Authoring tools for e-learning: critical analysis and pedagogical perspectives. The case of H5P in interactive digital teaching

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Abstract. This paper critically analyses authoring tools for e-learning, with a focus on the H5P platform, highlighting its transformative potential in digital teaching. H5P is an open-source technology capable of promoting interactive, inclusive and cognitively stimulating learning environments. The article emphasises that such tools should not be seen merely as technical solutions, but as pedagogical levers for a profound methodological restructuring of teaching. Through the integration of dynamic multimedia content and immediate feedback, H5P promotes motivation, self-regulation and meaningful learning. However, the effectiveness of digital innovation depends on the quality of instructional design and teacher training. Only conscious and thoughtful use of these environments can lead to real educational transformation, capable of going beyond the simple digital transposition of traditional teaching.

Keywords: H5P, E-Learning, Pedagogical Innovation.

1 Introduction

In recent years, the education sector has undergone a profound structural transformation, leading to increasing interaction with digital, online and hybrid learning environments [1]. This process, further accelerated by the COVID-19 pandemic [2], has forced school systems and academic institutions to adapt quickly to distance learning and blended learning, combining the flexibility and accessibility offered by virtual spaces with the importance of face-to-face interaction. This momentous transformation has led to a paradigm shift in education, prompting those working in the education sector to reconsider teaching practices in light of the potential offered by digital technology. In this context, the design of educational content has necessarily had to reformulate delivery processes, considering that, in today's scenario, teaching cannot ignore

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hybridisation with multimedia materials [3,4]. The integration of resources such as images, sounds, videos and animations is no longer a simple complement to traditional teaching, but rather an important pedagogical tool for motivating students and supporting highly complex cognitive processes, with the aim of promoting meaningful learning development [5,6,7,8]. The richness and interactive nature of these materials act as educational mediators capable of stimulating reflection, active participation and the constructivist construction of knowledge, essential elements for the educational success of new generations, who are increasingly called upon to interact with electronic devices in everyday and professional contexts.

Within this framework, e-learning authoring tools take on a strategic position, acting as digital devices that enable educators to design, create and distribute interactive content in virtual environments. These tools, among which H5P (HTML5 Package) stand out for its versatility and integration, allow the creation of dynamic and customisable materials, such as interactive videos, quizzes, enriched presentations, timelines, simulations and drag-and-drop activities, which can be easily integrated into the main Learning Management Systems (LMS) platforms. The uniqueness of these tools lies in their ability to overcome traditional transmissive logic, promoting constructivist and socio-cognitive teaching approaches that value active participation, reflection and self-regulation of learning [9]. Furthermore, as authoring environments do not require advanced programming skills, they enable the dissemination and customisation of educational content even among teachers who are less experienced in technology.

From a systemic perspective, the adoption of authoring tools represents a strategic lever for the design of inclusive, differentiated learning environments that can respond effectively to the challenges posed by distance and blended learning. In this sense, scientific literature shows that these technologies have a significant impact on student motivation, engagement and satisfaction, positively influencing overall learning outcomes [10]. In particular, H5P stands out for its ability to build non-linear learning paths, in which students actively interact with varied and dynamic content, developing a reflective and personalised learning process that not only activates higher cognitive processes but also increases students' autonomy and responsibility in their own learning path [11,12].

The digitisation of teaching, therefore, is not just a technological issue, but a profound pedagogical transformation that broadens accessibility, promotes personalised learning and responds more effectively to the multiple cognitive, emotional and social needs of students in the third millennium. In this perspective, the role of authoring tools becomes central, enabling the creation of multimedia and interactive teaching materials that overcome the static nature of traditional teaching, enriching educational communication and stimulating active, self-regulated and inclusive learning processes [13]. Parallel to the evolution and growing popularity of *Open and Distance Learning* (ODL), there has been an increasing need to develop *Self-Instructional Materials* (*SIMs) SIMs)* that are not only highly interactive and attractive, but also based on rigorous pedagogical structures capable of responding in a differentiated and targeted manner to the multiple cognitive, affective and motivational profiles of an increasingly diverse learning population [14]. ODL is a strategic training method for meeting the flexibility needs of university students, but it has also been extended to secondary school learners, shifting

the educational model from a transmissive and linear logic to a dialogic training process focused on operational autonomy, metacognitive awareness and the co-responsibility of the learner. In this perspective, interactive tools for teaching mediation are technological and pedagogical resources capable of effectively responding to some of the recurring critical issues in learning pathways, helping to make the educational experience more engaging on a sensory level, denser from a cognitive point of view and more relevant in terms of personal development [13].

In this perspective, the H5P platform allows the construction of highly interactive multimedia content, including enriched videos, dynamic questionnaires, simulations and animated presentations, which promote active learning processes, supported by immediate feedback mechanisms and continuous opportunities for meaningful interaction with other users of the platform [9,10,15]. Recent empirical evidence confirms that the integration of H5P in ODL contexts can positively impact on the overall quality of the learning experience, helping to improve learning outcomes and student satisfaction and counteract forms of disengagement and dispersion through teaching strategies focused on cognitive activation and continuous interaction between content and users [11,12].

In light of the reflections developed so far, the introduction of digital authoring tools cannot be interpreted simply as an accessory technological integration to traditional teaching devices, but rather as an effective epistemological restructuring of educational practices, capable of profoundly affecting the quality of teaching and learning processes. These tools are vectors of methodological innovation, promoting the design of learning environments that are more responsive to the cognitive, metacognitive and socio-relational needs of students, with a particular focus on promoting regulatory autonomy, inclusiveness and active participation.

In this direction, this paper aims to analytically explore the educational potential offered by authoring tools, with a specific focus on the H5P platform, in order to highlight the transformative impact that these technologies can have on blended and distance learning. The advanced features of H5P and their pedagogical implications in terms of cognitive activation, educational accessibility and personalisation of learning paths will be critically examined.

The aim is to highlight how the conscious use of highly interactive digital environments can not only support but also reshape traditional teaching, promoting a transition towards multimodal, dialogic training models centred on the reflective action of the learner. The proposed reflection, therefore, is part of a pedagogy of innovation based on criteria of educational sustainability, design flexibility and the enhancement of digital resources as complex teaching mediators.

2 Authoring tools

In the context of digital education, *authoring* tools for eLearning are advanced technological environments that enable the design and development of structured educational content using a wide range of multimedia resources, such as text, images, audio, video and interactive presentations, without the need for specialist IT expertise [16].These environments, which have profoundly changed the paradigm of educational production since the dawn of online training, now meet the dual need to simplify creation processes

and ensure the pedagogical quality and accessibility of training materials. The uniqueness of these tools lies in their intuitive interface, based on visual design logic, which allows even those without advanced technical skills to structure personalised training courses. This approach promotes a significant democratisation of educational design, as it allows for the direct and active involvement of teachers and education professionals in the process of designing and developing training materials [17]. By eliminating the need for specific technical skills and reducing dependence on external figures such as programmers or designers, these tools allow teachers to translate their pedagogical strategies into digital content with greater autonomy and timeliness, promoting a closer connection between real teaching needs and the technological solutions adopted, helping to make the training project more tailored to the specific needs of students and more consistent with the educational objectives pursued. In this way, accessibility to *authoring* tools is a key element in enhancing the professional skills of educators and promoting collaborative and participatory practices in the construction of learning experience [17].

The effectiveness of authoring tools is also evident in their ability to ensure high content usability, thanks to responsive interfaces that allow access from a variety of devices such as smartphones, tablets and computers, promoting continuity of the learning experience even when on the move. In this context, the integration of interactive features, such as simulations, multiple-choice exercises, branching paths and *gamification* elements [18], makes it possible to overcome the traditional linearity of transmissive teaching, promoting cognitive activation and personalisation of learning.

Particularly important is the focus on accessibility, which translates into the presence of technological devices capable of meeting the needs of a diverse student population: keyboard navigation aids, automatic subtitling, compliance with international guidelines for digital accessibility (WCAG), as well as automatic transcription of audiovisual content, which, in addition to ensuring inclusion, also facilitate translation and semantic search in training materials.

Another important aspect, according to [19], concerns the collaborative potential of these platforms, which facilitate co-design and content sharing between different actors involved in the training chain, facilitating the re , updating and integration of materials. The presence of centralised libraries for teaching resources, templates, lesson models and exercise databases is a further element supporting the standardisation and effectiveness of *instructional design* processes.

Authoring tools for creating eLearning content are mainly distinguished by how they are used and integrated into digital learning environments, thus forming different functional and operational categories. The first category includes desktop-based tools, such as Articulate and Adobe Captivate, which require local installation on dedicated devices. This software is known for offering a wide range of advanced features, allowing developers to design highly customised and complex content, integrating multimedia elements, simulations and sophisticated interactions. However, this type has limitations in terms of accessibility and collaboration, as its use is restricted to the machine on which the software is installed and requires specific technical skills to manage and update content.

In contrast, cloud-based tools, such as Genially, H5P and Canva, operate entirely on web platforms, offering greater flexibility and ease of access regardless of the device used. These tools facilitate collaborative work, allowing multiple users to work

simultaneously on the same educational project and enabling immediate and centralised updates [20]. Furthermore, cloud-based nature significantly reduces the costs and time associated with software installation and maintenance, promoting an agile and inclusive development model. This approach effectively responds to contemporary needs for flexibility and scalability in educational production, especially in complex institutional and organisational contexts.

A further category of tools is represented by those integrated directly into Learning Management Systems (LMS), such as Moodle Book or Google CourseKit. These tools allow content to be created and managed within the same platform used for training delivery and tracking, promoting an integrated workflow that reduces discontinuities between production and distribution. This integration facilitates centralised course management, learning data collection and the customisation of training programmes, representing an effective solution especially for institutions that adopt LMS as their main training infrastructure.

To ensure that content produced with these different tools can be shared, reused and monitored effectively on heterogeneous platforms, the adoption of interoperability standards is essential. Among these, SCORM (Sharable Content Object Reference Model) is one of the most established standards for the packaging and distribution of reusable training modules, allowing the tracking of learning activities in a standardised way. More recently, the Experience API (xAPI) has expanded data collection capabilities, allowing learning experiences to be recorded in unstructured contexts or outside traditional LMSs, enabling a more detailed analysis of the training process. Finally, the Learning Tools Interoperability (LTI) standard facilitates the integration of external tools within LMSs, enabling smooth and secure communication and inter tion between different platforms, which is crucial for increasingly complex and interconnected training environments. Together, these standards form an essential pillar for ensuring the technical compatibility, accurate traceability and scalability of eLearning content, contributing substantially to the quality and effectiveness of digital training.

The pedagogical evaluation of eLearning authoring tools is a multidimensional process aimed at determining their ability to support effective educational practices consistent with contemporary learning principles. Firstly, the usability of the tool is a determining factor, as an intuitive, accessible and functionally efficient interface facilitates instructional design by teachers, minimising technical barriers and promoting more fluid content management and updating [21]. This cognitive and operational accessibility is essential to ensure that educators can focus on pedagogical aspects without being hindered by technological difficulties. At the same time, the inclusion of interactive elements plays a key role, as educational literature emphasises that active participation and the social construction of knowledge are fundamental to deep, lasting and meaningful learning processes [22,23,24]. Authoring tools that integrate interactive activities, such as dynamic quizzes, simulations and branching scenarios, not only facilitate students' cognitive engagement, but also promote reflection and critical thinking, which are essential for meaningful learning [25].

Another essential criterion concerns the adaptability of tools and their compliance with international accessibility standards, such as the Web Content Accessibility Guidelines (WCAG) developed by the World Wide Web Consortium (W3C). These standards are fundamental to ensuring that educational materials are accessible to users with different sensory, motor or cognitive abilities, helping to reduce educational

inequalities and promote an inclusive paradigm that respects the right to education for all [26,27]. Finally, the ability of authoring tools to support the personalisation of the training path and continuous learning monitoring is a crucial aspect in a learner-centred teaching approach. The ability to adapt content and teaching strategies to individual needs, as well as to collect detailed performance data, enables targeted educational interventions and promotes metacognitive and motivational self-regulation processes [28,29]. This level of personalisation and traceability fits perfectly into the contemporary paradigm of dynamic; inclusive education geared towards the development of transversal skills. However, the widespread adoption of digital tools in education is not without limitations and critical issues that affect their pedagogical effectiveness and real innovativeness. Among the most common problems is the lack of adequate and systematic training for teachers on the potential and methods of integrating educational technologies. Numerous studies highlight how insufficient preparation and a lack of specific skills in the pedagogical use of digital tools and h s represent a significant obstacle to the implementation of truly transformative teaching practices [30,31] This training deficit often results in their use being limited to purely operational or technical functions, without any real reflection on the methodological reorganisation of teaching. Furthermore, there is a widespread tendency to adopt solutions that are predominantly 'content-based', i.e. focused on the simple digitisation of traditional teaching materials, rather than on innovative pedagogical design. This reductionist approach reduces digital tools to mere vehicles for the transmission of knowledge, neglecting the interactive, collaborative and adaptive potential offered by emerging technologies [32]. The side effect is digital teaching that mechanically replicates existing transmission models, without promoting active, critical and meaningful learning processes.

The most insidious risk, therefore, lies in the digital replication of traditional teaching practices, which continue to favour a unidirectional and passive mode of knowledge transfer. Such reproduction risks compromising the effectiveness of technological innovation, creating a dichotomy between the revolutionary potential of tools and their actual application in educational contexts [33, 34]. The failure to transform teaching and learning epistemologically and methodologically through digital technology results in an uninspiring and uninclusive educational experience that does not take full advantage of the opportunities offered by technological mediation.

Overcoming these critical issues requires a structural and ongoing investment in teacher training, aimed not only at acquiring technical skills, but above all at building an integrated and critical pedagogical vision. Only through a conscious and reflective approach will it be possible to avoid the simple digital transposition of traditional teaching, promoting instead innovative, participatory and learner-centred educational processes.

3 The H5P case: potential, experiences and pedagogical reflection

In the contemporary context of digital technologies applied to education, H5P stands out as one of the most relevant and versatile open-source solutions for the design, creation and dissemination of interactive educational content. This development environment, whose acronym stands for “HTML5 Package”, was launched in 2013 thanks to

an initiative promoted and funded by the Norwegian Centre for ICT in Education. It is a technological artefact inspired by an inclusive and democratic logic, aimed at promoting the equal dissemination of digital educational resources [35].

The design philosophy underlying the platform is based on the adoption of open and interoperable paradigms that encourage systematic sharing, content reusability and the possibility of adaptation and reworking by users. In stark contrast to the proprietary and closed models of commercial platforms, H5P stands out for its open-source nature, which not only allows free use of the tools provided, but also access to and modification of the source code. This promotes the construction of a participatory pedagogical ecosystem, in which teachers, learners and developers collaborate in the co-creation of digital learning experiences.

From a structural point of view, the platform is based on an extremely flexible modular architecture that currently supports over forty types of educational content. These include, for example, interactive quizzes, enriched audiovisual content, timelines, memory games, branching paths, completion exercises and drag-and-drop activities. These resources are characterised by a high level of interactivity and extensive customisation options, making them ideal tools for supporting active, student-centred teaching practices.

Another strength of H5P is its native compatibility with major Learning Management Systems (LMS), such as Moodle, WordPress and Drupal. These platforms, being open source, are also widely used in education and professional settings for managing and publishing digital content, enabling the creation of virtual learning environments, academic blogs, institutional websites and complex content management systems. The seamless integration between H5P and these LMSs ensures not only the scalability of training content delivery, but also centralised and consistent governance of digital learning environments. This structural and functional interoperability is a competitive advantage for educational institutions, as it allows the implementation of dynamic and integrated educational pathways within established digital contexts, responding to a systemic and complex vision of technology-mediated teaching [36].

Motivation to learn can be seen as the main driving force that lets students see themselves as active and intentional agents in the educational process. It not only encourages genuine commitment but also leads to a process of cognitive and emotional restructuring through which students rework their self-perception and redefine their role in the educational relationship [37]. In this perspective, promoting a qualitative increase in school motivation is equivalent to designing educational environments characterised by a high level of cognitive and emotional stimulation, selecting content capable of arousing interest and meaning, and adopting digital tools that allow immediate and bidirectional interaction, providing timely, continuous and personalised feedback.

In this regard, the contributions of Susetyarini et al. [38] are particularly relevant, as they offer a comprehensive interpretative model aimed at assessing students' school motivation through a series of indicators observable in the classroom context. The authors' proposal is based on a threefold perspective, which considers, on the one hand, the level of active involvement of students and their ability to persevere with continuity and determination in carrying out the tasks assigned; on the other hand, the quality of the attitudes adopted and the emotions expressed during the educational experience,

understood as signs of affective-cognitive disposition towards learning. Finally, the study also examines behaviours that occur in less structured moments of school life, such as breaks, transitions or non-directly educational phases, which, although not formally part of the teaching-learning process, are emblematic of the student's latent motivation and general attitude towards the educational environment.

To supplement and expand on the theoretical framework outlined above, [39] proposes a more detailed interpretative perspective, in which learner motivation is conceived as the dynamic result of a variety of interrelated factors, each with specific pedagogical and theoretical relevance. Among the elements identified, the first to emerge is the level of personal aspiration, understood as the student's ability to attribute meaning and purpose to their educational path, orienting their choices and efforts within a meaningful educational vision. A second element concerns confidence in one's abilities, i.e. the degree of perceived self-efficacy that directly influences commitment, perseverance and willingness to tackle complex cognitive challenges. Added to this are the psycho-physical conditions of the individual, which include emotional, physical and mental dimensions and act as facilitating or inhibiting factors with regard to active participation in learning processes. No less important is the influence of the living environment, including cultural, social and family variables, which, although external to the school setting, profoundly shape the motivational dispositions and educational expectations of the student. Finally, the teaching strategies implemented by the teacher play a crucial role: these include, in particular, clarity of presentation, the ability to create a positive and inclusive relational climate, and the adoption of creative methodologies capable of involving students in an authentic and meaningful way in the educational process.

It is in this theoretical context that the strategic usefulness of H5P can be found, as a digital platform capable of significantly increasing students' motivation levels while supporting teachers who, for various reasons, may be less inclined to experiment with teaching or creative design. Digital environments, due to their intrinsic media structure and the immediacy of communication that characterises them, are inherently more stimulating than transmissive teaching practices, which are rigidly frontal and based on the mere mnemonic reproduction of content [40].The use of a platform such as H5P stimulates students to take responsibility for their own learning, activating cognitive and metacognitive processes that shift the focus of educational interaction from a passive, teacher-centred paradigm to an active, participatory and *learner-centred* model. This model is not limited to the simple execution of tasks, but stimulates and supports the learner's awareness in decision-making, encouraging the development of willpower, critical thinking and autonomy, in line with their inclinations and potential.

Educational technologies such as H5P have a profound impact on the motivational and emotional aspects of learning: they simultaneously activate thought, emotions, interest and attention, promoting effective, interactive and multisensory pedagogical communication between teachers and students. As teaching mediation tools, these platforms are highly effective in transmitting content, as they combine standardisation with a high degree of customisation, helping to reduce interpretative ambiguity and increase the transparency of the educational message [41,42]. According to Kristanto [43], these environments promote clearer learning that is more consistent with the learner's

cognitive style and facilitate effective educational interaction that respects the individual rhythms, modes and characteristics of the student.

It is worth emphasising the strategic role that teaching materials play in digital technology-mediated teaching, especially in online contexts. Thanks to the continuous evolution of information and communication technologies, these materials have undergone a profound transformation, evolving from predominantly transmissive tools to multimedia devices capable of generating immersive, dynamic and highly interactive learning experiences. Currently, teaching resources can be designed to synergistically integrate different communicative elements, including text, static images, audiovisual content and animations, in order to stimulate active participation by the learner, promoting continuous and meaningful interaction between the user and the system.

In support of this perspective, Chen et al. [3] highlighted the educational effectiveness of using interactive digital content developed through the H5P (HTML5 Package) environment, which is particularly advantageous in terms of greater visibility and accessibility of materials, as well as more careful consideration of students' cognitive, motivational and educational needs. In particular, H5P content is a suitable tool for promoting active and constructive learning, thanks to its ability to stimulate cognitive interaction and reflective processing: it requires learners to interact directly with the content, tackle complex problems and implement strategies for applying the knowledge acquired, thus promoting meaningful and situated learning.

One of the most important aspects of this tool is its immediate feedback function, which is a powerful self-reflection device, as it allows students to monitor their learning process in real time, correct any mistakes and reorient their cognitive strategies. This type of feedback, which is part of a self-assessment process, promotes the development of autonomy in the learning process and reinforces the sense of self-efficacy.

Being structurally based on the HTML5 standard, the H5P platform also guarantees high cross-device accessibility, making it usable on a wide variety of digital devices – from computers to tablets and smartphones – without compromising its usability or educational effectiveness. Its native integration with various virtual learning environments further amplifies its versatility, making it compatible with a variety of educational contexts and adaptable to a wide range of disciplinary and methodological objectives [44].

From a pedagogical point of view, the features offered by H5P align with student-centred learning models, supporting approaches such as *microlearning* and situated learning. Support for *microlearning* takes the form of ' ', the possibility of building modular, short-term teaching micro-units that promote continuous, just-in-time and highly personalised learning [45]. This approach is particularly effective in flexible educational contexts, such as continuing education and professional learning, but also in secondary schools, where short content episodes allow for greater attention and cognitive engagement. The promotion of interactivity is a further strength: H5P allows for the structuring of non-linear learning paths, encouraging active exploration and self-regulation of the learning process. The immediate feedback tools integrated into the content, as already mentioned, facilitate a continuous cycle of action-evaluation-reflection, in line with constructivist learning theories and the formative assessment model [46]. Furthermore, the ability to create easily reusable, clonable and adaptable learning

objects makes H5P a highly efficient tool in terms of learning design sustainability: an activity designed for a university module can be easily reconfigured for a secondary school lesson, maintaining its structure and interactivity while updating the content. In terms of inclusivity, H5P complies with WCAG 2.1 accessibility standards and offers a responsive interface that can be used on mobile and desktop devices, thus contributing to reducing the digital divide and promoting equal access to education. The combination of interactivity, adaptability and accessibility makes H5P a tool capable of effectively responding to the diverse educational needs of today's world [47]. In school settings, studies conducted in Germany and Spain have shown that the use of H5P content in secondary schools is positively correlated with increased intrinsic motivation among students and greater participation in asynchronous activities, especially in integrated digital learning contexts [48]. The most recent systematic reviews [49], confirm that the use of interactive tools such as H5P has a positive impact on self-efficacy perceptions, sense of belonging to the learning community and course completion rates, contributing significantly to the construction of motivating and cognitively challenging learning environments. However, it should be emphasised that the effectiveness of H5P is not intrinsic to the tool but depends largely on the quality of the pedagogical design: technology can in fact become a facilitator or an obstacle, depending on its consistency with the educational objectives, the clarity of the instructions and its suitability for the students' profile. In this sense, pedagogical reflection on the use of H5P requires a rethinking of the roles of teachers, who must take responsibility for mediating the teaching- moving from simple content providers to designers of cognitive and metacognitive environments.

4 Conclusion and future prospectives

This study aimed to provide a critical and in-depth examination of authoring tools for e-learning, with a particular focus on the paradigmatic case represented by H5P. This tool is a highly versatile, interoperable, modular and accessible open-source platform that has demonstrated significant potential in terms of promoting interactivity, personalisation and cognitive activation in digital learning contexts [47]. H5P is therefore a virtuous example of educational technology capable of combining technical requirements and pedagogical needs, offering an environment conducive to the development of meaningful, constructivist and situated learning experiences. However, it is necessary to avoid any uncritical mythologisation of the tool. H5P, although highly functional and supported by a large international community of developers and educators, cannot be seen as a solution to the structural problems of digital teaching. Its effectiveness is not intrinsic to the technological device itself but is only realised to the extent that it is integrated into intentional, critical and conscious pedagogical design [33]. Converging empirical and theoretical evidence emphasises that the positive educational outcomes of using H5P are systematically mediated by the quality of the educational design, methodological consistency and the appropriateness of the educational setting in which these tools are used [50]. In outlining a critical perspective, it is essential to emphasise that educational technology is never neutral, but deeply conditioned

by the underlying epistemologies and practices that substantiate it. The introduction of digital tools such as H5P, if not accompanied by adequate methodological transformation, risks remaining a purely aesthetic operation, generating digitisation that is devoid of pedagogical effectiveness in traditional teaching [34]. In other words, the digital replication of transmission models is one of the most insidious and regressive outcomes of technological innovation disconnected from genuine pedagogical reflection. From this perspective, the role of the teacher must be completely reconfigured: no longer a simple provider of content, but a cognitive architect, director of educational interaction and mediator of knowledge. This professional reconfiguration requires the solid acquisition of *instructional design* skills, i.e. the ability to design authentic, dialogic, multisensory and meaningful learning environments. Without specific training in this area, authoring tools risk being used in a mechanical or standardised way, losing their transformative potential.

Numerous international studies highlight a systemic deficiency in the initial and in-service training of teachers with regard to the effective integration of educational technologies [51,52]. The gap between technological availability and pedagogical competence (the so-called 'second-level digital divide') is a real obstacle to the construction of truly innovative and student-centred learning environments [53].

The experience with H5P highlights how the complexity of technological mediation requires a systemic vision that integrates devices, content and practices within a coherent pedagogical framework. In the absence of such a framework, there is a risk of confusing technical interactivity with cognitive interactivity, multimedia with the plurality of educational languages, and personalisation with the individualistic fragmentation of learning paths.

In light of these findings, a number of strategic lines of development are needed to consolidate the integration of authoring tools such as H5P in educational contexts, promoting their sustainable, informed and pedagogically sound use.

It is a priority to provide teachers and educational institutions with theoretical and operational frameworks to guide the educational use of authoring tools. These guidelines should be structured on three levels: the first concerns the pedagogical principles of reference (constructivism, situated learning, dialogicity); the second concerns the design criteria for the creation of effective multimedia objects (interactivity, accessibility, modularity); the third, on the other hand, concerns implementation and evaluation protocols.

Training courses aimed at developing integrated *instructional design* skills that go beyond mere technical ability should be promoted. In this sense, training should be situated, i.e. carried out in realistic and authentic contexts; collaborative, with peer co-design experiences; reflective, favouring processes of educational metacognition. Teaching workshops based on authoring environments such as H5P, if properly guided, can be fertile ground for methodological experimentation, the enhancement of creativity and the activation of continuous professional learning pathways [20]. In a context increasingly focused on the quality and effectiveness of teaching, it is essential to move beyond assessment based on purely quantitative indicators (frequency of use, connection time, number of clicks) and adopt multi-level assessment models capable of capturing the real impact of digital learning objects on learning. The integration of tracking

tools such as xAPI allows the collection of granular data on student interactions, which, if correctly interpreted, can offer valuable insights into engagement, self-regulation, critical thinking and meaning construction [54].

Furthermore, the introduction of participatory assessment methodologies is recommended, directly involving students in reflection on learning processes and promoting forms of formative and metacognitive assessment.

The case of H5P provides a privileged observatory on the potential and limitations of the digitisation of teaching: on the one hand, it demonstrates the enormous opportunities offered by digital tools in the construction of interactive, adaptive and inclusive learning environments; on the other hand, it highlights the fragility of an education system that often struggles to integrate these tools into a mature and coherent pedagogical vision.

The challenge facing us today is not to use technologies without making any changes to the teaching-learning process, but rather to rethink education itself through and with technologies. This implies an epistemological, methodological and professional repositioning, which must start with teacher training and lead to the co-construction of a shared, critical and inclusive digital pedagogical culture.

Only through structural and multidimensional investment will it be possible to achieve a real transition towards an educational model capable of enhancing the potential of technology without sacrificing the centrality of relationships, reflection and educational planning.

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