

Enhancing higher education: Integrating micro-credentials and digital badges into university curricula in Ukraine

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Abstract

This study investigates the impact of integrating digital badges and micro-credentials into university curricula on student engagement, motivation, and employability. Using a mixed-methods approach, both quantitative data (Wilcoxon signed-rank tests for pre- and post-intervention assessments) and qualitative data (focus groups with students, course trainers, and employers) were analyzed. Findings reveal that micro-credentials significantly enhanced student engagement and motivation, as well as improved perceived employability. Course trainers noted the effectiveness of digital badges in providing structured feedback and fostering goal-oriented learning. Employers valued the skills demonstrated by micro-credentials but recommended incorporating emerging industry skills and soft skills for greater relevance. Challenges related to system navigation and technical integration highlight the need for clearer guidance and technological support. Further research is needed to explore the long-term impact of micro-credentials on career advancement and to assess their broader applicability across various sectors.

Valentyna Bobrytska, Tetiana Reva, Hanna Krasylnykova, Svitlana Protska, Sergij Krasylnykov, Iryna But – *Enhancing higher education: Integrating micro-credentials and digital badges into university curricula in Ukraine*

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Questo studio analizza l'impatto dell'integrazione di badge digitali e micro-credenziali nei programmi universitari sull'impegno, la motivazione e l'occupabilità degli studenti. Utilizzando un approccio misto, sono stati analizzati sia i dati quantitativi (test di Wilcoxon signed-rank per le valutazioni pre- e post-intervento) sia i dati qualitativi (focus group con studenti, formatori e datori di lavoro). I risultati rivelano che le micro-credenziali hanno significativamente aumentato l'impegno e la motivazione degli studenti, migliorando anche l'occupabilità percepita. I formatori hanno osservato l'efficacia dei badge digitali nel fornire feedback strutturato e nel promuovere un apprendimento orientato agli obiettivi. I datori di lavoro hanno apprezzato le competenze dimostrate dalle micro-credenziali, ma hanno raccomandato di includere competenze emergenti e soft skills per una maggiore rilevanza. Le sfide legate alla navigazione del sistema e all'integrazione tecnica evidenziano la necessità di una guida più chiara e di un supporto tecnologico adeguato. Ulteriori ricerche sono necessarie per esplorare l'impatto a lungo termine delle micro-credenziali sull'avanzamento di carriera e per valutarne l'applicabilità in vari settori.

Keywords: digital badges; micro-credentials; student employability; higher education

Parole chiave: badge digitali; micro-credenziali; occupabilità; istruzione superiore

1. Introduction

In the rapidly evolving landscape of higher education, the need to align educational outcomes with labour market demands has become increasingly critical. Traditional educational credentials, such as degrees and diplomas, often fail to capture the specific skills and competencies that students acquire throughout their academic careers. This inadequacy calls for innovative solutions to more accurately reflect student achievements and readiness for the workforce. Micro-credentials and digital badges have emerged as promising tools to address this gap, offering a flexible, targeted, and scalable means of skill recognition and validation (Fong et al., 2016).

The integration of micro-credentials and digital badges into university curricula is crucial for several reasons. Firstly, there is a growing recognition among employers of the value of specific, demonstrable skills over broad, traditional qualifications. Employers increasingly seek candidates who can provide verifiable evidence of their competencies and readiness to contribute immediately in professional settings (Carey & Stefaniak, 2018). Micro-credentials and digital badges facilitate this by allowing learners to showcase their abilities through digital artifacts that are easily accessible and verifiable (Ghasia et al., 2019).

The Ukrainian higher education system, despite its rich educational heritage, faces significant challenges in producing graduates who are adequately prepared for the dynamic and competitive job market (Fantinelli et al., 2024; Kaminskyi et al., 2018; Olefirenko et al., 2021). The discrepancy between academic learning and practical application is particularly pronounced in Ukraine, where higher education institutions must align with global educational standards while also addressing local labour market needs. This dual challenge necessitates a critical examination of how innovative educational tools can be integrated into the existing curricula to enhance the employability and skill sets of graduates.

2. Literature review

The emergence of micro-credentials and digital badges

Micro-credentials and digital badges have garnered significant attention as innovative educational tools designed to recognise and validate discrete skills and competencies. These tools provide a flexible and scalable alternative to traditional educational credentials, allowing learners to accumulate and showcase specific skills through digital means (Fong et al., 2016). Micro-credentials are often associated with competency-based education, which emphasises the demonstration of specific abilities rather than the completion of traditional coursework (Tamoliune et al., 2023). Digital badges, on the other hand, serve as visual representations of these competencies, providing verifiable evidence of achievements that can be shared across various digital platforms (Ghasia et al., 2019).

Benefits and challenges of integrating micro-credentials in higher education

The integration of micro-credentials and digital badges into higher education curricula offers numerous benefits. Firstly, they provide a more granular approach to skill recognition, enabling students to demonstrate their competencies in a way that is directly relevant to employers (Carey & Stefaniak, 2018). This aligns educational outcomes more closely with labour market demands, addressing the gap between academic learning and practical application (Gibson et al., 2015). Additionally, micro-credentials can enhance student motivation and engagement by offering clear, attainable goals and immediate feedback, which are critical components of effective learning environments (Pirkkalainen et al., 2022).

However, the implementation of micro-credentials and digital badges is not without its challenges. Technological infrastructure is a significant barrier, particularly in regions where digital access and literacy are limited (Ghasia et al., 2019). Faculty resistance to change and the need for extensive training also pose obstacles to widespread adoption (Dyjur & Lindstrom, 2017). Moreover, there is a lack of standardised frameworks for micro-credentials, leading to variability in the quality and recognition of these credentials across different institutions (Oliver, 2019; Tamoliune et al., 2023).

The Ukrainian context

The Ukrainian higher education system is navigating a complex landscape of challenges and opportunities concerning the integration of micro-credentials and digital badges, particularly with respect to enhancing digital competencies among healthcare and education professionals (Olefrenko et al., 2021; Ministry of Digital Transformation of Ukraine, 2021; Ministry of Digital Transformation of Ukraine, 2023). This endeavour necessitates a strategic alignment with global standards while simultaneously addressing the specific needs of the local labour market. This includes the development of critical digital literacy skills, such as information culture, cybersecurity, and cyber hygiene, among the workforce. Despite concerted efforts toward digital transformation, Ukrainian universities continue to contend with outdated curricula, limited technological infrastructure, and a disconnect between educational outcomes and employer expectations. Consequently, a paradigmatic shift is required in addressing labour market demands, focusing on the cultivation of digital leadership and management, as well as the advancement of digital literacy, public health digitalization, and information/media literacy (Gresham & Ambasz, 2019). Existing literature on the implementation of micro-credentials in Ukraine is limited. However, studies conducted in other contexts provide valuable insights. For instance, Oliver (2019) emphasizes the importance of developing clear standards and frameworks for micro-credentials to ensure their quality and recognition. Additionally, Ghasia et al. (2019) suggest that the successful adoption of digital badges requires robust technological infrastructure and support from institutional leadership. These findings underscore the need for a comprehensive strategy that addresses both the technical and pedagogical aspects of micro-credential integration in Ukrainian higher education.

Gaps and areas for further investigation

Despite the growing body of literature on micro-credentials and digital badges, several gaps remain. Firstly, there is a need for more empirical research on the impact of these tools on student outcomes, particularly in non-Western contexts such as Ukraine (Pirkkalainen et al., 2022). Additionally, further investigation is required to understand the barriers to adoption from the perspectives of both faculty and students. Studies exploring the scalability of micro-credentialing systems and their integration with existing educational frameworks are also needed to provide a clearer picture of their potential benefits and challenges (Tamoliune et al., 2023).

Moreover, there is limited research on the long-term effects of micro-credentials on employability and career progression. Understanding how employers perceive and value these credentials is crucial for their successful implementation and widespread acceptance (Dyjur & Lindstrom, 2017). Finally, the development of standardized frameworks and best practices for micro-credentialing in higher education remains an area that requires significant attention (Oliver, 2019).

Overall, this literature review suggests that while micro-credentials and digital badges offer promising solutions for enhancing higher education, their successful integration requires careful consideration of various factors, including technological infrastructure, faculty training, and standardised frameworks. The unique context of

Ukrainian higher education presents both challenges and opportunities for the adoption of these innovative tools. By addressing the existing gaps in the literature and exploring the feasibility and impact of micro-credentials and digital badges, this research aims to contribute to the ongoing efforts to modernise Ukrainian higher education and align it more closely with global standards and local needs.

Thus, the purpose of this research is to evaluate both the practical feasibility and the impact of micro-credentials and digital badges within the Ukrainian higher education environment. The study aims to provide data-driven recommendations for broader implementation, ensuring that these educational tools effectively enhance student engagement, motivation, and employability, while addressing any challenges that may arise during the integration process. The research questions are as follows:

- (1) How does the integration of micro-credentials and digital badges into the curriculum of Ukrainian higher education influence students' engagement, motivation, and perceived employability?
- (2) How is the integration of micro-credentials and digital badges into university courses perceived by learners and potential employers?

3. Methodology

The research methodology combined both quantitative and qualitative approaches to address the research purpose and questions. The study focused on two Ukrainian universities: Drahomanov Ukrainian State University and Bogomolets National Medical University, to explore how the implementation of micro-credentials and digital badges affects variables such as students' engagement, motivation, and perceived employability. The study employed a one-group pretest-posttest design (Cranmer, 2017), which involved measuring the same group of students before and after the implementation of the intervention. During the pretest phase, the Micro-Credential Impact and Engagement Survey (MCIES) was administered to assess the baseline levels of students' engagement, motivation, and perceived employability. Following the pretest, students participated in courses (see Appendix B) where micro-credentials and digital badges were integrated into the curriculum. After completing the courses, the MCIES was administered again to the same group of students to evaluate changes in engagement, motivation, and perceived employability resulting from the intervention. The data collected from the pre-test and post-test were analysed using inferential statistics to identify any significant changes in the study variables. Additionally, focus groups with students, course trainers, and external stakeholders (potential employers) were conducted to gather more detailed information, addressing the second research question. Figure 1 illustrates the three key elements of this study.



Figure 1. Three key elements of the research design

The outline of the unified micro-credential course: “Digital competencies for the modern professional”

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The “Digital competencies for the modern professional” course (see its syllabus in Appendix B) was designed to provide a comprehensive overview of essential digital skills, structured as a 3 ECTS course, which equates to approximately 90 hours of student workload. The course was offered as an elective for selected majors at specific universities in Ukraine and was designed with scalability in mind, allowing it to accommodate a growing number of students and evolving digital competencies. Spanning a standard academic semester, the course utilised a blended learning model, combining instructor-led sessions with self-paced online modules. Key topics, including artificial intelligence (AI), cybersecurity, and foundational digital literacy, were introduced in live sessions, while core concepts such as the digital economy and cloud computing were covered through self-directed study. To ensure students could apply their knowledge in practical settings, a capstone project was included, supported by ongoing instructor guidance and feedback. Assessments comprised a combination of automated quizzes, peer reviews, and evaluations by both instructors and industry professionals, fostering critical thinking and collaboration while ensuring that the skills learned were relevant to real-world applications. The course also facilitated the sharing of students’ achievements within university student groups to enhance visibility and improve job prospects. Importantly, the course was designed to align with two key national frameworks: the Conceptual and Reference Framework for the Digital Competence of Educational and Instructional University Personnel (Ministry of Digital Transformation of Ukraine, 2021) and the Conceptual and Abstract Framework for Digital Competencies of Healthcare Workers, focusing on the development of information culture, digital literacy, cybersecurity, and cyber hygiene among healthcare employees (Ministry of Digital Transformation of Ukraine, 2023).

Sampling

A convenience sampling technique was used in this study to select 34 participants (29 females aged 22-24 and 5 males aged 22-23), all of whom were pursuing Master’s programs in Preschool Education, Primary School Education, and Higher Education at Drahomanov Ukrainian State University, and in Public Health, Pharmacy, and Education at Bogomolets National Medical University. These universities were chosen because they were planning to implement micro-credentials and digital badges into their curricula.

A random sampling technique was used to select participants for three focus groups: students (8 participants), course trainers (5 participants), and stakeholders/employers (5 participants).

Data collection and analysis

Quantitative data were collected before and after the intervention using the Micro-Credential Impact and Engagement Survey (MCIES), which was originally designed in Ukrainian and translated into English for presentation in this article. The questionnaire consisted of 18 questions distributed across three variables: student engagement, motivation, and employability. These variables were further divided into several domains, such as behavioural, emotional, and cognitive engagement; intrinsic and extrinsic motivation; goal orientation; skill development; job market readiness; and employer recognition. The tool utilized a 5-point Likert scale and was validated prior to the study with a small group of students. The content validity index (I-CVI) was 0.933, Fleiss’s Kappa coefficient was 0.421, and Cronbach’s α showed a reliability of 0.917, suggesting that the tool was reliable for use in the study.

Qualitative data were obtained from three focus groups (see Appendix C) consisting of students (8 randomly selected participants), course trainers (5 randomly selected participants), and employer representatives (5 randomly selected participants). Each focus group interview was conducted in Ukrainian via the ZOOM

conferencing platform and lasted approximately 60 minutes. The meetings were recorded using Zoom’s recording function and subsequently transcribed using the Maestra Web App (<https://maestra.ai/tools/audio-to-text/transcribe-ukrainian>), which supports the Ukrainian language. The textual data were then translated into English for thematic analysis.

The paired samples Wilcoxon signed-rank test (non-parametric test) was conducted to analyse the statistical data from the MCIES regarding students’ engagement, motivation, and perceived employability before and after the intervention (micro-credentials and digital badges). The analysis was performed using *Jamovi* [Computer software, Version 2.2] (<https://www.jamovi.org/>). NVivo computer software (<https://lumivero.com/products/nvivo/>) was used for the thematic analysis of the focus group data.

Ethical considerations

This study adhered to ethical standards to ensure integrity and protect participants. All participants (students, course trainers, and employer representatives) provided informed consent before data collection, fully understanding the study’s aims and procedures. Confidentiality was maintained by anonymizing participant identities in all data handling. Both quantitative and qualitative data were kept confidential and securely stored. To ensure validity and reliability, the MCIES tool demonstrated high reliability and validity (I-CVI = 0.933, Fleiss’s Kappa = 0.421, Cronbach’s α = 0.917), confirming its effectiveness in measuring engagement, motivation, and employability.

4. Results

The results of the measurements performed before and after involving the sample students in the Unified Micro-Credential Course: “Digital competencies for the modern professional,” and analysed using the paired samples Wilcoxon signed-rank test, as presented in Table 1, showed statistically significant improvements in engagement, motivation, and employability scores following the intervention. The effect sizes demonstrated substantial changes, suggesting that the intervention had a strong positive impact on the measured variables.

Table 1. Results of the paired samples Wilcoxon Signed-Rank Test for Engagement, Motivation, and Employability scores before and after the unified micro-credential course: “Digital competencies for the modern professional”

Paired Samples T-Test			Statistic	<i>p</i>	Mean difference	SE difference	95% Confidence Interval		Effect Size	
							Lower	Upper		
Engagement Pretest	Engagement Post-test	Wilcoxon W	0.00	<.001	-.900	0.0442	-1.000	-0.800	Rank biserial correlation	1.02
Motivation Pretest	Motivation Post-test	Wilcoxon W	0.00	<.001	-.900	0.0386	-0.950	-0.800	Rank biserial correlation	1.23
Employability Pretest	Employability Post-test	Wilcoxon W	0.00	<.001	-1.000	0.0426	-1.100	-0.900	Rank biserial correlation	1.31

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As shown in Table 1, the results for engagement scores revealed a significant difference between pretest (Mdn = [pretest median]) and posttest (Mdn = [posttest median]) scores, Wilcoxon $W = 0.00$, $p < .001$. The mean difference of -0.900 ($SE = 0.0442$) indicates a substantial decrease in engagement scores post-intervention, with the 95% confidence interval for the median difference ranging from -1.000 to -0.800 . The rank biserial correlation of -1.02 signifies a rather strong effect size, suggesting a substantial improvement in engagement as a result of the intervention. For motivation scores, the paired samples Wilcoxon signed-rank test also showed a significant difference between pretest and posttest scores, Wilcoxon $W = 0.00$, $p < .001$. The mean difference of -0.900 ($SE = 0.0386$) reflects a notable increase in motivation post-intervention, with the 95% confidence interval for the median difference ranging from -0.950 to -0.800 . The rank biserial correlation of -1.23 further supports a strong effect size, highlighting a notable enhancement in motivation as a result of the intervention. Similarly, the employability scores demonstrated a significant change with a Wilcoxon W of 0.00 , $p < .001$. The mean difference of -1.000 ($SE = 0.0426$) indicates a considerable improvement in employability post-intervention, with the 95% confidence interval for the median difference ranging from -1.100 to -0.900 . The rank biserial correlation of -1.31 suggests a robust effect size, underscoring a substantial increase in employability following the intervention.

The results from the focus groups also supported the integration of micro-credentials and digital badges into the university curriculum. The responses indicated that digital badges significantly boosted engagement and motivation among students. Participants found that the visual representation of their achievements fostered greater interest in course activities. This finding aligns with the concept that goal-setting and rewards can enhance student motivation (Zimanyi & Schüler, 2021). The integration of micro-credentials appears to have created a more dynamic and goal-oriented learning environment. Some illustrative quotes from students were as follows:

“... Micro-credentials and digital badges made the course a lot more interactive and fun...”

“... Getting digital badges gave me quick recognition for my hard work, which pushed me to get more involved...”

Students perceive micro-credentials as valuable tools for enhancing employability. The recognition of these credentials as stand-alone proof of skills suggests that they are seen as beneficial additions to traditional academic qualifications. This perception aligns with findings that credentials provide concrete evidence of skills and can improve job market competitiveness. Some of the students' quotes were as follows:

“... Micro-credentials really boost my resume... They help me stand out to potential employers...”

“Yeah, I'd totally recommend them. They add extra motivation and are great for showing off my skills to future employers...”

Challenges faced by students related to understanding and navigating the badge system highlight the need for clearer guidance and better system integration. Addressing these issues is crucial to ensure that the benefits of digital badges are not diminished by procedural complexities:

“... One challenge was the initial confusion about how to earn the badges and what was required for each...”

Students suggested that clearer instructions and a more streamlined process would enhance their learning experience. This feedback underscored the importance of user-friendly systems and transparent communication to maximise the effectiveness of digital badges. One student emphasized the need to *“provide more detailed guidelines on how badges are earned to improve clarity for both students and trainers”*. The course trainers supported the idea that incorporating digital badges led to a more structured approach in course design, highlighting the benefits of integrating goal-oriented elements into educational planning. However, technical issues underscored the need for robust technological support to ensure seamless implementation. Trainers also observed increased

student engagement and improved performance associated with the use of digital badges. This finding aligns with research suggesting that gamified elements, such as badges, can positively influence student engagement and academic performance. One trainer noted: *‘Students seemed more eager to participate in discussions and complete assignments when they knew it would contribute to earning badges.’*

Trainers found micro-credentials to be effective for assessing student progress and providing feedback. This suggests that badges can serve as valuable assessment tools, offering both motivation and a basis for constructive feedback. One trainer shared that micro-credentials allowed them to track students’ progress and give targeted feedback aligned with their badge achievements. However, recommendations for better integration with existing systems highlighted the need for improved technological alignment. Ensuring compatibility between badge systems and course management platforms is essential for maximizing the effectiveness of digital badges.

Employers recognised the value of micro-credentials as they provide concrete evidence of specific skills and a candidate’s commitment to ongoing development. This perspective supports the idea that micro-credentials can enhance the recruitment process by showcasing relevant competencies. While they acknowledged the relevance of the skills demonstrated by micro-credentials, they suggested that future iterations should incorporate emerging industry skills and soft skills. This feedback indicates that micro-credentials should evolve to remain aligned with industry needs. Some of the employers’ quotes include:

“The skills represented often match the competencies we look for.”

“Including skills related to emerging technologies and soft skills like leadership could improve future credentials.”

Employers advocated for closer collaboration between universities and industry to ensure that micro-credentials align with current job market needs. This approach could enhance the value of these credentials and better prepare students for employment.

5. Discussion

The integration of micro-credentials and digital badges into the university curriculum has garnered significant attention in educational research, particularly for their potential to enhance student engagement, motivation, and employability. The novelty of this study lies in its triangulated approach, combining quantitative data with in-depth qualitative insights from multiple stakeholders. By doing so, this research offers a comprehensive analysis of the multifaceted impact of micro-credentials and digital badges, providing actionable insights for educators, administrators, and employers. The study also highlights the potential for these digital tools to enhance student outcomes, while identifying key areas for improvement, particularly in system usability and industry alignment.

The quantitative results, as shown in Table 1, demonstrate a significant improvement in student engagement, motivation, and employability following the implementation of micro-credentials. Engagement scores exhibited a substantial increase post-intervention (Wilcoxon $W = 0.00$, $p < .001$), with a strong effect size ($r = -1.02$), suggesting that digital badges served as a powerful motivator for students to participate in course activities. Similarly, motivation and employability scores improved markedly, with both measures showing significant changes ($p < .001$) and robust effect sizes ($r = -1.23$ and $r = -1.31$, respectively). These findings align with previous research indicating that goal-oriented mechanisms, such as badges, can foster intrinsic motivation (Black & Allen, 2016; Howard et al., 2021) and enhance learning experiences (Zimanyi & Schöler, 2021).

Qualitative data from the focus groups further reinforce the positive impact of micro-credentials on student engagement. Students reported feeling more motivated to complete assignments and actively participate in class after earning digital badges. This finding aligns with research on gamification, which suggests that incorporating

reward systems can positively influence student engagement and academic performance (Jaramillo-Mediavilla et al., 2024; Nozhovnik et al., 2023). One student noted that badges made the course “a lot more interactive and fun,” reflecting the value of visual achievements in motivating learning. However, the study also uncovered challenges, particularly related to the complexity of the badge system. Students expressed frustration with navigating the process, underscoring the need for clearer instructions and better system integration. As one participant suggested, “providing more detailed guidelines on how badges are earned could improve clarity for both students and trainers.” These challenges echo concerns in existing literature about the potential for poorly designed gamified elements to detract from the learning experience (Lockley et al., 2016; Schoenenberger, 2024). Course trainers also recognised the value of micro-credentials, particularly in providing a structured framework for assessing student progress and delivering feedback. However, they identified technical issues as a barrier to seamless implementation. This aligns with findings by Timotheou et al. (2023) and Bećirović (2023), who highlight the importance of intense technological support in successfully integrating digital tools into educational settings. Trainers also noted that badges encouraged student participation, with one trainer stating, “Students seemed more eager to participate in discussions and complete assignments when they knew it would contribute to earning badges.”

From an employability perspective, employers viewed micro-credentials as valuable indicators of specific skills and dedication to professional growth. This finding supports previous research suggesting that digital badges can serve as a bridge between academia and the labour market by providing concrete evidence of competencies (Cheng et al., 2020; Carey & Stefaniak, 2018). However, employers also recommended the inclusion of emerging industry skills and soft skills, such as leadership, to increase the relevance of micro-credentials. This feedback highlights the importance of continuously evolving these tools to align with the ever-changing demands of the workforce.

5. Conclusion

This study underscores the potential of micro-credentials and digital badges to significantly enhance student engagement, motivation, and employability within higher education. The quantitative findings demonstrated strong improvements in these areas, with both students and course trainers noting the benefits of incorporating digital badges into the learning process. The qualitative data further reinforced the positive impact of these tools, revealing that students found badges to be a motivating factor in their academic activities, while trainers appreciated their value in assessing progress and providing feedback. However, the research also highlighted several challenges, particularly around the complexity of the badge system and the need for clearer guidance and technological support. Both students and trainers emphasized the importance of a user-friendly interface and better system integration to ensure the seamless adoption of micro-credentials. Moreover, employers recognized the value of micro-credentials but suggested that they evolve to include emerging industry skills and soft skills, which would enhance their relevance in the labour market. Further research should explore the long-term impact of micro-credentials on employability and career advancement, as well as their applicability across diverse industries and educational settings.

6. Recommendations

Scientists are recommended to implement evidence-based practices for designing and using micro-credentials to boost student engagement and performance. They should create clear, meaningful badges with well-defined criteria to enhance student motivation and clarity. Practitioners are advised to collaborate with industry experts

to ensure that badges align with current job market needs, thereby enhancing their relevance. They should also continuously gather feedback, address issues, and make improvements to the badge system based on user experiences. Additionally, practitioners are encouraged to promote the benefits of micro-credentials within their institutions and share best practices with their peers.

7. Limitations

The study has several limitations to consider. First, the data collected from focus groups is based on participants’ self-reports, which may be influenced by personal biases or the desire to provide socially acceptable answers. Second, the research primarily focused on immediate outcomes such as engagement and motivation, without assessing the long-term impacts of micro-credentials on employability or academic success. Third, the employers involved may represent specific industries, potentially limiting the applicability of the findings to other sectors with different skill requirements.

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Appendices

Appendix A. Micro-Credential Impact and Engagement Survey (MCIES)

Variable	Domain	Question and Scale
1. Student Engagement	1. Behavioural Engagement	1. On a scale of 1 to 5, how often do you participate in activities related to the micro-credential courses?
		2. Compared to traditional courses, how often do you engage with classes and complete assignments in courses that offer micro-credentials? (1 = Much less often; 2 = Less often; 3 = About the same; 4 = More often; 5 = Much more often)
	2. Emotional Engagement	3. How much do you enjoy the process of earning micro-credentials and digital badges? (1 = Not at all, 5 = Very much)
		4. How excited are you about the opportunity to earn micro-credentials? (1 = Not excited, 5 = Very excited)
	3. Cognitive Engagement	5. How often do you find yourself thinking about the skills you are learning through micro-credentials outside of class? (1 = Never, 5 = Very often)
		6. To what extent do micro-credentials motivate you to go beyond the basic course requirements? (1 = Not at all, 5 = Very much)
2. Student Motivation	1. Intrinsic Motivation	7. I engage in courses with micro-credentials because I enjoy learning new things. (1 = Strongly Disagree, 5 = Strongly Agree)
		8. How interesting do you find the topics covered in micro-credential courses? (1 = Not interesting, 5 = Very interesting)

	2. Extrinsic Motivation	9. Earning micro-credentials is important to me because it will look good on my resume. (1 = Strongly Disagree, 5 = Strongly Agree) 10. I am motivated to earn digital badges because they will help me get recognised by employers. (1 = Strongly Disagree, 5 = Strongly Agree)
	3. Goal Orientation	11. My main goal in courses with micro-credentials is to learn as much as possible. (1 = Strongly Disagree, 5 = Strongly Agree) 12. I am focused on earning high grades in my courses with micro-credentials. (1 = Strongly Disagree, 5 = Strongly Agree)
3. Perceived Employability	1. Skill Development	13. The skills I am learning through micro-credentials are relevant to my career goals. (1 = Strongly Disagree, 5 = Strongly Agree) 14. Earning micro-credentials has helped me develop skills that are not covered in traditional courses. (1 = Strongly Disagree, 5 = Strongly Agree)
	2. Job Market Readiness	15. I feel more prepared to enter the job market because of the micro-credentials I have earned. (1 = Strongly Disagree, 5 = Strongly Agree) 16. Micro-credentials give me confidence in my ability to perform well in a job. (1 = Strongly Disagree, 5 = Strongly Agree)
	3. Employer Recognition:	17. I believe that employers value the micro-credentials I earn. (1 = Strongly Disagree, 5 = Strongly Agree) 18. Digital badges will make me stand out to potential employers. (1 = Strongly Disagree, 5 = Strongly Agree)

Appendix B. Syllabus of the unified micro-credential course: “Digital competencies for the modern professional”

Course overview

The “Digital competencies for the modern professional” course was designed to provide students across various majors with essential digital skills that are increasingly important in today’s economy and society. This unified course will cover a wide range of topics, from foundational digital literacy to advanced concepts such as AI and intelligent decision support systems. The course aimed to equip students with the competencies needed to navigate and excel in a digital world, regardless of their field of study.

Course objectives

- To provide students with a broad understanding of the digital economy and its impact on various sectors.
- To develop students’ abilities to effectively utilize digital educational resources and tools.
- To enhance students’ skills in cybersecurity, protecting digital identities, and managing digital risks.
- To introduce students to artificial intelligence (AI) and its applications in decision-making processes.
- To foster skills in digital collaboration, data analysis, and the automation of management processes.

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Course modules

1. Digital Economy and Society: a) Overview of the digital economy: its growth, impact, and future trends.
1. Understanding how digital transformation affects different industries. b) The role of digital society in shaping social, economic, and cultural dynamics.
2. Digital Educational Environment: a) Using digital platforms for learning and teaching. b) Integrating digital tools into the educational process. c) Designing and managing a digital learning environment.
3. Digital Educational Resources: a) Evaluating and utilising online educational resources. b) Creating digital content for educational purposes. c) Best practices for curating and sharing educational materials.
4. Digital Assessment: a) Tools and techniques for digital assessment in educational settings. b) Designing digital quizzes, exams, and assignments. c) Analyzing and interpreting digital assessment results.
5. Cybersecurity: a) Fundamentals of cybersecurity: threats, vulnerabilities, and best practices. b) Managing digital identities and data protection. c) Understanding legal and ethical considerations in cybersecurity.
6. Artificial Intelligence and Intelligent Decision Support Systems: a) Introduction to AI and its applications in various fields. b) Using intelligent decision support systems in professional settings. c) Case studies on the use of AI for data-driven decision-making.
7. Interaction in the Ecosystem: a) Principles of effective digital communication and collaboration. b) Tools for teamwork and collaboration in digital environments. c) Developing skills for virtual interaction and remote work.
8. Assessment of Risks and Problem-Solving in the Digital Environment: a) Identifying and assessing risks in digital environments. b) Strategies for mitigating digital risks. c) Problem-solving frameworks for addressing digital challenges.
9. Professional Development and Research with Digital Technologies: a) Using digital tools for professional growth and lifelong learning. b) Conducting research with the latest digital technologies. c) Developing digital portfolios to showcase skills and research work.
10. Data Analysis in the Digital Environment: a) Basics of data analysis and visualization. b) Tools for data collection, analysis, and interpretation. c) Applying data analysis skills to real-world scenarios.
11. Automation of Management: a) Introduction to automation in management processes. b) Tools for automating administrative tasks. c) Case studies on successful automation in various sectors.

Digital badges

1. Bronze Level: Completion of foundational modules, demonstrating basic digital literacy and understanding of the digital economy and society.
2. Silver Level: Participation in intermediate modules, applying skills in digital education, cybersecurity, and digital assessment.
3. Gold Level: Mastery of advanced modules, including AI, intelligent decision support systems, data analysis, and digital problem-solving, demonstrated through comprehensive projects and assessments.

Appendix C. Focus group interview questionnaire

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Focus group 1: Students

Engagement and Learning:

1. How did the integration of micro-credentials and digital badges influence your engagement with the course content?
2. Did you feel more motivated to complete tasks or participate in class after earning digital badges? If so, how?

Perceived Value:

1. How do you perceive the value of micro-credentials and digital badges in relation to your future employability?
2. Would you recommend courses with micro-credentials to other students? Why or why not?

Challenges:

1. What challenges did you face while earning the micro-credentials? Were there any technical or content-related difficulties?

Suggestions for Improvement:

1. How could the process of earning micro-credentials and badges be improved to enhance your learning experience?

Focus group 2: Course trainers

Course Design and Delivery:

2. How did the integration of micro-credentials and digital badges affect your approach to teaching and course delivery?
3. What challenges did you encounter while implementing these digital tools into the curriculum?

Student Engagement and Performance:

1. In your observation, how did micro-credentials and badges impact student engagement and participation in the course?
2. Did you notice any differences in student performance or motivation after implementing the badges?

Assessment and Feedback:

1. How effective do you think micro-credentials were in assessing student progress and providing feedback?

Suggestions for Improvement:

1. What improvements would you suggest for the future implementation of micro-credentials and badges in similar courses?

Focus group 3: Employers (external stakeholders)

Perception of Micro-Credentials:

1. How familiar are you with the concept of micro-credentials and digital badges?
2. Do you believe these credentials provide value when assessing potential employees?

Relevance to Employability:

1. From your perspective, how relevant are the skills demonstrated by micro-credentials in the hiring process?

2. Would you consider a candidate with digital badges more qualified for a role in your organisation? Why or why not?

Skills and Competencies:

1. Are the skills represented by the micro-credentials aligned with the competencies you seek in new hires?
2. Are there any specific skills or areas that you believe should be included in future micro-credentials to better match industry needs?

Future Opportunities:

1. How can universities collaborate with employers to ensure that micro-credentials align more closely with industry standards and requirements?

What would make micro-credentials and digital badges more valuable or attractive to your organisation?

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