

ABSTRACT

This study analyses the digital transformation of teaching in vocational training programmes, particularly in the tourism and services sectors. It examines current uses of ICT and the prospects for its future integration through digital platforms, collaborative tools, blended learning approaches, simulation

and artificial intelligence. The findings show that digital technology helps to diversify teaching practices, develop professional skills and bring learning closer to the realities of the world of work. However, its roll-out continues to face challenges relating to infrastructure, inequalities in access, the digital skills of those involved and pedagogical support. In the future, artificial intelligence, adaptive learning and immersive technologies could facilitate more personalised and

vocationally-oriented learning pathways. The study thus emphasises that the success of this transformation depends on the strategic integration of digital technology, linking technological innovation, educational objectives, professional skills and the needs of the labour market.

Keywords: Digital education, ICT, Vocational training, Foresight, Services, Tourism, Educational innovation, Artificial intelligence, Professional skills.

1. Introduction

1.1. Definition of concepts

Before addressing the specific issues relating to the future of digital education in vocational courses, it is necessary to clarify the main concepts used in order to establish a rigorous theoretical framework. A precise definition of key concepts not only helps to define the scope of the study, but also to structure the analysis by avoiding the terminological confusion that is common in the field of educational technologies and vocational training.

The central concept of ‘digital education’ refers to the whole range of digital tools, resources and environments that support, facilitate or transform the processes of learning and teaching. It forms part of a broader trend towards the digitalisation of the education sector, which encompasses both hardware (computers, tablets, internet networks) as well as educational software, online learning platforms and connected devices. Digital education is therefore not limited to the mere use of technological tools, but also involves a change in teaching practices, the dynamics of interaction between teachers and learners, as well as methods of assessment and certification. Thus, ‘digital pedagogy’ constitutes a fundamental variation on this concept, characterised by the thoughtful and critical integration of technologies to serve educational objectives.

Furthermore, the term ‘vocational courses’ refers to training programmes specifically designed to prepare students for enter the workforce directly in a specific professional sector, in this case the services and tourism sector. These programmes combine theoretical teaching, practical skills and work placements in order to ensure the best possible match between the skills acquired and the demands of the labour market. This is a particularly complex structure, as highlighted by the diversity of sectors that make up the tourism sector, ranging from hospitality and the hotel industry to event management and tourist guiding. This diversity necessitates a flexible and tailored pedagogical approach, capable of incorporating

digital innovations that can enhance graduates’ employability in a rapidly changing environment.

The third concept, which is often overlooked but crucial to this discussion, concerns ‘information and communication technologies’ (ICT). This concept encompasses a wide range of technical tools used for the creation, sharing, exchange and management of information via digital media. ICT plays a key role in the transformation of the education system, particularly in terms of educational continuity, lifelong learning, and adapting to major crises such as that caused by the Covid-19 pandemic, which has accelerated digital integration into vocational training processes. Furthermore, ICTs are not merely tools: they are revolutionising traditional learning methods by introducing new forms of interaction, multimodal resources and opportunities for personalised learning pathways.

Finally, it is necessary to introduce the concept of ‘prospective’, as it underpins the approach envisaged for analysing current uses and projecting scenarios for future developments. In the educational and technological context, foresight involves anticipating future transformations by taking into account emerging trends, technological innovations such as artificial intelligence, and socio-economic changes affecting the education sector. This forward-looking approach is based on rigorous analyses of current practices, but also on an examination of the disruptive potential of technologies as a means of improving the quality and accessibility of training programmes. In this regard, assessment of current ICT usage in vocational training programmes is becoming an essential step in formulating recommendations tailored to future needs, particularly in sectors linked to services and tourism, where digitalisation is rapidly expanding.

These definitions provide a conceptual framework that enables the study to be situated within a coherent body of research and to critically examine the integration of digital technology into an education sector characterised by its professional diversity and specific challenges. Understanding these concepts in all their complexity is essential for gaining a nuanced understanding of the transformations currently underway and those to come in the Moroccan educational landscape and beyond that, in relation to global developments in digital technologies and their pedagogical implications.

1.2. Context of the study

The context of this study is set against a backdrop of competing and complementary dynamics that are currently shaping vocational training pathways, particularly in the services and tourism sectors. In Morocco, as in many developing countries, the education system is at a crossroads where the need to integrate digital technologies is no longer simply a choice but a strategic imperative for to meet the challenges of modernisation, employability and international competitiveness. These realities are compounded by the sector-specific complexity characteristic of tourism, a multifaceted sector comprising some fifteen distinct professional branches, each requiring specialised and specific skills that must be taken into account in the design of training programmes. This diverse sectoral context therefore calls for a flexible pedagogical approach, capable of harnessing the varied contributions of ICT whilst respecting the unique characteristics of the professions concerned.

Moreover, the recent situation, marked by the global Covid-19 health crisis, has profoundly disrupted traditional forms of training, highlighting both the vulnerabilities of a system with limited digitalisation and the opportunities offered by accelerated digitalisation. This crisis has precipitated the widespread adoption of digital tools to ensure educational continuity and vocational training, including in the tourism and services sectors, where roles are traditionally based on physical presence and direct interactions. This enforced transformation has revealed not only shortcomings in terms of digital equipment and skills within educational institutions, but also the pressing need for a more structured and sustainable development of digital systems. In this sense, it acts as a real-world laboratory for rethinking teaching methods, training formats and their alignment with new market demands.

Beyond the short-term reactions triggered by the pandemic, rapid technological change, notably with the advent of artificial intelligence and online learning platforms, creates a framework conducive to forward-looking thinking. The integration of ICT cannot be limited to a mere short-term adaptation; it involves embarking on a strategy of systemic pedagogical innovation aimed at profoundly transforming learning methods, knowledge management and the integration of theoretical training with professional practice. The Moroccan experience, documented in recent analyses of pedagogical innovation, illustrates a clear commitment to harnessing digital potential whilst addressing the specific needs on the ground, which are often characterised by regional disparities and accessibility challenges. This contextual diversity calls for the design of flexible and inclusive

technological solutions that promote teaching which is both high-quality and tailored to local socio-economic realities.

Furthermore, the use of ICT is also a crucial lever for strengthening the resilience of the education system in the face of adversity, as demonstrated by the lessons learnt from countries such as Burkina Faso, where the very survival of education depends on the widespread adoption of information and communication technologies. This model highlights just how much the sustainability and effectiveness of vocational training programmes depend on robust digital systems, embedded within coherent public policies and supported by targeted training for teachers and trainers. The issue of improving the digital skills of those involved in the education system is therefore central to ensuring a successful technological transition and avoiding any risk of exclusion or increased inequality.

In this context, this study takes into account the specific characteristics of the Moroccan context in terms of educational infrastructure, the regulatory framework and strategies for the development of the tourism sector, with a particular focus on current uses of ICT in vocational training establishments. Identifying effective practices, the obstacles encountered and the levers that can be mobilised is an essential preliminary step in order to devise relevant scenarios for the future integration of digital technology in education. Such projections are based on a critical analysis aimed at anticipating possible structural transformations, whilst taking into account the wide range of stakeholders involved – pupils, teachers, institutions, partner organisations and the economic challenges linked to the modernisation and competitiveness of the tourism sector.

1.3. Methodological approach

The methodological approach adopted in this study centres on an explicit aim to capture the complex and multifaceted reality of current uses of information and communication technologies (ICT) within vocational courses focused on services and tourism, whilst considering their future potential from a forward-looking perspective. This dual objective requires a rigorous methodological framework, combining qualitative and quantitative approaches, in order to understand both the concrete dynamics on the ground and the prospects for technological and pedagogical development.

The first stage of the methodology is based on an in-depth literature review, designed to identify and summarise existing knowledge relating to the integration of ICTs into the Moroccan education sector, with a particular focus on the tourism and services sectors.

Table 1: Analysis of ICT integration in the Moroccan education sector

Areas of analysis	Existing knowledge	Applications in tourism and services	Main limitations	Research prospects
Public policies on digital education	Morocco has gradually integrated digital technology into its strategies for modernising the education and training system.	Development of digital training programmes and improved alignment between training and professional needs.	Discrepancy between national guidelines and their implementation in certain institutions.	Assessing the actual impact of digital policies on vocational training programmes.
Digital infrastructure and equipment	Development of IT equipment, connectivity and digital platforms.	Use of digital tools in hospitality, tourism and service sector establishments.	Inequalities in access to equipment and the internet depending on the establishment and region.	Examining the material conditions necessary for the sustainable integration of digital technology.
Learning platforms	LMS platforms and digital environments facilitate the delivery of content and distance or blended learning.	Training in hotel management, reception, bookings, tourism marketing and customer relations.	Use is sometimes limited to document storage and communication.	Develop interactive, skills-based teaching scenarios.
Teachers' digital skills	Teachers' digital skills are a key factor in the success of educational transformation.	Creation of digital resources and simulation of professional scenarios.	Need for ongoing training and pedagogical support.	Designing programmes to develop trainers' digital skills.
Students' digital skills	Students make extensive use of digital tools, but their skills may be uneven and do not always meet professional requirements.	Use of digital tools for information retrieval, communication, marketing and customer management.	The digital divide and differences in proficiency with professional tools.	Identify the digital skills that are priorities for employability in tourism and services.
Digital pedagogy	ICTs promote collaborative, self-directed, interactive and blended learning.	Case studies, digital role-plays, hospitality simulations and managing	Risk of using technology without bringing about genuine pedagogical	Examine the pedagogical models best suited to vocational training.

		tourism scenarios.	transformation.	
Simulation and immersion	Immersive technologies enable the reproduction of complex professional situations.	Virtual reality for hospitality, the hotel industry, catering and exploring destinations.	Cost of equipment and lack of technical expertise.	Assess the effectiveness of virtual and augmented reality in the acquisition of professional skills.
Artificial intelligence	AI opens up new possibilities in terms of personalisation, support and assessment of learning.	Tourism chatbots, personalisation of the customer experience, data analysis and learner support.	Ethical issues, data protection, reliability of content and necessary skills.	Exploring the educational and professional applications of AI in tourism training programmes.
Blended and distance learning	The growth of distance learning has accelerated, particularly since the pandemic.	Continuing professional development for practitioners and flexible learning for students.	Challenges relating to learner engagement, assessment and support.	Developing hybrid models tailored to the constraints of vocational training.
Aligning training with employment	Digital transformation is changing the skills sought after in the labour market.	Development of skills in digital marketing, online booking, CRM, e-tourism and digital communication.	Potential mismatch between curricula and the rapid evolution of professions.	Establish a forward-looking monitoring system for digital skills in tourism and services.
Training-business partnerships	Collaboration with businesses helps tailor training programmes to the needs of the market.	Work placements, digital projects, real-world case studies and training in professional software.	Partnerships still vary depending on the institution and sector.	Develop digital ecosystems bringing together institutions, businesses and tourism stakeholders.
Future trends in digital education	The trend is towards more personalised, immersive and data-driven training programmes.	AI, virtual reality, adaptive learning, smart platforms and professional simulation.	Uncertainty regarding costs, acceptance and the necessary skills.	Developing forward-looking scenarios for the integration of digital technology into the tourism and services

				sectors in Morocco.
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The methodological approach of this research combines a robust empirical approach, based on data triangulation, with a forward-looking analysis incorporating technological and pedagogical innovations. It thus addresses the complexity of vocational pathways in tourism and services, in a context marked by a health crisis that has laid bare both the weaknesses and the potential of the education system, whilst forming part of a broader trend towards innovation and greater resilience. This methodological framework provides a rigorous basis for understanding current uses of ICT and for considering their future integration in a thoughtful, adaptable and strategically oriented.

1.4. Composition of the research team

The research team was put together in close alignment with the complexity and multidimensional nature of the subject under study, namely the prospects for digital education within vocational pathways related to services and tourism. It therefore became essential to bring together multidisciplinary expertise offering complementary insights in terms of both methodology and subject matter. This collective approach aims to ensure a detailed and nuanced understanding of the realities on the ground, institutional frameworks, but also of the technological and pedagogical challenges inherent in the digitisation of training programmes within a changing Moroccan context.

The core of the team consists of researchers in educational sciences, specialising in pedagogical innovations and the use of digital technology in school and professional settings. In addition, specialists in the social sciences, particularly in the sociology of work and organisations, complement this framework in order to assess the impacts of digital transformations on professional practices within the tourism sector, whose complex structure requires a detailed analysis of the interactions between stakeholders and institutions.

The technological aspect is handled by experts in information and communication technologies, trained in digitisation processes, online learning platforms and artificial intelligence applied to training. Their role also extends to technology monitoring, which is essential for informing the second, forward-looking phase of the study, which projects possible developments in educational systems and career pathways in the medium and long term. Thus, the diversity of expertise within the team enables a cross-examination of analytical perspectives and enriches critical reflection, particularly with regard to the technical and organisational factors that may

either enhance or hinder the adoption of ICT in vocational training.

The involvement of practitioners, such as trainers at vocational training establishments, educational managers, as well as institutional representatives from the relevant ministries, constitutes another crucial aspect of the composition of the extended team. This inclusion ensures that local constraints and needs are taken into account in a pragmatic manner, as well as providing validation of the hypotheses formulated regarding the practices observed. These collaborators play a pivotal role in organising surveys and interviews, facilitating access to a rich and representative sample, which contributes to the study's robust, empirically grounded nature.

The composition of the research team reflects the need for a wide range of expertise, capable of facilitating effective dialogue between the educational, technological and professional sectors. This interdisciplinary approach is reflected in a collaborative structure, where each member contributes a specific yet complementary perspective, which is essential for analysing current patterns of ICT use and envisaging their future integration in a realistic and relevant manner within the targeted sectors. This approach organisation is therefore in line with the recommendations arising from previous work on the complexity of vocational training in the tourism sector in Morocco and in the Africa, where the networking of skills is a decisive factor in the success of the digital transition in education.



Image 1: Pupils in a lecture theatre

2. Overview of ICT use in schools

2.1. Presence or absence of ICT

An analysis of the presence or absence of information and communication technologies (ICT) in vocational training establishments focused on the services and tourism sectors is a fundamental step towards understanding the extent of effective digital integration. This assessment must take into account several dimensions, ranging from physical infrastructure to the availability of digital teaching resources, including the organisational conditions that either facilitate or hinder the regular and appropriate use of these technologies.

First of all, the current state of technological infrastructure reveals a mixed picture depending on institutional and geographical contexts. In some schools, equipment such as computers, tablets, interactive projectors and high-speed internet access is sufficient, or even state-of-the-art, enabling a variety of educational uses that facilitate the acquisition of digital skills by learners. Here, the physical presence of ICT is linked to a clear commitment to integrating these tools into educational practices, facilitated by institutional investment or international partnerships, such as the projects supported by UNESCO for the digitisation of African education systems. This hardware forms the essential foundation for the constructive digitalisation of training programmes, as they determine the very possibility of practising the digital skills recommended by current curricula.

Conversely, many vocational training programmes, particularly within the Moroccan context, still suffer from a partial or total lack of such equipment. This lack of equipment is often the result of a budgetary imbalance or insufficient prioritisation of technological resources in education policies. The lack of equipment is frequently accompanied by a shortage of suitable teaching resources, which severely restricts opportunities for digital learning. This situation is corroborated by the work of Nejari and Bakkali, who emphasise that the actual use of ICT depends not only on the physical availability of the equipment, but also on teachers' perceptions of their role in integrating digital technology. Without adequate equipment, it is unrealistic to expect regular use, which contributes to widening the digital divide within vocational courses, thereby hampering the future competitiveness of young graduates in meeting the demands of the tourism and services markets.

The presence of ICT in vocational schools remains a necessary but not sufficient condition. It must be assessed from a systemic perspective that takes into account equipment, teaching resources, institutional frameworks, as well as the

actual practices of teachers and learners. This observation highlights the need for public policies and coordinated local initiatives aimed at reducing digital access disparities, strengthening the digital skills of all stakeholders, and to establish ICT as a key driver of pedagogical transformation within Morocco's vocational education and training sectors, in line with the international trends observed in other African countries.

2.2. Actual uses (administration, teaching, assessment)

An analysis of the actual use of ICT in vocational training institutions, particularly those focused on services and tourism, requires an examination of practices across three key areas: administration, teaching and assessment. These dimensions concretely reflect the way in which technologies are utilised on a day-to-day basis, beyond their mere physical availability, to address the specific professional challenges of the relevant sectors.

In the administrative sphere, ICTs are playing an increasingly important role in the management of educational establishments. The computerisation of administrative processes – from managing enrolments and organising timetables to monitoring students' progress – represents a significant step forward in enhancing efficiency and transparency. However, in many Moroccan schools, this transition remains incomplete, primarily due to a lack of digital skills amongst administrative staff and the fact that the tools provided are ill-suited to local circumstances. This shortcoming can result in a twofold loss: on the one hand, it hampers the smooth running of day-to-day operations and, on the other hand, it prevents the collection of reliable data that could inform analyses aimed at the continuous improvement of training programmes. The gradual integration of digital tools tailored to school administration thus appears to be a key driver for modernising schools and freeing up time to focus on improving teaching.

In educational terms, the use of ICT often forms part of a more complex dynamic. Access to a variety of digital resources – learning platforms, multimedia resources, professional simulators or collaborative tools offers undeniable potential to enrich teaching practices and better prepare learners for the digital demands of the tourism sector and services. For example, the use of hotel management software or simulations of professional scenarios via immersive digital environments adds a concrete and practical dimension to training, facilitating the acquisition of technical and behavioural skills.

However, the reality observed in many institutions reveals that its use is often limited to one-off applications and is not well

integrated, due to a lack of initial and on training for teachers in the use of digital tools and the persistence of a predominantly transmissive approach. Furthermore, teachers' perceptions of the role of digital technology strongly influence the extent and quality of its use: when digital technology is perceived as merely an ancillary tool, it is rarely utilised to foster an active, collaborative and personalised approach amongst learners. This situation highlights the need for targeted pedagogical support and the promotion of innovative practices tailored to the professional context.

As for assessment, the integration of ICT is still in its infancy but holds great promise. The digitisation of assessment methods makes it possible, for example, to diversify the types of assessment through interactive questionnaires, digital projects or digital portfolios. Such an approach promotes a more formative assessment, offering personalised feedback and encouraging critical self-assessment – essential skills in the tourism sector, where flexibility and responsiveness are key. However, its operational implementation remains limited or dependent on isolated initiatives, hampered by technical constraints and a lack of familiarity amongst teaching staff. Furthermore, the assessment of digital skills itself is often not systematically integrated, even though it is a key factor in demonstrating the adaptability of future professionals to the specific tools of their profession. Thus, the development of tools and protocols for assessment that are compatible with digital environments remains an area requiring further consolidation in order to fully capitalise on the potential offered by ICT.

2.3. Digital skills of teachers and learners

Analysing the digital skills of teachers and learners is an essential step towards understanding the limitations and potential of the integration of technology into vocational training programmes, particularly those focused on the service and tourism sectors. Indeed, simply making digital equipment or resources available does not guarantee their effective use; it is, above all, the expertise and understanding of those involved in education that determine the role played by ICT in the teaching process. This issue is consistent with the previous observations regarding the fragmentation and disparity in usage, which often stem from shortcomings in the digital skills of teaching staff and pupils.

As far as teachers are concerned, digital skills often vary widely, reflecting varied career paths and initial training that is sometimes not particularly focused on these aspects. Their skills are not limited to simply using tools: they also encompass the ability to integrate ICT effectively into their teaching, to design appropriate learning situations and to

support pupils in a critical and autonomous approach. However, in the Moroccan context, as Nejari and Bakkali point out, teachers often hold a narrow view of digital technology, perceiving it merely as a tool, which limits the transformative potential of ICT in teaching practice. This narrow perception is often exacerbated by a lack of initial and continuing professional development, but also by a lack of institutional recognition of innovative pedagogical uses. Consequently, the use of ICT tends to remain incidental, sporadic, or even marginal, which hinders the development of a truly integrated and reflective digital culture.

Teachers involved in vocational courses must, however, face a twofold challenge: mastering digital tools specific to the tourism and services sectors, whilst developing teaching methods capable of utilising these tools to meet the practical demands of the labour market. For example, simply knowing how to use hotel management software is not enough if it is not accompanied by an understanding of collaborative management, decision-making or the resolution of real-world problems, all underpinned by critical and secure digital practices. This aspect is all the more crucial given that, as Giré reveals, the digital skills employed in an educational context require safe and critical use, particularly in information management and digital production – skills which are still insufficiently developed among educational staff.

As for learners, their natural familiarity with digital technologies does not necessarily lead to effective mastery within a formal educational context. Indeed, although a large majority of young people claim to be competent at searching for information online or producing digital content, as a recent survey highlights, these skills are often linked to social or recreational uses and do not necessarily correspond to the digital skills prescribed by schools, which require legitimate, methodical and explicitly structured skills. This distinction is particularly pronounced in vocational courses, where the challenge lies in combining general digital knowledge with specialised digital skills, in line with the requirements of the targeted professions. For example, the ability to research and select reliable information on a tourism market or to produce high-quality professional documents requires not only a command of the tools but also a critical and reflective mindset, which is rarely spontaneous among young people without adequate guidance.

As a result, learners' digital skills must be developed in a progressive, structured and coherent manner throughout their schooling. This approach is in line with the current recommendations of the French Ministry of Education, which integrates digital technology into subject-specific curricula and emphasises the continuous assessment of these skills at

various levels. Pupils' education must go beyond the mere consumption of information to encourage production, collaboration and critical evaluation – fundamental skills in a service sector where adaptability, creativity and autonomy are highly valued. However, in many Moroccan schools, the juxtaposition of ICT equipment with a lack of support for pupils in acquiring these skills severely limits the benefits they derive from it.

The interplay between the digital skills of teachers and learners thus appears to be an indispensable lever for the effectiveness of digital initiatives in vocational education programmes. Continuing professional development for teachers must therefore be a priority, not only to strengthen their technical skills but also to raise their awareness of the pedagogical implications of digital technology, by encouraging a shift from transmissive teaching practices towards more interactive and reflective approaches. At the same time, training programmes must explicitly incorporate the development of digital skills tailored to professional contexts, thereby creating continuity between the development of digital skills and their application in real-life situations.



Image 2: Pupils at break time

3. Educational outlook for 2035–2040

3.1. Current trends

Current trends in digital education as applied to vocational courses reflect a complex dynamic, characterised by rapid technological advancement coupled with profound changes in teaching methods. The exponential development of information and communication technologies (ICT) is no longer limited to the incorporation of digital tools into learning environments; it is manifesting itself as a systemic transformation of teaching and learning methods, in which data, artificial intelligence, as well as virtual and hybrid environments, play a central role. This development forms part of a broader context characterised by globalisation, the

digitalisation of economies and the emergence of a labour market that demands advanced and integrated digital skills.

A key area to consider is the rise of digital education, which is seen as a catalyst for the structural transformation of higher and vocational education. Indeed, as highlighted in the Vision 2050 for Algerian higher education, which is intended to inspire the African perspective, digital technology is not merely a medium, but embodies a strategy of educational sovereignty and organisational innovation. This ambitious vision anticipates the widespread adoption of digital learning environments between 2035 and 2050, involving not only the mastery of tools, but above all the design of hybrid, adaptive teaching methods based on rich and multifaceted interactivity. From this perspective, the use of digital technology is becoming a key factor in meeting contemporary demands for quality, accessibility and relevance in training programmes, particularly in the service and tourism sectors, where job roles are constantly evolving.

Moreover, the digital revolution in the education sector is characterised by a growing appetite for the use of big data (big data) and the analysis of learning outcomes through intelligent systems. This trend, widely highlighted by Fortin, emphasises that the data generated by digital interactions in a learning context enables inform educational policies and guide personalised strategies. In vocational programmes, this aspect is crucial for identifying emerging skills, continuously assess learning outcomes and adapt learning pathways to the specific needs of learners and their future career integration. However, this approach also raises ethical and pedagogical questions relating to the management of personal data and the need to preserve a humanistic and critical approach to education. The question of striking a balance between technological innovation and respect for fundamental educational values is therefore central.

Furthermore, national strategies for the development of digital education, such as those implemented in various African countries and documented in particular in Senegal, demonstrate a clear political commitment to structuring and institutionalising this technological transition. These strategies are based on three widely recognised pillars: the improvement of digital infrastructure, targeted training for education stakeholders, and the promotion of educational content tailored to local needs and sector-specific characteristics, of which tourism forms an integral part. The transformation of vocational training, encouraged by these public policies, thus aims to build a more cohesive society, a strengthened rule of law, and an inclusive digital economy. The challenge lies in moving beyond mere computerisation

objectives to establish integrated, reflective and geared towards the development of productive and innovative skills.

Another striking aspect of current trends is evident in the changing nature of learning methods, with the rise of blended learning environments combining face-to-face and distance learning. The recent experience of the COVID-19 pandemic has accelerated the expansion of digital educational platforms and heightened awareness of the need for advanced digital skills, among both teachers and learners. This situation has also made it possible to gauge disparities in equipment and access, as well as the importance of appropriate support to prevent a widening digital divide. This observation is particularly relevant in vocational courses, where learning through practice and real-life scenarios are essential. The trend is therefore towards increased use of virtual simulations, serious games, or collaborative online workshops that replicate professional contexts, facilitating the transfer of theoretical knowledge into practical skills.

From this perspective, understanding current trends in digital education not only enables us to identify the immediate challenges relating to skills and practices, but also provides a glimpse into the future transformations expected for the period 2035–2040. It emphasises the importance of a coherent strategic approach, combining technological modernisation, continuing professional development and pedagogical innovation, in order to effectively prepare vocational education programmes to operate within a constantly changing digital world.

3.2. Gradual digital transition

The gradual integration of digital technology into vocational education forms part of a planned and carefully considered process, in which the gradual adaptation of teaching systems is an essential step in ensuring the sustainability and effectiveness of the transformation. This gradual evolution addresses a number of imperatives, both technical and pedagogical, and must be understood as a cumulative process rather than an abrupt break, thereby avoiding the risk of marginalising ill-prepared stakeholders or causing cognitive overload for learners. The experience accumulated to date highlights the need for a gradual adoption of digital tools, accompanied by the simultaneous development of teachers' and learners' skills, in order to ensure that technological innovations are genuinely and sustainably adopted.

At the heart of this gradual transition lies the realisation that digital technology does not operate in isolation; it is a tool that must be integrated coherently into teaching strategies, curricula and assessment methods. This integration is not

limited to the sporadic use of digital resources, but aims to build hybrid learning ecosystems capable of combining the richness of human interaction with the efficiency of digital tools. The rise of adaptive and personalised learning environments reflects a shift towards training programmes better tailored to the specific needs of different learner profiles and to professional requirements, particularly in sectors such as tourism and services, where the diversification and personalisation of skills are particularly pronounced. This gradual approach allows time to experiment, evaluate and refine the systems, an approach that proves crucial in avoiding the pitfalls of technologies imposed without in-depth reflection or an appropriate pedagogical context.

Furthermore, the progressive architecture of digital education involves the consolidation of both tangible and intangible digital infrastructures. The quality and reliability of internet connections, the availability of high-performance equipment, as well as the secure and ethical management of educational data, form the indispensable foundation of the transition. The gradual digital transition must be planned in close conjunction with the challenges of critical and civic education, which are essential to ensuring the responsible and ethical use of digital tools. The aim is to go beyond mere technical proficiency in order to develop an informed perspective on the social, economic and ethical implications associated with the use of digital technology in education. This critical approach, which is gradually being integrated into curricula and practices, is fundamental in sectors as sensitive as tourism and services, where human interactions remain central and where technologies must act as facilitators rather than substitutes. Training in digital skills must therefore incorporate a reflective dimension, in order to prepare professionals capable of developing autonomously and as responsible citizens within a constantly changing digital environment, as advocated by the medium- and long-term strategic visions.

Thus, the gradual digital transition, far from being a mere accumulation of tools, represents a systemic and gradual transformation of vocational education systems. It brings together technical, pedagogical and ethical advances, engaging all stakeholders in an inclusive and evolving process. This approach will ensure the resilience and adaptability of training programmes to future market demands and will contribute to the development of a sovereign and innovative digital identity, which is key to competitiveness in the services and tourism sectors by 2035–2040.

3.3. Technological and pedagogical disruption

The idea of a techno-pedagogical shift within vocational education programmes, although sometimes perceived as a diabolical development, is in fact an inevitable and necessary step towards a fully integrated digital education system by 2035–2040. Whilst the previous phase emphasised caution and a gradual approach to the introduction of digital practices, envisaging a techno-pedagogical paradigm shift involves recognising that certain changes, in the long run, will no longer be satisfied with a mere gradual extension of existing tools or methods, but will necessitate a profound rethinking of educational paradigms. This transformation, far from being arbitrary, stems from the intrinsic potential offered by digital technology, which redefines not only teaching methods, but also the very nature of knowledge, skills and interactions between educational stakeholders.

From this perspective, the techno-pedagogical breakthrough can be interpreted as a qualitative leap in which technological and pedagogical innovation becomes the main driving force behind a systemic transformation. This dynamic is fully in line with the forward-looking vision of education systems which, beyond the technical mastery of ICT, are implementing new forms of learning centred on personalisation, collaboration and the empowerment of learners. For example, the emergence of immersive environments through virtual or augmented reality is radically transforming the development of professional skills in tourism and services: it is no longer simply a matter of acquiring abstract knowledge, but of immersing oneself in near-real contexts, encouraging guided experimentation and immediate feedback. This innovative teaching method, still in its infancy today, is set to become the norm in the coming decades, enabling not only a narrowing of the gap between training and the professional workplace, but also an enrichment of the diversity of learning profiles.

The techno-pedagogical shift also involves rethinking the role of teachers, no longer as transmitters of knowledge, but as facilitators of an evolving digital ecosystem. This new role requires hybrid skills, combining an in-depth mastery of emerging technologies with updated pedagogical knowledge. The transition cannot be limited to superficial technical training; it requires the development of a critical and reflective digital culture, where educators guide the use of learning data to shape students' learning pathways and foster collaborative collective intelligence. Data plays a central role in this context, as it enables precise analysis of progress, difficulties and specific needs, paving the way for the dynamic adaptation of teaching strategies. This development responds to calls for a 'society based on solidarity and the rule of law' founded on the ethical and sovereign use of digital technology, as

highlighted by the strategy adopted in vocational and technical education in several African countries.

Moreover, whilst this disruption is intrinsically linked to a major technological shift, it must be accompanied by a fundamental overhaul of ethical and institutional frameworks. The widespread integration of digital tools requires a rethinking of the architecture of education systems, both in terms of their physical infrastructure and their organisational regulations, in order to ensure data confidentiality, security and sovereignty. Furthermore, the techno-pedagogical disruption calls into question the very purpose of vocational training: it compels us to move beyond the mere transmission of practical skills to embed, on a large scale, a critical, inclusive and responsible digital culture. This necessity has been highlighted in contemporary discussions on digital education, which regard a grasp of social and ethical issues as inseparable from technical development, particularly in sensitive sectors where people remain at the heart of the professions.

Thus, far from being a mere radical break with no basis, this techno-pedagogical transformation forms part of a coherent trajectory, in which technological innovation, pedagogical reform and digital ethics converge to lay the foundations for a sovereign, robust and resolutely forward-looking vocational education system.

Conclusion

The future of digital education in vocational tourism and services programmes is not limited to the introduction of new technologies. It involves a profound transformation of pedagogical models, the skills of those involved and institutional structures. By 2035–2040, hybrid learning, artificial intelligence, immersive environments and lifelong learning could facilitate more flexible, personalised and vocationally oriented pathways. However, this transformation must be accompanied by a particular focus on equitable access, ethics, data protection and digital sovereignty. Thus, the success of this transition will depend above all on the ability of institutions and trainers to combine technological innovation, educational quality and inclusion, in order to prepare learners sustainably for the changes in careers within the tourism and services sectors.

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