Promoting Inclusive Practices Through Emerging Technologies in Higher Education: Faculty Professional Development via Blended Learning

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Abstract

Higher education institutions face the growing challenge of equipping faculty with inclusive digital skills essential for delivering quality education to all students. This paper details a study that designed, developed, and evaluated a blended-learning professional development programme for university faculty in Spain, emphasizing the use of emerging technologies through an inclusive lens. Employing a qualitative methodology, the study utilized a case study design, conducting semi-structured interviews with faculty members and focus groups with students. The research involved a needs assessment of faculty training requirements, followed by an evaluation of the programme's implementation, outcomes, and impact. Findings indicated that integrating inclusive technological practices benefits both educators and students and offers a scalable model for other institutions. This study highlights the critical role of online training in supporting faculty development and fostering equitable learning experiences in contemporary higher education settings.

Keywords : *Higher education, Faculty professional development, Training, Blended learning, Emerging technologies, Inclusive education*

1. Introduction

Inclusive education, which promotes learning and engagement for all students without exception, remains a significant challenge in higher education globally (UNESCO, 2021). Research underscores the pivotal role of faculty in achieving inclusion, emphasizing the necessity of providing ongoing professional development (PD) opportunities through targeted training programmes (Roberts et al., 2011).

The experiences of students with disabilities, alongside challenges introduced by innovative pedagogical approaches and the COVID-19 pandemic, have underscored the vital role of technology in fostering inclusive learning environments (Fernández Batanero et al., 2022; Reyes et al., 2022). The integration of technology within university settings necessitates a critical reassessment of teaching methods to ensure equitable access and participation for all learners, irrespective of their abilities.

Emerging technologies such as adaptive learning systems and mobile platforms are transforming higher education teaching methods, as noted by the EDUCAUSE Horizon Report (Alexander et al., 2019). These innovations are reshaping educators' instructional approaches and have accelerated the adoption of flexible and online learning modalities, which are increasingly preferred by students (Pelletier et al., 2023). This evolution redefines the educational experience by blending technology with inclusive principles and enriching the diversity of university education.

Despite the critical role of technology in enabling educational inclusion, research reveals that many faculty members lack adequate preparation to address the needs of students with disabilities or to effectively utilize inclusive technological tools (Moriña & Carballo, 2017). Consequently, implementing targeted training initiatives that empower faculty to acquire relevant knowledge and integrate emerging inclusive technologies into their teaching practices is essential (Park et al., 2017; Traxler, 2016).

In response to this need, this article presents findings from a study that designed, developed, and assessed a blended-learning professional development programme tailored for faculty. This programme focused on emerging technologies within an inclusive framework and emphasized practical application to facilitate effective adoption in the university context.

2. **Literature Review**
    2.1. Advancing Inclusive Education for Achieving Quality Education for All

Inclusive education represents both a legal mandate and an ethical commitment grounded in principles of diversity, equity, and social justice (Koutsouris et al., 2022). It is now widely accepted that educational institutions must guarantee quality education that is accessible and relevant to every student (UNESCO, 2021). Embracing inclusion involves valuing diversity within university environments by recognizing the varied ways students learn, affirming the worth of every learner, and implementing strategies that enhance participation and genuine learning experiences (Moriña, 2022). In such inclusive settings, student-centred pedagogies and Universal Design for Learning (UDL) have been shown to effectively support academic achievement (Hitch et al., 2016).

Student-centred approaches focus on placing learners at the core of the educational process, respecting their individual differences, and encouraging their autonomy. These methods are intrinsically linked to inclusive education as they enable the customization of teaching practices and materials to accommodate the unique needs of all students, especially those with disabilities. Likewise, learning-centred approaches emphasize the development of students' competencies and skills, paying close attention to how learning occurs rather than just the content acquired. This framework is crucial for inclusion, as it calls for ongoing assessment of student progress and the tailoring of instructional strategies to align with diverse learning styles and paces (Altay, 2014).

Nonetheless, progressing toward truly inclusive universities presents several challenges that were less visible in earlier decades (Fernández Batanero et al., 2022). A prominent example is the rapid technological advancement, which has been accelerated by training demands stemming from the COVID-19 pandemic (Lee et al., 2022). This swift evolution underscores the necessity for faculty to remain current and engage in continuous professional development (Bong & Chen, 2021). Moreover, pedagogical methods have evolved, with a growing endorsement of learner-centred approaches. Concurrently, the increasing enrollment of traditionally marginalized groups in higher education—such as individuals with disabilities—necessitates the adaptation of teaching methodologies to address this changing demographic (Koutsouris et al., 2022). Together, these developments call for a reexamination of the teaching role and underscore the importance of lifelong learning for educators in this new context.

Today's university teaching role extends beyond subject mastery; it requires proficiency in pedagogy, the ability to tailor instruction to student needs, and effective use of diverse educational resources, including technological tools (Reyes et al., 2022). However, simply employing technology is insufficient—these resources must be intentionally designed with accessibility and inclusion in mind to ensure all students can benefit (Sánchez-Díaz et al., 2022; Stambekova et al., 2020; Williams Van Rooij & Zirkle, 2016). Accordingly, providing adequate training for faculty is critical in promoting inclusive teaching practices that enhance learning outcomes for every student.

Within this framework, Universal Design for Learning (UDL) emerges as a powerful strategy to dismantle learning barriers. It supports the implementation of inclusive education at the university level by fostering learning environments that respect and value diversity in all its forms without exception (CAST, 2024; Dell'Anna et al., 2024).

2.2. Emerging Technologies to Support Inclusive Teaching Practices

Higher education is experiencing a significant transformation fueled by the growing adoption of emerging technologies. These innovations have the capacity not only to bridge the digital divide but also to ensure equitable access to learning experiences customized to accommodate the diverse learning preferences, styles, and needs of students (Czerkawski, 2013; Martin et al., 2020). Within this evolving landscape, faculty members play a critical role, as their pedagogical strategies and openness to incorporating new technologies are vital factors in fostering inclusive classroom environments (Looi et al., 2014).

Among the technological advances shaping this transformation, mobile applications have become invaluable tools in enhancing the teaching and learning process for students with disabilities, while simultaneously supporting educators and promoting inclusivity in education (Pegalajar-Palomino, 2022). These apps not only personalize learning experiences and stimulate active classroom participation, as demonstrated in earlier studies (Wang et al., 2009), but they also enhance collaborative learning dynamics (Ault & Horn, 2018). This has paved the way for innovative pedagogical methods such as gamification, flipped classrooms, and virtual reality (Kalogiannakis et al., 2021; Lampropoulos et al., 2022; Nguwi, 2021). Such technological advancements have revolutionized interactions between students and content, significantly boosting motivation, engagement, and academic outcomes (Castellano-Beltran et al., 2025; Criollo-C et al., 2024; Talan, 2020).

Beyond mobile apps, the integration of gamification, augmented reality (AR), and virtual reality (VR) offers powerful opportunities to advance inclusive education. Gamification introduces game-like elements into learning settings, enhancing student motivation and engagement, particularly benefiting those with attention challenges or disabilities by providing structured, interactive, and enjoyable activities that foster participation (Talan, 2020). Meanwhile, AR and VR create immersive educational experiences that deepen students' understanding of complex

subjects. These technologies improve accessibility to content and deliver customized support, which is especially critical in inclusive classrooms where alternative forms of engagement and comprehension are required (Kalogiannakis et al., 2021).

Effectively incorporating these technologies underscores the need for comprehensive training for educators. Faculty must develop both technical skills and inclusive pedagogical approaches that harness the potential of gamification, AR, and VR to create equitable learning opportunities for all students (Bas & Sarigöz, 2018).

2.3. Faculty Professional Development and Blended Learning Training for Enhancing Teaching Practices

Ongoing enhancement of specialized skills and knowledge is essential for faculty members. This continuous growth is typically facilitated through learning activities and professional development (PD) opportunities such as courses, workshops, conferences, mentoring, and research engagement (Desimone, 2009). Moriña (2022) highlights the critical role of faculty training in fostering inclusive education. Faculty who embrace learner-centred methodologies and have confidence in the capabilities of all students contribute to creating an inclusive learning environment from the very beginning.

In the realm of faculty PD, particularly concerning inclusive education, blended learning (b-learning)—which integrates both face-to-face and online modalities—has been increasingly recognized for its value (Shu & Gu, 2018). Research indicates that the effective incorporation of technology can boost student participation and promote an inclusive educational atmosphere (Lázaro & Duart, 2023). Nonetheless, the literature reveals a notable gap regarding evaluations of the combined impact of emerging technologies and inclusion in faculty training. To date, no studies comprehensively address both technological innovation and inclusion while simultaneously assessing the development and outcomes of related training programs. Existing research, however, has concentrated on faculty training addressing disability, inclusive education, and Universal Design for Learning (UDL) principles (Hockings et al., 2012; Moriña & Carballo, 2017). Other works have focused on accessible distance education and assistive technologies, such as those by Park et al. (2017), while additional studies investigate faculty development in technology skills (e.g., Báez et al., 2019; Kluge et al., 2023).

It has also been observed that many blended learning PD initiatives lack sustained support and post-training evaluations for faculty participants, underscoring the need for more extensive research into PD within blended learning frameworks (Huang et al., 2017).

Regarding training types, their impact on teaching practices is heavily influenced by factors such as program duration and delivery format. Hitch et al. (2016) critique short-term, sporadic in-service university training efforts, asserting that such approaches impede meaningful cultural and practical transformations within institutions. This criticism highlights the necessity for more comprehensive and ongoing training strategies. The literature affirms the importance of diverse training formats, from in-person workshops to prolonged seminars and online courses (Burgstahler & Doe, 2006). Offering a range of formats provides faculty with flexibility, enriching their professional development and enabling them to tailor learning experiences to their unique needs and educational contexts (Wynants & Dennis, 2018).

Moreover, diversity in PD program design is essential to accommodate individual faculty needs (Gelbar et al., 2015). Online and self-paced learning modalities, which afford flexible participation (Janahi et al., 2023; Zhang et al., 2010), are effectively complemented by constructivist and learner-centred approaches (Gunersel & Etienne, 2014). Applying the acquired knowledge and skills within real teaching environments not only improves instructional quality but also enhances students' educational experiences (Moriña & Carballo, 2017).

Systematic evaluation of PD effectiveness is indispensable. Established frameworks like Kirkpatrick's model offer a multi-level assessment of training outcomes, examining participants' reactions, learning gains, behavioral changes, and resultant impacts (Kirkpatrick & Kirkpatrick, 2006). Such structured evaluation ensures that positive perceptions of PD are substantiated by rigorous evidence. Additionally, other evaluation models, such as Stake's (1967) framework employed in this study, emphasize analysis of both processes and outcomes. These comprehensive evaluations facilitate identification of strengths and weaknesses within training initiatives, contributing to a deeper understanding of their overall effectiveness. Ultimately, these methods ensure that PD programs meet intended goals and support the ongoing advancement of inclusive teaching practices.

Grounded in this literature and methodological foundation, the present study seeks to evaluate a faculty training program focused on emerging technologies and inclusive education. Specifically, it aims to: (1) assess faculty training needs and design a blended learning program responsive to those needs; (2) develop and implement the training while examining its influence on teaching practices; and (3) evaluate the program's impact on student learning outcomes, educational inclusion, and faculty professional growth.

3. Method

This exploratory study centered on the design, implementation, and evaluation of a training program focused on emerging technologies and inclusion, aimed at all students with a particular emphasis on those with disabilities. The program was specially developed for faculty members at a Spanish university and delivered through a blended learning format via the Moodle virtual platform. A qualitative approach, specifically a case study methodology (Yin, 2009), was employed to gain an in-depth understanding of the program's needs, design, development, and impact on educational practices, as well as to evaluate its effectiveness in promoting inclusion for all students and supporting faculty professional development.

3.1. Blended Learning Training Program

The training program was crafted based on scientific research and expert literature (Hitch et al., 2016; Janahi et al., 2023; Moriña & Carballo, 2017; Zhang et al., 2010), addressing identified needs alongside technical, pedagogical, and organizational considerations.

Spanning 90 hours over four months, the course was delivered in a blended learning format that combined 12 hours of face-to-face sessions with 78 hours of online activities to provide participants with flexibility for self-directed learning. The in-person sessions were scheduled at three key points—beginning, midpoint, and conclusion—each lasting four hours.

The curriculum was divided into eight modules, each dedicated to a particular inclusive technology or pedagogical approach. Table 1 outlines the module titles, intended objectives, and principal activities:

Table 1. Summary of Training Modules on Inclusive Technologies: Objectives and Key Activities

Module	Main Objective	Key Activities
1. Emerging Technologies and Inclusion	Introduce foundational concepts	Readings, videos, and forum discussions
2. Designing Accessible Materials	Develop inclusive educational resources	Workshops and practical assignments
3. Inclusive Practices Using Mobile Learning	Apply mobile learning techniques in teaching	App reviews and task design
4. Mobile Applications for Inclusive Learning	Assess inclusive mobile tools	Hands-on testing and rubric evaluations
5. Gamification as an Inclusive Methodology	Incorporate game-based strategies	Design of escape rooms and group discussions
6. Flipped Learning as an Inclusive Methodology	Redesign teaching sequences	Video creation and class session mapping
7. Augmented and Virtual Reality for Inclusion	Explore AR/VR applications in inclusive settings	Tool utilization and immersive experiences
8. Virtual Assistants for Inclusion	Understand the pedagogical use of voice assistants	Guided practice and critical analysis

The Moodle platform served as the central hub for the virtual learning environment, housing reading materials, multimedia content, presentations, links to digital tools, and SCORM-compliant activities which facilitated tracking users' engagement. Communication was supported through forums and both synchronous and asynchronous channels to foster interaction.

The program emphasized a discursive approach combined with active and participatory learning methods. Participants engaged in group discussions, hands-on activities, formative assessments, and critical reflections. Sharing personal experiences and perspectives was encouraged to promote collaborative knowledge construction.

Assessment was continuous and formative, incorporating tools such as attendance monitoring, quizzes, practical assignments, and forum participation. Feedback was delivered in a personalized, timely, and constructive manner, with peer feedback playing an integral role within the collaborative learning framework.

3.2 Procedure and Timeline

The development of the teacher training programme followed a systematic process divided into five key phases: Needs Assessment, Programme Design, Materials Development, Implementation, and Evaluation. Table 2 outlines the timeline and the primary activities conducted during each phase.

Table 2. Procedure and Timeline of the Teacher Training Programme

Phase	Duration	Description
Needs Assessment	Months 1–2	An initial survey was conducted to identify the specific needs of teachers, which guided the design of the programme.
Programme Design	Months 3–4	The content and instructional methods were established, emphasizing emerging technologies and inclusive practices.
Materials Development	Months 5–6	Educational materials, including modules on gamification and AR/VR, were created or adapted to suit the programme goals.
Implementation	Months 7–10	The programme was delivered through a blended learning model, during which teachers began applying new strategies in their classrooms simultaneously.
Evaluation	Months 11–12	Data collection via interviews and focus groups assessed the impact of the programme on teaching practices.

Notably, during the implementation phase (months 7 to 10), participants attended training sessions while concurrently applying their newly acquired skills within their own classrooms. This simultaneous training-and-application approach is a distinctive characteristic of the programme design (refer to Section 3.1).

3.3 Participants

Participants were selected by the University's Faculty Training Centre based on strict inclusion criteria: (1) active teaching during the programme semester, (2) commitment to integrating the training into at least one specific course, and (3) willingness to engage in the research process, which included completing interviews and questionnaires.

Initially, 21 faculty members enrolled in the programme. However, seven withdrew before the start, one was excluded for not teaching during the relevant period, and two dropped out due to scheduling conflicts. The final cohort included 11 participants who completed both the implementation and evaluation phases (see Table 3).

Table 3. Participant Characteristics

Participant	Age	Faculty	Professional Category	Years of Teaching Experience
P1	27	Geography and History	Predoctoral Fellow	1
P2	27	Geography and History	Predoctoral Fellow	1
P3	37	Geography and History	Senior Lecturer	11
P4	28	Philology	Predoctoral Fellow	4
P5	43	Education	Senior Lecturer	15
P6	38	Education	Senior Lecturer	13
P7	58	Education	Senior Lecturer	26
P8	28	Communication	Predoctoral Fellow	1

Participant	Age	Faculty	Professional Category	Years of Teaching Experience
P9	31	Psychology	Associate Lecturer	5
P10	51	Psychology	Lecturer	24
P11	29	Psychology	Postdoctoral Fellow	2

Regarding participant backgrounds, the group included four senior lecturers, one lecturer, four predoctoral fellows, one associate lecturer, and one postdoctoral fellow. Their affiliations spanned various faculties: Education (3 participants), Geography and History (3), Psychology (3), Communication (1), and Philology (1). Ages ranged from 27 to 58 years, reflecting a broad spectrum of teaching experience from 1 to 26 years at the university level. The sample comprised 7 women and 4 men. Detailed participant profiles are provided in Table 3.

3.4.   Data   Collection   Instruments
Data for this study were gathered using semi-structured interviews with faculty members and focus group discussions with their students. Each faculty participant was interviewed three times—prior to, during, and after the training program. These interviews employed open-ended questions designed to explore faculty members' experiences with the training and their integration of emerging technologies into their teaching practices.

The initial interview, conducted before the training commenced, concentrated on identifying faculty members' training needs. Sample questions included: Why are you interested in participating in this training? What are your specific training needs related to educational technology and inclusive education? What is your current understanding of emerging educational technologies? In your opinion, do these technologies and methodologies support inclusive education?

The second interview, held midway through the training, focused on evaluating the progress and implementation of the program. It aimed at identifying areas for improvement before the training's conclusion. The final interview, conducted after completion of the program, sought to assess outcomes concerning student learning, inclusion, and professional growth of faculty members. Questions posed during this phase included: What benefits and challenges did you encounter using a blended learning format? Which aspects of the training do you consider most positive, and why? Do you believe the training has enhanced your students' learning? How has your approach to inclusive teaching evolved as a result of this program?

To further evaluate the impact of the training, focus groups were organized with students from all participating faculty members, except one (P8), who opted out of this stage. These sessions aimed to capture students' perspectives on their learning experience. Guiding questions included: What aspects of this experience did you find most valuable, and why? Do you think the integration of technology supports learning and participation for all students, including those with disabilities? Do you feel that all students can access the materials provided by your faculty member? Has your perception of your faculty changed? If so, how? Has your relationship with your faculty member changed, and why?

A total of 50 students voluntarily took part in 10 focus groups. Among these participants, two students with disabilities were included: one student with autism and dyslexia in the P2 group, and another with attention-deficit/hyperactivity disorder (ADHD) in the P9 group.

Table 4 outlines the data collection methods alongside their corresponding abbreviations, which are used throughout the results section to denote the source of each quotation.

Table 4. Instruments and Abbreviations

Faculty Participant	Initial Interview	Process Interview	Final Interview	Student Focus Group
P1	IIP1	PIP1	FIP1	FGP1 (8 students)
P2	IIP2	PIP2	FIP2	FGP2 (6 students)
P3	IIP3	PIP3	FIP3	FGP3 (3 students)
P4	IIP4	PIP4	FIP4	FGP4 (5 students)
P5	IIP5	PIP5	FIP5	FGP5 (6 students)

Faculty Participant Initial Interview Process Interview Final Interview Student Focus Group

Faculty Participant	Initial Interview	Process Interview	Final Interview	Student Focus Group
P6	IIP6	PIP6	FIP6	FGP6 (6 students)
P7	IIP7	PIP7	FIP7	FGP7 (3 students)
P8	IIP8	PIP8	FIP8	Did not participate
P9	IIP9	PIP9	FIP9	FGP9 (6 students)
P10	IIP10	PIP10	FIP10	FGP10 (4 students)
P11	IIP11	PIP11	FIP11	FGP11 (3 students)

Key:

- IIP: Initial Interview – Pre-Implementation Phase (Faculty Member)

- PIP: Process Interview – During Implementation (Faculty Member)

- FIP: Final Interview – Post-Implementation Phase (Faculty Member)

- FGP: Focus Group – Post-Implementation (Students)

- 3.5.   Data   Analysis
  Data analysis was conducted according to the approach outlined by Miles and Huberman (1994). Initially, all interviews and focus group discussions were transcribed verbatim. After participants reviewed and validated the transcripts, the research team carefully read through these materials to interpret the data meaningfully. Through this process, an inductive coding system was developed directly from the data, allowing categories and codes to emerge naturally. The analysis was iterative: core categories and codes were established during the initial phase and subsequently refined and expanded with additional specific codes as new insights arose (see Table 5). To enhance reliability, two researchers independently analyzed all the data, facilitating data triangulation. MAXQDA software was utilized to manage and organize the substantial volume of data generated.

- Table 5. Category and Code System

Category	Code	Description
1. Needs	1.1 Training needs	Areas in which participants expressed a need for improved training, particularly regarding emerging technologies and inclusive education.
2. Training Modality	2.1 Favourable aspects of b-learning	Benefits identified in delivering the training program using a blended learning (b-learning) approach.
	2.2 Aspects for improvement in b-learning modality	Suggestions for enhancing the implementation of the blended learning format.
	2.3 Virtual platform	Evaluation of the functionality and design of the virtual platform employed during the training.
3. Implementation (Faculty Perspective)	3.1 Impact on students	Faculty perceptions of how the experience influenced student learning outcomes.
	3.2 Inclusive education	Views on whether the practice contributed to improved learning and participation among all students, including those with disabilities.
	3.3 Professional Development	Key content and skills faculty acquired through the training program.
4. Implementation (Student Perspective)	4.1 Impact on students	Students' perspectives on the effect of the experience on their learning.
	4.2 Inclusive education	Students' opinions on whether the practice enhanced learning and inclusion for all, including peers with disabilities.

- To ensure coding reliability, the two researchers collaboratively designed the category and code system and jointly coded the transcripts. Inter-coder reliability was assessed using Cohen's Kappa coefficient,

which yielded a value of 0.81, indicating strong agreement between coders. Any discrepancies identified were resolved through team discussions to reach consensus.

- 3.6.   Ethical   Considerations
  All participants provided signed informed consent forms, which assured confidentiality and anonymity, and they were informed of their right to withdraw from the study at any time. To maintain participant anonymity, each faculty member was assigned a unique identifier beginning with "P" followed by a number, corresponding to the 11 faculty members involved. Students were similarly anonymized with designated codes to prevent identification. Additionally, ethical approval for the study was granted by the funding agency supporting the research.

- Findings
  4.1. Assessment of Training Needs in Emerging Educational Technologies and Inclusion, and Development of the Training Programme

This study commenced by investigating faculty members' training needs related to emerging technologies and inclusive education. The insights and experiences shared by participants underscored critical areas requiring attention to enhance the quality of education that is both inclusive and technologically advanced.

A prominent concern raised by faculty was the importance of ensuring that technologies are accessible to all students, regardless of their abilities. There was a clear need to evaluate the accessibility of digital platforms and applications, as many currently lack adequate tools to support diverse disabilities. To address this, the programme included a module titled "Designing Accessible Learning Materials," which focused on applying Universal Design for Learning (UDL) principles to create educational content accessible to every learner.

Faculty members also expressed the need for deeper knowledge and more extensive use of advanced technological tools. Many felt that training often stopped at basic applications, leaving them inexperienced with more complex tools like simulation software and interactive programming platforms. This gap limited their ability to diversify instructional methods and tailor content to individual learner needs. As one participant noted:

"I need to develop my technological competence in order to promote interaction with students and encourage my students to understand that, firstly, diversity affects all students and, secondly, considering educational inclusion is part of the faculty's job" (IIP7).

In response, the programme introduced specialized modules such as Mobile Applications for Inclusive Learning and Augmented Reality and Virtual Reality for Educational Inclusion in the Classroom, empowering faculty to gain advanced skills in emerging technologies.

Another key theme was the need for effective integration of technology with inclusive practices. Faculty recognized the urgency of building technological skills that foster interactive classrooms while emphasizing inclusion as a fundamental aspect of education. The programme addressed this by offering modules like Inclusive Practices with Mobile Learning and Gamification as an Inclusive Methodological Strategy in the Classroom, which guided instructors on leveraging technology to create participatory and inclusive learning environments.

Finally, faculty highlighted the urgent demand for practical, hands-on training focused on emerging technologies and inclusion. They emphasized the value of concrete learning experiences and real-world examples that would help them translate theoretical knowledge into effective classroom implementation. To meet this expectation, the programme was designed to provide ample practical opportunities, equipping faculty with the skills needed to tackle current challenges in inclusive education and technology integration effectively.

4.2. Development of the Training Programme and Evaluation of Its Implementation

In its online format, the organisational design of the platform played a crucial role in effectively guiding participants through the modules and assigned tasks, fostering active engagement and collaborative learning. The Moodle environment was structured to be user-friendly and easily accessible. At the programme's outset, faculty members were provided with a didactic guide that clearly outlined the objectives and expectations. Additionally, a comprehensive tutorial on the Moodle platform ensured that all participants were comfortable with its features, creating a smooth and supportive learning experience.
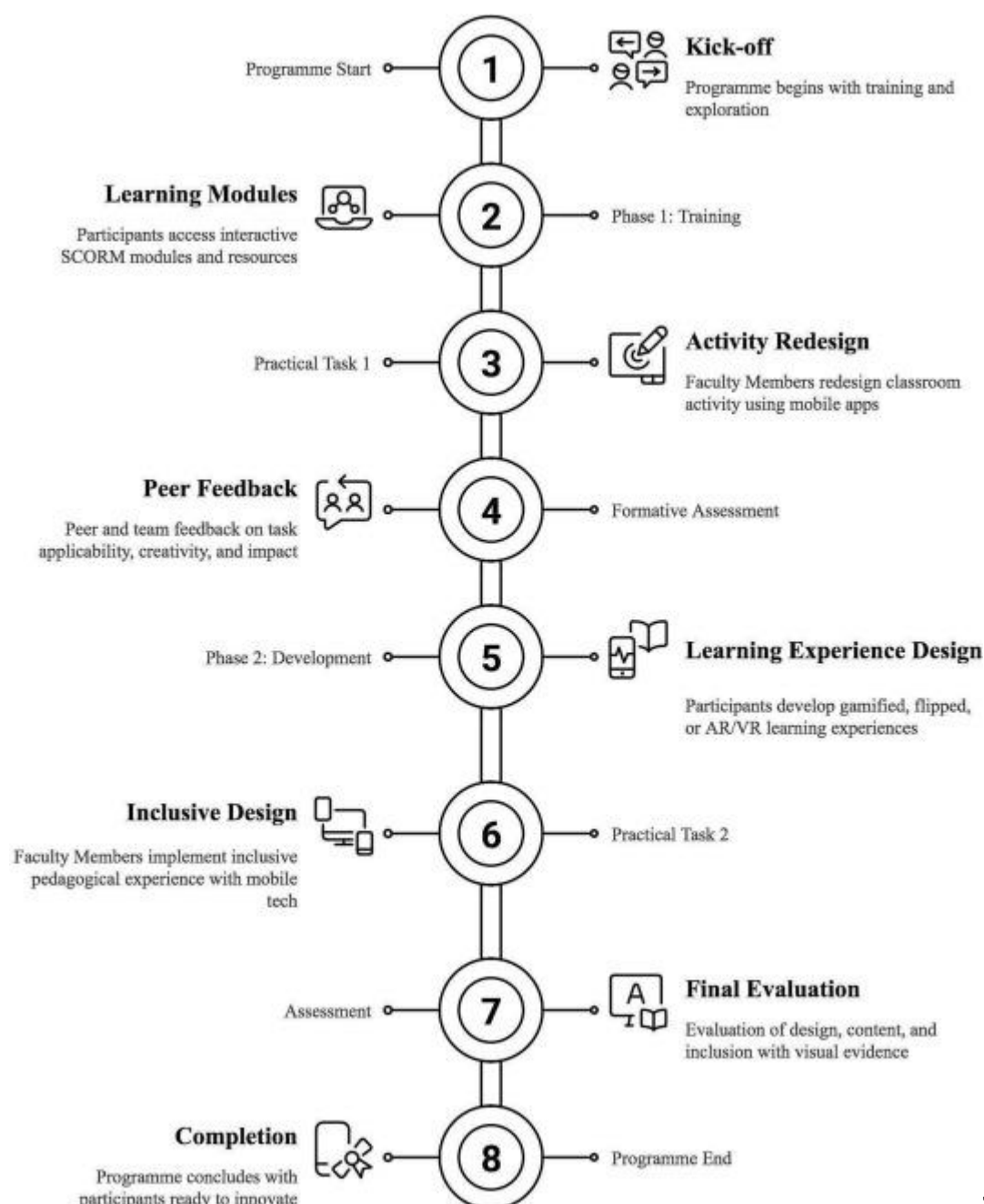
The programme consisted of eight content modules delivered as SCORM packages, enabling faculty to interact with the material dynamically. Supplementary resources in PDF and other formats were made available for extended learning. The content was organised into two training phases, each emphasising practical application of technologies and pedagogical strategies. The first phase introduced foundational theories, tools, guidelines, and

support regarding emerging technologies and inclusive education. The second phase concentrated on applying these technologies within inclusive classroom practices.

Throughout the programme, participants completed two practical assignments. The first task, conducted at the end of the initial training phase, required faculty to redesign and implement a classroom activity incorporating mobile applications from both pedagogical and inclusivity perspectives. This assignment was formatively evaluated based on its relevance, creativity, and impact on student learning, using a combination of peer feedback and predefined criteria established by the teaching team.

For the second task, participants planned and developed a new teaching practice, selecting from gamified learning, flipped classroom models, augmented reality applications, or virtual assistants to implement in their classrooms. Faculty chose a specific approach and utilized mobile and web-based tools to construct inclusive pedagogical experiences. Evaluation focused on the design's effectiveness, content quality, and degree of student inclusion. Both practical tasks involved pilot implementations of redesigned learning activities, with participants documenting key moments through images and concise descriptions. These records served as visual evidence of successful technology integration and supported a thorough evaluation of each experience.

Figure 1 presents an overview of the training activity sequence, detailing the structure of both implementation phases and their associated evaluation components.

Kick-off — Programme begins with training and exploration (1, Programme Start)

Learning Modules — Participants access interactive SCORM modules and resources (2, Phase 1: Training)

Activity Redesign — Faculty Members redesign classroom activity using mobile apps (3, Practical Task 1)

Peer Feedback — Peer and team feedback on task applicability, creativity, and impact (4, Formative Assessment)

Learning Experience Design — Participants develop gamified, flipped, or AR/VR learning experiences (5, Phase 2: Development)

Inclusive Design — Faculty Members implement inclusive pedagogical experience with mobile tech (6, Practical Task 2)

Final Evaluation — Evaluation of design, content, and inclusion with visual evidence (7, Assessment)

Completion — Programme concludes with participants ready to innovate (8, Programme End)

The in-person segment of the programme comprised three interactive sessions designed to enhance practical learning.

During the first session, participants engaged with the initial four modules, receiving theoretical instruction and completing interactive exercises to solidify their understanding. They were then assigned a case study to select two mobile applications for conducting an inclusive practice within their subjects, encouraging immediate application of concepts.

In the second session, faculty presented their initial case studies and received peer feedback via an online quiz. Subsequently, the final four modules—focused on advanced methodologies and tools for inclusive education— were explored. Participants collaborated to design a second case study, creating a session using one of the newly studied methodologies.

The third and final session involved the presentation of these second case studies, followed by interactive discussions with peers and trainers. This phase provided an opportunity for critical reflection and constructive critique of the designed practices.

Regarding the evaluation of the training programme's development, although participants generally expressed satisfaction, they also offered recommendations for improvement during its implementation. One key concern raised by faculty members was the need to focus more thoroughly on inclusion, particularly in the context of educational practices:

"In my case, I did not know very well how to adapt the issue of inclusion in the practices I had to do. I feel that I am learning more about applications and technologies, but less about inclusion, and I would like to see more emphasis on this issue, if possible" (PIP4).

To address this, practical sessions were introduced through face-to-face workshops. These sessions allowed participants to explore inclusive teaching practices and receive personalized guidance on applying these strategies in real classroom settings. Additionally, collaborative work among faculty members was encouraged, facilitating the exchange of experiences and best practices for implementing inclusive methods.

Another notable recommendation concerned the provision of examples and supporting materials. Several participants expressed the need for a broader range of practical examples to better illustrate the programme's concepts. In response, real case studies and diverse educational scenarios were incorporated to demonstrate how various technologies and pedagogical strategies could be applied effectively. Furthermore, interactive tutorials and video demonstrations were produced, offering detailed, step-by-step instructions for implementing these technologies in inclusive educational environments.

Effective time management during face-to-face sessions was also highlighted as a critical issue. Participants reported feeling rushed, which negatively impacted their learning experience. This feedback emphasized the importance of careful planning to ensure that future sessions cover content at a manageable pace, taking into account participants' time constraints and availability.

The process evaluation also focused on the platform used for the programme. Several faculty members voiced concerns about its organisation and usability, with difficulties in locating specific information, activities, or questionnaires frequently mentioned:

"Perhaps the interface should be better organised, as sometimes it is difficult to find a certain piece of information, activity or questionnaire" (PIP8).

Such comments underscored the necessity to improve the platform's structure and search functionality to boost user satisfaction and enable more efficient access to course resources.

Additionally, the option to download content was identified as a desirable feature. Participants expressed a strong preference for being able to download materials in PDF format, which would facilitate offline study. Responding to this, the functionality was implemented, significantly enhancing the platform's practicality and the overall learning experience for participants.

4.3. Evaluation of the Programme's Results

The programme evaluation demonstrated a positive impact on student learning, the adoption of inclusive practices, and the professional development of participating faculty members.

4.3.1.   Faculty   Members'   Perspectives
Faculty members emphasized that integrating emerging technologies into their teaching notably boosted student

motivation and engagement. They observed that these tools fostered more interactive teaching methods, which captured students' attention and encouraged active participation:

"I think that the use of technologies motivates the students; I saw that they were more attentive and eager to participate." (FIP9)

Additionally, faculty noted that technology enhanced students' autonomy and clarified complex content, allowing instruction to be tailored better to diverse learning needs. They particularly valued how these tools could be transferred to students' future professional environments, especially within primary education.

A central focus of the programme was promoting inclusive and accessible teaching practices. Faculty reported that their training equipped them to meet the needs of all learners, including those with disabilities. For example, one participant shared how a student with autism demonstrated increased engagement and improved outcomes through the use of digital tools:

"The use of technological tools has a double advantage in the specific case of students, as it not only improves their learning process, but also increases their interest in the subject thanks to the use of these more alternative methods in the disciplinary field of Arts and Humanities." (FIP2)

Faculty generally linked inclusion with expanded opportunities for participation, emphasizing the necessity of designing strategies with all learners in mind.

The programme also had a significant impact on faculty professional development. Participants appreciated not only gaining technical skills but also the inclusive pedagogical framework accompanying these tools. They stressed the importance of understanding not just how to use the tools, but why and for whom:

"I think it was important not only to know the tools themselves, that is, to know the existence of digital tools, but to know who you are using them for… So, knowing not only the digital tools, but also why we use them, I think is the most important thing I learned from the course." (FIP2)

Finally, the programme encouraged a shift in faculty attitudes towards technology. Many reported growing confidence and a willingness to experiment, which helped them overcome initial apprehensions:

"Well, that it is easy to do, and it also helps you as a faculty member to be more efficient; that's what I emphasise a lot." (FIP5)

4.3.2.   Students'   Perspectives

Students echoed many of the viewpoints expressed by faculty, sharing that emerging technologies made classes more dynamic and engaging. They appreciated moving beyond traditional lecture formats to more participatory learning experiences:

"I think it helps you learn. Because you get out of what we always do, which is to give a class, the teacher, a 'monologue'... It is more active, and we participate more." (FGP1)

Students also stressed that technology supported their learning by enhancing their autonomy and providing flexible access to course materials:

"For me, it has helped me to be more autonomous, and that has made me more involved. I like this type of methodology better; it makes me more active and gives me more freedom to organise how I learn." (FGP3)

Regarding inclusion, students reported that digital tools made learning more accessible. One participant shared:

"Technologies helped us access the subject materials more flexibly, which made the learning experience more inclusive." (FGP7)

This was especially significant for students with disabilities. For instance, a student with dyslexia and ADHD explained how gamification enabled them to focus, stay engaged, and interact with the material in a way that suited their needs:

"As I am dyslexic, it is much easier for me to learn through gamification and interaction... With attention deficit and hyperactivity, it is even more complicated... So, being able to make a game gives me the possibility of doing different activities... it was much easier." (FGP9)

Furthermore, students highlighted the user-friendliness and accessibility of the digital tools, reinforcing the perception that these technologies supported inclusivity for all learners, not solely those with specific needs.

5. Discussion

This study demonstrates that the programme successfully equipped faculty members with the essential digital skills needed to deliver quality and inclusive education to all students. By doing so, it addresses a notable gap in the academic literature regarding professional development (PD) focused on technology education from an inclusive standpoint. This work responds to the challenges identified by Fernández Batanero et al. (2022), Pelletier et al. (2023), and Reyes et al. (2022), who emphasize the importance of preparing faculty to effectively integrate technology into teaching while meeting the diverse needs of 21st-century learners. This accomplishment marks a significant stride toward establishing a more equitable education system that aligns with contemporary societal demands.

The primary contribution of this research invites a deeper exploration of the factors that enabled this success. Specifically, the processes of assessing training needs, designing the training programme, and evaluating both its development and impact provide valuable insights into how PD can be structured to promote inclusive education through technology. These findings can also guide other educational institutions in shaping training policies and strategies aimed at similar objectives.

A fundamental starting point is the identification of faculty members' training needs. Tailoring training to their actual expectations not only enhances faculty engagement but also ensures that programme goals remain realistic, relevant, and applicable within the educational context.

Our programme's design directly reflected the specific needs raised by participants, which included improving accessibility and mastering the effective integration of technology within inclusive education, along with its hands-on classroom application. While most content was well received, some faculty noted challenges related to emerging technologies such as augmented reality, highlighting the need for deeper training on these tools before implementation. Consequently, future programmes should consider offering more comprehensive instruction on such advanced technologies.

This approach allowed us to develop a training programme that addressed faculty concerns while being informed by existing research. Although no prior programmes combining technology and inclusion were identified, we drew inspiration from successful initiatives in inclusion, educational technology, and Universal Design for Learning (UDL) (Hockings et al., 2012; Kluge et al., 2023; Moriña & Carballo, 2017; Park et al., 2017).

Furthermore, it is advisable to heed recommendations from Burgstahler and Doe (2006), Gelbar et al. (2015), and Gunersel and Etienne (2014), who advocate offering varied training modalities to accommodate faculty schedules and preferences. As Hitch et al. (2016) note, brief interventions such as single-day workshops typically have limited influence on institutional culture and teaching practices. From the outset, it was clear that our programme needed to be extended and comprehensive, covering a broad range of content in a practical manner.

Faculty responded positively to the blended learning (b-learning) format, valuing its temporal flexibility and ability to balance professional, academic, and personal commitments. This flexibility was crucial for their active and sustained engagement throughout the training.

Participants also underscored the importance of selecting an online platform that supports not only flexibility and accessibility but also effective organization, user-friendliness, and the option to download material for offline use. These features emerged as key areas for improving the online learning experience, aligning with findings by Zhang et al. (2010). Our results provide important guidance for future enhancements of the Moodle platform, aiming to develop a more intuitive and functional digital environment that enriches user experience and learning outcomes.

Since many university training courses tend to focus heavily on theory with minimal impact on teaching practice, incorporating opportunities to apply learned content directly in the classroom is highly beneficial. Greater effectiveness is achieved when this practice is shared and evaluated amongst peers during the course itself. Thus, universities should integrate hands-on, practice-oriented activities and adopt reflection-action-reflection cycles in their PD programmes. This strategy formed the core of our training approach and is key to successfully developing faculty digital and inclusive competencies. Echoing Moriña and Carballo (2017), we affirm that more practice-focused training yields better results. Our programme exemplifies this by combining face-to-face sessions featuring practical case resolutions and simulations with online learning, providing a comprehensive and applied training experience.

The demonstrated acquisition of digital skills underscores the value of university-led PD initiatives in fostering inclusion (Park et al., 2017; Roberts et al., 2011). Teaching through technology within a UDL framework enables the creation of accessible, inclusive learning environments that actively engage all students (CAST, 2024; Koutsouris et al., 2022; UNESCO, 2021).

This approach supports prior research (Talan, 2020; Wang et al., 2009) showing that such teaching methods significantly enhance student participation, peer interaction, motivation, and attention. From a faculty development standpoint, it marks substantial progress by fostering confidence and readiness to confront contemporary educational challenges (Lee et al., 2022).

Our focus was chiefly on ensuring inclusive practices that promote learning, participation, and a sense of belonging among all students. The data clearly indicate that technology-infused practices developed by faculty substantially improve inclusion by creating accessible, equitable, and learner-centered environments (Hitch et al., 2016; Koutsouris et al., 2022). In this context, inclusion extended beyond technological accessibility to encompass pedagogical adaptations addressing student diversity. The programme design incorporated specific strategies to promote active participation through accessible platforms and technology tailored to varied needs.

In summary, recognizing the pivotal role of faculty development in advancing inclusive and equitable education leads to the following key recommendations for university PD programmes: (1) design flexible, adaptable programmes that suit faculty schedules, including online components and anytime access to learning resources; (2) integrate technology effectively, ensuring faculty develop digital competencies to create inclusive, enriching learning experiences; (3) encourage collaboration and sharing of best practices to mutually enhance training and tackle classroom challenges; (4) provide opportunities for practical application of training content to deepen understanding and capacity; and (5) consistently evaluate programmes using evidence-based methods to assess impact on teaching.

As evidenced by this study, fostering inclusive and equitable education in higher education institutions requires ongoing commitment to faculty professional development. The recommendations presented here offer a solid foundation for developing effective programmes that prepare educators to meet the evolving demands of post-COVID educational landscapes and contribute to building a society that truly serves all.

5.1 Limitations and Future Research

A key limitation of this study is the relatively low participation of faculty members, which impacts the representativeness across various academic disciplines. While a larger participant pool would have been ideal, current teaching demands—characterized by intense commitments to research and administrative duties—hindered broader involvement. Future studies should aim to include a larger and more diverse sample of faculty from different subject areas. Expanding participation in this way would provide a more comprehensive and representative understanding of educators' needs and experiences in developing digital and inclusive competencies.

Another limitation concerns the study's focus on a single university, which may limit the generalizability of the findings on a global scale. To obtain a more holistic and representative perspective on professional development practices related to digital inclusion and competencies in higher education, it is important to replicate this research across multiple institutions with diverse contexts and settings. Such efforts would facilitate a more accurate assessment of the effectiveness and applicability of the proposed strategies in varied academic and geographical environments.

Additionally, the evaluation of program outcomes relied exclusively on interviews and focus groups. While these qualitative methods offer valuable insights, future research could benefit from incorporating additional data collection techniques, such as surveys for both teachers and students, classroom observations, and the analysis of teaching artifacts and student work. This multi-method approach would provide a richer understanding of the program's impact on student learning and faculty professional growth.

Despite these limitations, the findings of this study provide important insights and lay the groundwork for more extensive research in this area.

6. Conclusions

This study, focused on faculty training in emerging technologies and inclusive education, has illuminated the complex interplay involved in fostering inclusive teaching practices in the digital era. The results demonstrate how a thoughtfully designed training program, delivered through a blended learning approach, can transform teaching practices and promote inclusion for all learners. Faculty members not only acquired technical skills but also developed an appreciation for adapting technologies to accommodate the diverse needs of their students. These findings highlight the critical need for ongoing, specialized training to ensure that inclusive education moves beyond aspiration to become a reality in 21st-century classrooms. It is hoped that these outcomes can be replicated at other universities to further enhance inclusion and equity in higher education.

Moreover, the insights gained from this research can inform policy decisions and educational intervention planning, offering evidence-based guidance to address the evolving challenges of contemporary education. Investing in these improvements within higher education represents a commitment to a more just and equitable future, reinforcing institutions' roles in fulfilling their educational and social responsibilities.

Declaration of AI Use

The authors confirm that this manuscript was prepared without the assistance of artificial intelligence tools.

CRediT Authorship Contribution Statement

Anabel Moriña: Writing – original draft, Writing – review & editing, Supervision, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization.
Víctor H. Perera: Writing – original draft, Writing – review & editing, Supervision, Investigation, Funding acquisition, Formal analysis, Conceptualization.

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Data Availability

Data supporting the findings of this study are available upon request.

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