

Design Standards for Interactive E-Books: A Systematic Literature Review from 2020 to Early 2026 and a Proposed Theoretical Framework

معايير تصميم الكتاب الإلكتروني التفاعلي مراجعة منهجية للادبيات

بالفترة (من 2020 إلى بداية- 2026) وإطار نظري مقترح

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Received: 18 / 04 / 2026

Accepted: 27/ 06 / 2026

Abstract:

This study aimed to identify the design standards for interactive e-books through a systematic review of the educational literature published during the period of beginning of 2020 to 2026. The study adopted the descriptive-analytical method using the systematic review approach in accordance with the PRISMA protocol. A total of 23 studies—comprising both Arabic and foreign publications—were examined and analysed, drawn from the following databases: Google Scholar and the Algerian Scientific Journal Platform (ASJP). The review findings revealed a consensus in the literature on educational standards and certain technical standards relating to user interface and multimedia. Nevertheless, the analyses disclosed a research gap concerning standards related to adaptive design, artificial intelligence (AI), and the capacity to support collaborative learning within the e-book. The study concluded(Based on a literature review)by developing a proposed conceptual framework(preliminary and exploratory) for standards that transcends traditional “static” standards to encompass indicators related to accessibility, immersive technologies, and intelligent content personalisation. The study recommends conducting research into the most significant technical standards that contribute most substantially to enhancing the interactivity of e-books.

Keywords: Interactive e-book; design standards; systematic review; educational technology; adaptive design.

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ملخص: هدفت الدراسة لتحديد معايير تصميم الكتاب الإلكتروني التفاعلي من خلال إجراء مراجعة منهجية للأدبيات التربوية المنشورة خلال الفترة الزمنية (2020-2026 بداية). اعتمدت الدراسة على المنهج الوصفي التحليلي باستخدام أسلوب المراجعة المنهجية (Systematic Review) وفق بروتوكول (PRISMA)، حيث تم فحص وتحليل 23 دراسة) ما بين دراسات عربية وأجنبية مستخلصة من قواعد البيانات Scholar Google : الباحث العلمي و (Algeraien Scientific Journal Platform (ASJP المنصة الجزائرية للمجلات العلمية

كشفت نتائج المراجعة عن وجود اتفاق في الأدبيات على المعايير التربوية وبعض المعايير الفنية أو التقنية المتعلقة بواجهة المستخدم، والوسائط المتعددة، ومع ذلك، أظهرت التحليلات وجود فجوة بحثية في المعايير المتعلقة بالتصميم التكيفي (Adaptive Design) والذكاء الاصطناعي، والقدرة على دعم التعلم التشاركي داخل الكتاب.

وخلصت الدراسة (بعد المراجعة المنهجية للدراسات) إلى وضع مقترح لتصور نظري (أوليا استكشافيا) يتجاوز المعايير "السكنة" التقليدية ليشتمل مؤشرات تتعلق بسهولة الوصول، والتقنيات الانغماسية، والتخصيص الذكي للمحتوى. وتوصي الدراسة بإجراء بحوث عن أهم المعايير التقنية التي تساهم بدرجة أكبر في زيادة تفاعلية الكتاب الإلكتروني.

الكلمات المفتاحية: الكتاب الإلكتروني التفاعلي؛ معايير التصميم؛ مراجعة منهجية؛ تكنولوجيا التعليم؛ التصميم التكيفي.

Introduction

The call for developing tools to acquire, store, interconnect, and disseminate information dates back to 1945, when the American scholar Vannevar Bush laid the conceptual groundwork for information and communication technology in education in developed countries. This was followed by the introduction of computers in the early 1960s for administrative and financial purposes at American universities. Usage subsequently expanded dramatically in schools from 1997 onwards, driven by the proliferation of personal computers and the emergence of the Internet, along with the digital media associated with it—a development that produced a major leap in digital media-based education (Al-Mihna et al., 2022, p. 186).

With technological advancement, the spread of computers, and the entry of technology into the educational field, a new type of book emerged: the electronic book. Its roots trace back to the 1980s, after which it gradually spread until it became an alternative to the printed book that had long been in use.

The term “e-book” refers to any text or book in digital format that can be read using devices such as computers, smartphones, tablets, or dedicated digital reading devices (Farhat & Suryal, 2023, p. 11).

The educational e-book is defined as an instructional course analogous to the conventional textbook, yet differing in form and surpassing it in content, in that it may include written texts, images, and video clips that render the content more engaging and clearer for learners (Al-Mihna et al., 2022, p. 189). It is also described as a text displayable on a computer screen, unconstrained by physical limitations such as paper, binding, and volume, and integrated storage structures that can store large quantities of diverse data (Al-Siddiq, 2022, p. 162).

Its significance lies in the ease of reading it using electronic media—such as computers, tablets, and mobile phones—as well as the ease of linking it to scientific references and the ability to update its content without the need for reprinting.

E-books take many formats, including ASCII, Plain Text, HTML, XML, Microsoft Word, and Adobe PDF. From the perspective of interactivity, e-books are classified into two categories: interactive and non-interactive. Non-interactive e-books are those presented in html-pdf-word formats, which can be browsed directly or through specialised software, offering readers features such as font size adjustment, comment insertion, and text highlighting (Hussein, 2025, p. 364).

The interactive e-book, by contrast, comprises multiple digitally enhanced pages incorporating a range of media (text, audio, images, graphics, video clips), through which the learner can interact and engage with annotations and browse information while connected to the Internet.

The use of e-books has become an urgent necessity rather than a choice, given the new generation’s tendency to use technological media in all aspects of life. This is borne out by the findings of several studies, including ElAdl and Musawi (2020), which found a significant positive correlation between student use of e-books and their motivation to learn. Ali and Yusri (2021) concluded that this type of book enhances the enjoyment of learning, while Listanto et al. (2025) reached important findings by providing strong statistical evidence (via meta-analysis) confirming the superiority of interactive digital media over traditional media. This has compelled those responsible for educational systems at various levels—general and higher education—to strive for the adoption of

this type of book, and indeed to pursue excellence in its design and construction, as well as the development of its models, in order to keep pace with the changes brought about by accelerating technological advancement. It is this imperative that has prompted this study to shed light on the design of this type of book.

2. Research Problem

The design of an e-book is a complex process that goes well beyond merely converting print into a digital format. Accordingly, design standards and indicators—defined as the set of procedures that must be followed by instructional designers, producers of educational e-books, and curriculum developers—are adopted with the aim of designing and producing an electronic course that facilitates better learning (Abd al-Mun‘im, Azmi, & al-‘Uthmānī, 2022, p. 164).

The rapid expansion in the use of multimedia—including written text, graphics, static and animated images, audio, and music—has led to a heightened emphasis on their integration in the design of interactive e-books, as they enrich learners’ experiences and enhance their motivation to engage with educational materials. Indeed, such standards serve as instruments to ensure the effectiveness of this type of book in achieving its assigned objectives. Some theoretical literature has highlighted the importance of design-related standards, with certain studies classifying these standards into pedagogical and technical or technological categories—such as Hussein (2025) and Farhat and Suryal (2023)—while other studies emphasise the importance of multimedia, spatial design (Ran & Jinglu, 2020), and technical design in the comprehensive and integrated design of e-books. Bhat and Alyahya (2023) demonstrated the superiority of interactive digital media over static (non-interactive) electronic versions in language learning. Accordingly, the continuous development in the production of digital media must be accompanied by commensurate progress in design and production; a failure to keep pace with accelerating technological advancement may result in weaknesses in instructional design, which would in turn undermine the effectiveness of the interactive e-book in fulfilling its roles.

Given the divergence—or lack of consensus—among the literature regarding which design standards are most important, coupled with the scarcity of reference studies at the local level (to the best of the researcher’s knowledge) that have addressed the topic of design standards for interactive e-books, the present study comes as a continuation embodying cumulative knowledge, building upon studies such as Al-Salami and Al-Farānī (2022), which sought to

identify design standards for interactive e-books through searches of the following databases: Dār al-Manzūma, ERIC, and EBSCO, covering the period 2018–2022. It also extends the work of Tlili et al. (2024), which sought to identify the barriers to e-book use through a systematic review of a set of experimental studies (123 studies).

This study is thus distinguished not only at the level of thematic focus but also in its approach and its concentration on different databases—specifically Google Scholar and the Algerian Scientific Journal Platform (ASJP)—within a time frame (2020–2026) that has its own justifications. This will contribute to a more comprehensive understanding of the core research preoccupations, which have been formulated in the following research questions.

3. Research Questions

- What design standards for interactive e-books did the prior literature focus on during the period 2020–2026?
- What design standard gaps were overlooked by the studies selected for the systematic review?
- What is the proposed theoretical framework for designing e-books that aligns with the requirements of modern digital learning?

4. Research Objectives

- To identify the design standards for interactive e-books emphasised in the prior literature during the period 2020–2026.
- To reveal the design standard gaps overlooked by the studies selected for the systematic review.
- To develop a proposed theoretical framework for e-book design standards consistent with the requirements of modern digital learning"

The significance of this research lies in the anticipated outcomes of its objectives: namely, the derivation of a list of design standards emphasised in the literature during the selected period (2020–2026) that reflects an integrative approach to design; the identification of design standards that have been overlooked; and the construction of a framework from which designers, authors, and those responsible for the production and design of interactive e-books can benefit.

6. Methodology and Procedures

6.1 Research Scope: Review Framework

The PRISMA protocol was followed in selecting studies from the following data sources and search databases:

- Google Scholar: for studies in Arabic and English.
- Algerian Scientific Journal Platform (ASJP).

6.2 Inclusion and Exclusion Criteria

The study was restricted to peer-reviewed open-access scientific research:

- In which the electronic or digital book is one of the study variables (Phase 1).
- In which the sample consists of students at various educational levels, including higher education.
- In which e-book design standards—with a focus on the interactive e-book (Phase 2)—are among the research questions or primary research concerns.

In implementing the PRISMA protocol, the search was restricted to the aforementioned data sources, focusing on studies published in Arabic and English during the period 2020 to early 2026. This time frame was selected because it encompasses the post-COVID-19 pandemic period, during which a significant transformation in the use of digital technologies and electronic media occurred—both locally and globally—across all educational levels, including higher education (as evidenced by the growth in the use of digital platforms and media), as well as the formal adoption of the electronic textbook by Algeria’s Ministry of National Education at the beginning of the 2022–2023 academic year.

6.3 Research Methodology

The systematic review method was adopted for the following reasons: it enables the researcher to identify points of agreement and disagreement in the research evidence with respect to the study variables—the e-book and design standards—and the aggregation of findings (systematic, objective review) from a set of studies produces stronger and more reliable conclusions than any single study.

6.4 Research Procedures

The structured systematic review procedures were followed as described below.

A search was conducted for studies (prior literature) addressing the e-book, the interactive e-book, and design standards for the interactive e-book (in Arabic), along with their English-language equivalents, within the selected platforms for the period 2020 to early 2026. Following a thorough search, studies were compiled in accordance with the aforementioned parameters and then filtered according to the pre-defined exclusion criteria, following the search flowchart.

6.5 Search Process Flow

Identification Phase

Following the search across the designated platforms, a total of studies addressing the e-book were identified, distributed as follows:

Table 1.- illustrates the distribution of research papers by platform in the identification phase

	Scholar Google (الباحث العلمي)	Algerian Scientific Journal Platform (ASJP)
English language	120	0
Arabic language	60	4
Total	180	4

Source: Prepared by the researcher

Initial Screening Phase

Studies and research were excluded in accordance with the exclusion criteria, following a careful reading of titles and abstracts. This led to the exclusion of a number of studies for the following reasons:

Table 2.- Illustrates the total distribution of studies across selected platforms during the screening phase

Reasons for Exclusion	Scholar Google (الباحث العلمي)		Algerian Scientific Journal Platform (ASJP)	
	English	Arabic	English	Arabic
- Sample restricted to students at various educational levels and higher education students. - Design standards must be among the research questions or concerns. - Peer-reviewed scientific studies only.	31	13	0	0
	44		0	

Source: Prepared by the researcher

Eligibility Phase

A thorough reading of the full texts of the studies was carried out, which resulted in the exclusion of duplicate studies, yielding the following included studies (remaining research):

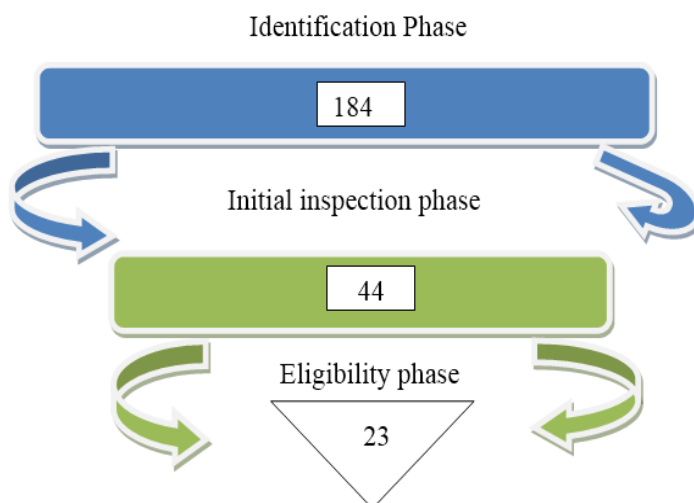
Table 3.- illustrates the total distribution of research papers across selected platforms during the eligibility stage.

Scholar Google		Algerian Scientific Journal Platform (ASJP)	
English language	Arabic language	English language	Arabic language
15	8	0	0
23			

Source: Prepared by the researcher

A search flowchart (Search Flowchart) illustrating the process is included in the study.

Figure N° 1: Flow diagram of the search process (Prepared by the researcher)



Source: Prepared by the researcher

7. Key Terms

Interactive E-Book (IEB): Digital educational content encompassing a formal structure (texts, images, graphics, activities, videos, etc.) organised in digital pages with which the learner interacts on a continuous basis through a direct connection to the Internet.

Design Standards for Interactive E-Books: The set of foundational principles and conditions that must be followed by instructional designers and producers of interactive e-books, with the aim of producing an interactive electronic course that facilitates improved learning.

8. Review Findings

8.1 Response to Research Question 1

What design standards for interactive e-books did the prior literature emphasise during the period 2020–2026?

There is a consensus among the studies on general standards across different age groups. The studies focused on constructing a list of design standards comprising numerous criteria, which were classified broadly into pedagogical standards and technical or technological standards. Hussein (2025) indicated that two main categories must be present: the pedagogical or

instructional standard—from which numerous sub-standards derive, including learning objectives, educational content, learning activities, instructional strategies, and guidance and direction—and the technical standard. This is consistent with the findings of Farhat and Suryal (2023) and Hassan et al. (2025).

Other studies focused on books designed for specific subjects, including Cahyani and Purwandari (2025), which examined the design of an interactive e-book for mathematics in alignment with problem-based learning to stimulate creative thinking, and called for the integration of creative thinking skills within the interactive e-book for mathematics. All studies agreed that the modern interactive e-book is no longer a mere vessel for information but rather a complex technical system through which interactive technologies are integrated—as noted by Al-Salami and Al-Farānī (2025) and Hassan, Muhammad, and ‘Abduh (2025) with regard to technical standards—consistent with the classification of Farhat and Suryal (2023).

Some studies adopted this standard as an advanced approach to e-book design by relying on various technologies as design references, including augmented reality, as in Putranti (2024), which emphasises strengthening interaction between the student and the content. That study focused specifically on the design and development processes of Interactive E-Books (IEBs) and their integration with modern technologies such as augmented reality (AR), three-dimensional animations, and video files.

Paramitha et al. (2023) affirmed the necessity of incorporating interactive designs in e-book creation for their role in developing learners’ critical thinking, while other studies—including Putranti (2024)—emphasised the introduction of simulation environments and distinctive media, such as the combination of images, links, and audio annotations, thereby transforming the learner from a passive consumer of knowledge into an active participant in its construction. Atiyya (2023) added that converting complex information and data into visual images and graphics facilitates rapid understanding and comprehension, replacing the reading of lengthy pages.

Bhat and Alyahya (2023) adopted a Computational Perspective, arguing that this perspective focuses on “what happens behind the scenes” from a technical standpoint to make the book intelligent and interactive—through the simultaneous integration of various media (audio, video, and graphics), the activation of feedback mechanisms, and the segmentation of content into small

algorithmic units to facilitate engagement. This computational perspective transforms the book into a digital tutor that monitors student progress, analyses weaknesses, and adapts content to suit each student's individual learning pace.

In a singular conceptual contribution, Ran and Jinglu (2020) proposed structuring the e-book through a three-module model (content, media, technology), offering an integrated solution for implementing digital books that encompasses design and multimedia. Masrifah et al. (2021) called for the necessity of presenting information in more than one format (text, image, video, audio, simulation) within the e-book, in order to address different senses and learning styles. This approach supports the TPACK model, which focuses on the optimal integration of three types of knowledge: content knowledge, pedagogical knowledge (encompassing teaching methods and strategies for delivering information), and technological knowledge of the digital tools employed.

8.2 Response to Research Question 2

What gaps in design standards were overlooked by the studies selected for the systematic review?

Analysis of the prior studies included in the review reveals that their concentration on evident technical and interactive aspects led to the neglect of more fundamental standards relating to inclusivity and cognitive depth (avoiding distraction), genuine flexibility (deep personalisation and user adaptation), and digital security (privacy). Integrating these overlooked standards is what will elevate e-books from being merely digital to being truly interactive in the fullest sense, and comprehensively effective. The most significant standards overlooked by the prior literature are as follows:

A. Standards of Access Inclusivity and Equal Opportunity

Prior studies lack the specification of clear criteria for creating high-quality textual descriptions (alternative text) for complex visual elements—such as interactive graphs, dynamic charts, and animations—as these are essential for learners, particularly at the basic education level (middle and secondary school), who rely on screen readers. General standards are insufficient to describe the dynamic nature of these elements.

B. Standards of Cognitive Enrichment and Narrative Experience

A reading of prior studies focused on technical standards and the adoption of various technical media reveals that they failed to clarify that the addition of

interactive features that are incoherent (unconnected) with the narrative or content can distract the reader and impede learning or cognitive progress. Accordingly, standards for evaluating “cognitive coherence” between text, image, audio, and movement, and for managing them so as to avoid overloading the reader’s memory, represent an insufficiently researched area.

C. Standards of Personalisation and Adaptive Flexibility

A detailed reading of most studies addressing design standards reveals that e-books are designed for individual, independent reading, and that features enabling social interactions (such as sharing annotations or remote group reading) or creative interactions (such as rewriting the story or drawing on it) are extremely limited and have received scant attention in prevailing design standards.

AI-Supported Adaptive Learning Pathways: Despite references to “smart books” as a future generation, the integration of explicit design standards that adapt content based on the reader’s performance and learning style (using artificial intelligence) remains in its early theoretical stages and has yet to be translated into practical design standards in most studies.

D. Standards of Continuity and Contextual Integration

Offline Functionality in Resource-Limited Environments: While standards are trending towards the integration of advanced technologies that require constant Internet connectivity (such as augmented/virtual reality), these studies have not addressed standards for ensuring the continuity and effectiveness of e-books in low-resource or poor-connectivity environments—a major obstacle to the wide adoption of such technologies.

8.3 Response to Research Question 3

What is the proposed theoretical framework(preliminary and exploratory) for designing e-books that aligns with the requirements of modern digital learning?

Based on the findings of prior studies that affirmed the effectiveness and importance of the interactive e-book and recommended the adoption of rigorous standards in its design, yet where those standards varied according to each study’s general orientation and specific objectives—while neglecting essential elements such as the e-book’s support for personalised learning pathways, the enhancement of learner engagement, and what is known as adaptive learning

(i.e., the text adapts to the reader, not the reverse)—the same pedagogical standards were retained given the general consensus among prior studies.

The pedagogical standards comprise: educational content, learning activities, instructional strategies, guidance and direction—each with its own specific indicators.

Table 4.- . Proposed educational criteria (Prepared by the researcher)

Axis	Learning Objectives	Educational Content	Learning Activities	Instructional Strategies	Guidance and Direction
Indicators	- Measurability - Relevance, clarity	- Accuracy - Organisation into units (chunking) - Currency	- Variety - Feedback - Connection to real life	- Self-directed learning - Variety - Motivational stimulation	- Learning support - Book map - User guide

Source: Prepared by the researcher

With regard to the technical or technological standards, the following framework is proposed:

Table 5.- Proposed artistic and technical criteria (Prepared by the researcher)

Axis / Indicator	Interactive Infrastructure	Accessibility	Immersive Technologies	Intelligent Personalisation
Indicator 1	Hypertext linking	Perceptual flexibility	Augmented reality (AR)	Intelligent personalisation standards
Indicator 2	Multimedia integration	Adaptive design	Integration of audio effects	Adaptive learning
Indicator 3	Bidirectional interaction	Cognitive simplification	—	Intelligent summarisation
Indicator 4	—	—	—	Personalised reading experience

Source: Prepared by the researcher

9. Discussion of Findings

The majority of studies (in Arabic and English) highlighted the importance of the interactive e-book in the educational process. The study findings also agreed on the growing use of e-books at various educational levels, particularly in higher education, as a digital educational tool whose deployment has followed an upward trajectory in terms of generalisation. Accordingly, most Arabic studies during the selected period focused on the design of this type of book using specific technologies such as augmented reality and gamification elements.

The development of e-book design in its various forms has proceeded from different theoretical perspectives, including connectivism, multiple intelligences theory, and Gestalt theory—which explains the limited number of studies addressing design standards:

- Studies employed the developmental methodology in accordance with thematic orientations, specifically the development of e-books designed according to various models.
- Studies during the period selected for the current study tended towards establishing design standards that transcend rigid templates, focusing significantly on the integration of augmented reality (AR) as a tool for linking theoretical content to tangible reality, which requires precise standards for controlling “immersion” and avoiding distraction. The studies emphasised the necessity of employing gamification elements—such as achievement badges, leaderboards, and progress points—not merely as entertainment features but as mechanisms for reinforcing learners’ intrinsic motivation. The design competence in these studies is manifested through the “coordinated integration” of multimedia: texts, two- and three-dimensional illustrations, interactive video clips, and directional audio effects, together with simulation environments that allow learners to experiment in a safe setting. The fundamental standard in this system is “active interactivity,” which ensures the book’s responsiveness to the user through control buttons, thereby transforming the e-book from a vessel of information into an intelligent and integrated learning environment. However, the success of designing such books does not depend on the quantity of media used, but rather on their “functional suitability” to the educational content and ease of navigation among their various elements. This position is supported by Mayer’s (2024) reference

to “media deployment” within the Cognitive Theory of Multimedia Learning in its latest updates, where the theory emphasised the Coherence Principle—which holds that removing irrelevant material (even if engaging) enhances learning. It also affirms that the integration of video or simulation in the e-book must follow the “Spatial Contiguity Principle,” meaning that explanatory text should be placed directly alongside the interactive element to minimise eye movement distraction.

Educational technology experts, in alignment with contemporary developments, note that gamification in modern e-books is no longer merely about points; it has evolved into what is termed “Structural Gamification (i.e., embedding game logic into content structure)”—transforming the content itself into a video game or interactive story, with the book’s pathway designed as an exploratory journey. This stimulates the learner and increases their sustained engagement with the screen.

Scholars note that augmented reality (AR) is not merely a visual technology but an application of embodied cognition theory, which posits that learning is deeper when linked to bodily movement and interaction with the surrounding environment, and that the use of AR in e-books allows the learner to engage in “mental manipulation” of objects, thereby transforming knowledge from abstract information into a “sensory experience” stored in long-term memory (Mustafa, 2022, p. 127).

In the domain of artificial intelligence, developments in educational technology and the design of “Adaptive E-books” supported by AI indicate that the modern e-book must function as a pedagogical scaffold (Scaffolding): if the system detects—through the user’s interaction with the simulation—that the user is encountering difficulty, the book immediately simplifies the content or presents an assistive mediator (an explanatory video).

The current trend in educational technology is shifting from “the book as a source of information” to “the book as an intelligent learning environment.” Technology in the e-book must be “transparent”: that is, present to enhance meaning without making the learner feel burdened by the technology itself.

10. Conclusion

A clear transition is evident in the literature from the question “Are interactive books useful?” to the question “How do we design interaction to be better?” The answer offered by the current studies is that the growing attention to design standards has produced a qualitative leap in the field of design in general.

Recent research trends (2020–2026) have concluded that the design of the interactive e-book is no longer a technical luxury, but rather a precise instructional architecture grounded in robust theoretical frameworks. Through the integration of the Cognitive Theory of Multimedia Learning (Mayer) to regulate cognitive load, and flow theory via gamification elements, the book has been transformed from a static medium into an active learning environment. The systematic deployment of augmented reality (AR) and interactive simulation technologies, supported by multimedia integration of text, image, audio, and video, contributes to shifting the learner from the role of “recipient” to “explorer.” Accordingly, the fundamental standard in contemporary educational technology determines that the quality of an interactive book is measured by its capacity to provide a Personalised Learning experience that adapts to user needs and supports their motivation, making it a pivotal tool for achieving learning outcomes in the digital age—without overlooking the fundamental pedagogical standards related to the design of educational content, regardless of its type. The researcher therefore recommends conducting studies on the most significant technical standards that contribute most substantially to enhancing the interactivity of e-books.

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