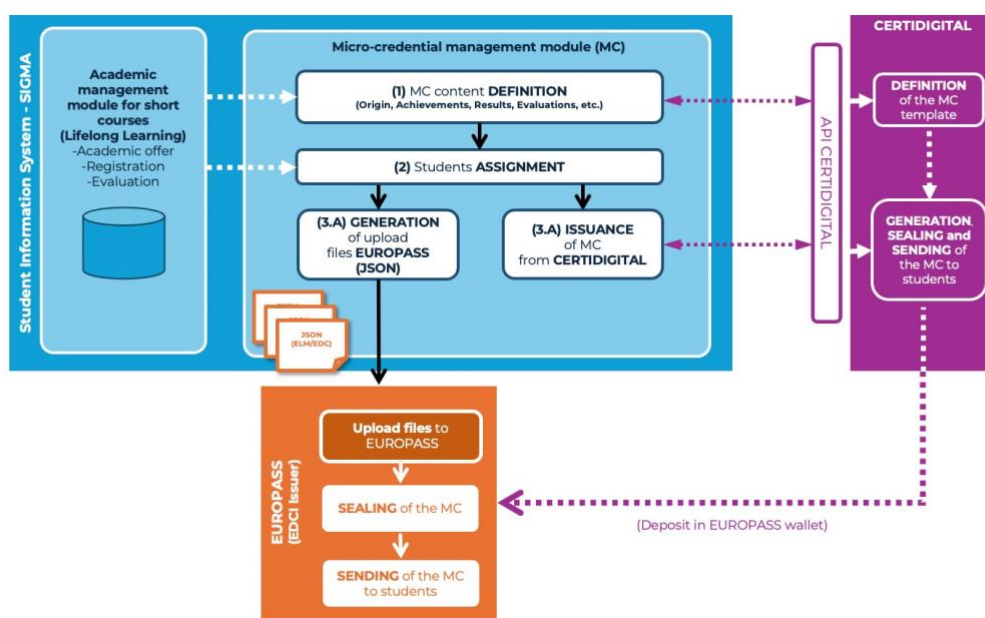


Figure 3. Integration of micro-credential management into SIS SIGMA

In this second phase of the project, part of the definition and automatic assignment of students developed in the first phase will be of use. SIS SIGMA will be connected to the CERTIDIGITAL API to transfer the information on the defined micro-credential to this platform. The same applies to the information on the students who have been assigned to this micro-credential after passing the corresponding course and receiving results. The CERTIDIGITAL API has the appropriate security measures to validate the authenticity of the communication between the two systems.

Therefore, the process of defining the micro-credential, registering the associated training activity, its qualification, and assigning students to it will still be carried out by SIS SIGMA. It will send CERTIDIGITAL the necessary information regarding these processes as they take place. From this point on, at the request of SIS SIGMA, the CERTIDIGITAL platform generates, seals and sends the micro-credential to the assigned student's wallet using the data previously provided by SIS. CERTIDIGITAL has its own wallet system where students' micro-credentials are stored. It also sends

them to the EUROPASS wallet. This allows each student to share their certificate information in both wallets.

This solution offers clear advantages, such as control over the entire management lifecycle for issuing micro-certificates by SIS SIGMA. With CERTIDIGITAL, it is also possible to issue certificates in Spain's co-official languages. Another relevant aspect of CERTIDIGITAL is that, like EUROPASS, it is based on the EDC model. It is therefore fully interoperable and compatible with the requirements established by the European institutions for this type of digital credential.

The second phase of the solution is currently under development. The aim is to release a version in the second half of 2025.

The third phase of the project aims to expand the types of training activities available in SIS SIGMA as a source or requirement for obtaining a micro-grant. It will be possible to establish not only training activities based on short courses, but also activities based on specific subjects or modules within long-term curricula, which, when passed in isolation, will entitle the holder to obtain a micro-credential. This third phase will be addressed following the second phase.

4 Conclusions

Upon reviewing the ground covered thus far to integrate micro-credential management into SIS SIGMA, we can confirm that one of the main obstacles has not been technical in nature or related to the availability of suitable tools. Rather, it has been more organisational and related to how the micro-credentials are conceptualized and defined, in an attempt to make them as appropriate and attractive as possible within the academic offer of the universities.

The lack of clear guidelines has left institutions open to interpret and debate what a micro-credential is and what kind of information should be part of its definition. This was compounded by changes and modifications to regulations during the process. This meant that decisions taken during the project had to be adapted, leading to several iterations of the proposed solution. Although the plan for introducing micro-credentials is well underway and higher education institutions are able to offer micro-credentials to both students and professionals, there are still aspects that need to be clarified.

In this sense, there is still no homogeneous approach to many of the characteristics that training activities must meet to be considered micro-credentials. For example, there is no consensus among EU countries on the maximum number of ECTS credits that a micro-credential should be worth. Countries such as Spain specify that it should be less than 15 ECTS credits.

The European Learning Model (ELM) has been unanimously adopted as the common data model for micro-credentials. The ELM facilitates the interoperability of these credentials and their traceability, for example, by enabling the validation and recognition of the competences and qualifications described in them. However, there are some differences in the interpretation and meaning of many of the elements and attributes modelled by the ELM, as well as a lack of consensus on which of them (currently more than 450 attributes) are necessary for the definition of micro-credentials. In Spain, a consensus has been reached, led by CRUE (Conference of Rectors of Spanish Universities) and RUEPEP (University Network for Postgraduate Studies and Lifelong Learning), which establishes a series of guidelines aimed at clarifying the meaning and use of the various elements of the ELM that

comprise the definition of a micro-credential, as well as the minimum set of ELM elements that should be included in any definition of a micro-credential.

Another issue that needs to be resolved is how to develop and maintain the tools provided to institutions, such as CERTIDIGITAL, which is funded by NextGeneration funds from a group of universities. Currently, it is not clear how to finance the evolution of this tool, nor how to articulate the necessary changes. The same is true for EUROPASS; the European Commission made this tool available to all the Member States, but the future development of this tool is unclear.

This uncertainty has led us to doubts about the best course of action. As developers, we feel more comfortable implementing the complete solution, but this entails an extra effort that is certainly not justified. To offer solutions in line with the European directives quickly, we have prioritised time to market.

This experience can serve as a model for other European institutions. In this regard, the steps we would recommend for undertaking a similar project are as follows.

It is essential to clearly define which elements form part of the micro-credential, that is, what content will be accredited upon certifying a study. It is important to consider that the European Commission's HUB has defined the minimum set of elements that should constitute a micro-credential (as reflected in Figure 2 of this document). Additionally, it should be verified whether there are any national directives on the matter, like those established in Spain.

With this information, any data not covered in the SIS that needs to be integrated must be validated and incorporated into the solution. Furthermore, the institution must identify in its study catalogue what kind of training activity it considers a micro-credential. For instance, in the Spanish context, a distinction is made between regulated or official training and non-regulated training. Non-regulated training, by its nature, typically consists of shorter-duration studies with more specific purposes, making it the most evident candidate for a micro-credential.

Another decision is to determine which tool will be used to generate the micro-credential (JSON), seal, and send it to the interested party. There may be various alternatives; the first step is to explore whether there are any national initiatives to integrate with, such as CERTIDIGITAL in Spain. One could also consider using the CERTIDIGITAL solution, keeping in mind that it is funded by NextGeneration funds and is open-source, meaning it is available to any institution. Although it must be deployed with the institution's own resources and infrastructure, it should follow the manuals developed during implementation. Another option is to use EUROPASS, considering the previously discussed advantages and disadvantages.

Each institution will need to evaluate, weigh, and decide on the best option for its case. With this paper, our intention was to share our experience in finding a solution that facilitates institutions using SIS SIGMA to meet the commitments they have undertaken.

One final reflection: initially, this challenge appeared to be a technological problem, but after this period of work, we have concluded that there was a clear issue of lack of definition and decision-making. Tools are helpful, but a clear application scenario and greater pragmatism are necessary to avoid distorting or hindering the improvements that introducing micro-credentials should bring to education and labour in Europe.

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6 Author biographies

Carmen Díaz is the Product Director at SIGMA. She is a computer engineer with over 15 years of experience, having dedicated her entire career to the higher education sector from different points of view. As a product manager, she has a close relationship with Spanish higher education institutions and possesses a strategic vision of how universities evolve and adapt to these changing times. This position has allowed her to expand her knowledge on how institutions of higher education work and broaden her vision on what aspects have the most influence. Carmen is an active member of EUNIS, and is on the board of directors and a leader of the Mobility & Digital Credentials SIG.

Javier Justo is Product Owner at SIGMA. He is a senior telecommunications engineer with extensive experience in student information systems for higher education. As part of the Product Department at SIGMA, he helps identify opportunities and propose solutions to needs that educational institutions must cover, in addition to developing new features and capabilities to enhance and adapt the SIGMA software platform to cope with the evolving scenario of higher education academic management processes.

Estefania Muñoz is the Director of Communication and Human Resources at SIGMA. She holds a degree in Advertising and Public Relations from the University of Girona, a master's in marketing and digital communication from ESERP Business School, and an MBA from ThePowerMBA. With extensive experience in various communication agencies and companies. She has been with SIGMA since 2018, where she currently leads the Communication and HR departments, helping shape strategic initiatives while managing internal and external relations

Núria Cuní is a Computer Engineer who has been working at SIGMA since 2000 and as a Project Manager since 2024. She has been involved in research solutions for several years, focusing on the development and implementation of tools that enable efficient scientific information management, facilitate data-driven decision-making, and enhance the visibility of research output. Currently, as a Project Manager, she is responsible for leading and managing academic management projects in higher education institutions, ensuring that objectives are met on time and with quality.