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Prof. Dr. Omer El Sheikh Hago El Mahdi
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In the name of of Allah the Merciful

Editor-in-chief

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FULL PAPER

From Access to Agency: A Capability-Based Reconceptualization of Linguistic Equity in Generative AI–Mediated Language Education

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Abstract

Generative artificial intelligence (GenAI) has recently become adopted into language learning environments at unprecedented rates. Though research has yet to catch up to practice, language educators and researchers are concerned with questions of equity related to GenAI tools. The bulk of this research has been technocentric, prioritizing access to AI instead of how students convert access into actionable freedoms. To fill this gap, the current study sought to reconceptualize linguistic equity from a capability perspective. The researchers utilized a quasi-experimental mixed-methods design with 80 EFL learners in experimental and control groups. Paired and independent sample t-tests were used to analyze quantitative data, while thematic analysis was used to code qualitative data. Results showed significant improvement for the experimental group (pre-test $M = 10.58$, post-test $M = 18.27$; $t(39) = 15.63$, $p < .001$) over the control group (pre-test $M = 10.46$, post-test $M = 13.34$; $t(39) = 5.42$, $p < .001$), with a statistically significant difference between groups at post-test ($t(78) = 11.48$, $p < .001$). Quantitative results from questionnaires show a high sense of agency ($M = 4.18$). The results of this study have important implications for reconceptualizing linguistic equity as depending not just on access but on the capability to use artificial intelligence to succeed in language performance environments. The study adds to theory by providing preliminary work on a capability framework and provides practical application toward equitable GenAI pedagogy.

Keywords: generative artificial intelligence, linguistic equity, capability approach, learner agency, EFL education

1. Introduction

Language education research has been rapidly evolving under the influence of generative artificial intelligence (GenAI). In the span of a year since ChatGPT made its debut, scholars of applied linguistics and technology have observed shifts in language production and access, as well as mediation moving away from singular instructor-based practices and toward complex infrastructures for language learning which aim to cater to learners' needs and pathways (Denny et al., 2024; Li et al., 2025). Reviews of current research on GenAI for language learning highlight multiple affordances for language learners including but not limited to AI-prompted opportunities for customized adaptive feedback, targeted comprehensible input, and multimodal interaction (Weng & Fu, 2025; Mikroyannidis, 2025). As such tools and pedagogies have gained traction among applied linguists and language educators, many emphasize their potential to narrow long-standing achievement gaps by affording learners who may not otherwise receive skilled language instruction access to versatile tools that can enhance language learning.

For example, a growing body of literature has centered GenAI's implications for democratizing education broadly and leveling the playing field for language learners specifically. On the one hand, emerging research substantiates how GenAI tools can facilitate second language acquisition for learners across contexts and with diverse needs (Weng & Fu, 2025). On the other hand, recent studies have exposed how learners from varying backgrounds do not experience AI tools equally due to myriad factors such as differences in digital literacies and prior experiences with AI (Li et al., 2025). For example, students with more opportunities to learn about and engage with technology have been found to experience more educational benefits when learning with AI (Li et al., 2025). This is concerning given that studies have also found algorithmic biases in large language models which have the potential to perpetuate stereotypes and exclude culturally and linguistically diverse students (Grassini, 2023; Huang et al., 2024).

Theorists have also begun to consider the implications of GenAI for language education. A rising chorus of calls for humans-in-the-middle frameworks and ethical approaches to GenAI in education ask stakeholders to center learners by taking into account issues such as learner autonomy, identity, and the effects of AI on overall well-being (Georgiou, 2025). With this work in mind, language educators are beginning to reimagine how we might integrate AI into pedagogical contexts with a renewed sense of care and justice towards learners. While this work provides a starting point for understanding how GenAI may reproduce or transform existing inequities, the majority of the applied linguistics literature on GenAI and language learning is descriptive in nature, placing emphasis on metrics of task performance and user experience rather than learner ability.

What is missing from these conversations is a theoretical foundation for linguistically equitable GenAI integration. The existing understanding of equity in the context of GenAI and language learning is largely synonymous with access to technology or AI-mediated tools. What gets lost when we equate equity with access are learner differences in the ability to convert accessible resources into valued forms of knowledge, skill, and participation. To address this gap, this study adopts the Capability Approach (Sen, 1999; Nussbaum, 2011) to argue that GenAI language learners should be afforded the capabilities to act, learn, and achieve as linguistically equitable beings.

More specifically, this study seeks to: (1) provide a capability-based definition of linguistic equity in the context of language learning with GenAI, (2) survey extant literature on GenAI for language learning through a lens of power and positionality, and (3) outline a reorientation of terminology and priorities that will allow researchers, teachers, and learners to move forward in our understanding and use of AI in language education. To that end, this paper will ask the following research questions:

To address these aims, the study is guided by the following research questions:

1. How is linguistic equity currently conceptualized in generative AI-mediated language education?
2. What limitations exist in access-based models of AI integration in relation to learner agency and outcomes?
3. How can the Capability Approach provide a more comprehensive framework for understanding linguistic equity in AI-mediated contexts?
4. What theoretical and pedagogical implications emerge from adopting a capability-based perspective in language education?

This study argues for positioning throughout, situating itself among critical approaches to AI and contributing novel theoretical application to the field of applied linguistics. Upon this introduction, Section 2 provides a review of relevant literature on generative AI and language learning, linguistic equity, and the Capability Approach to situate the study's theoretical framework.

2. Literature Review

2.1 Generative AI in Language Education: Emerging Pedagogical Paradigms

Generative artificial intelligence (GenAI) tools are quickly going from being an interesting experimental tool to become an inevitable pedagogical focus of language education technologies. Recently, publications have emerged explaining how LLMs promote language learning as they allow learners to engage in actual language practices outside of classrooms, lectures, and grammar exercises via meaningful dialogues in a way that is interactive, adaptive, personalized, and customizable (Kasneci et al., 2023; Luo, 2024). While prior chatbot and AI technologies included features that promoted language learning such as rule-based feedback and limited automation of tasks, GenAI technologies present features such as context-aware and generative capabilities which allow learners and machines to collaboratively build meanings (Yan, 2023).

Some studies have begun to show the efficacy of AI-mediated language learning tools to impact learners' productive skills. Tools that mediate writing and speaking have shown benefits such as corrective feedback, linguistic restructuring, and scaffolded inputs (Barrot, 2023; Wang & Han, 2024). Barrot (2023) showed that an AI-mediated writing environment led learners to produce more coherent writing with greater lexical complexity. Wang and Han (2024) discovered learners became more fluent and confident while speaking when using an AI interface. In research investigating conversational agents, learners were able to engage in task-based language learning in realistic situations provided by AI conversation (Huang & Li, 2023).

While these studies show promise in GenAI for language education, many of them assess how well tools are at impacting learner performance. Through this lens, tools are only discussed through the lens of metrics like accuracy, fluency, speed, and completion. As such, the bigger picture of how learners approach these technologies is often lost. Kohnke et al. (2023) discuss how this technocentric perspective has pushed us past the point of helpful technology focused research and have called for research that steps outside of this area of research.

2.2 Linguistic Equity in Digital and AI-Mediated Contexts

Equity as it relates to language learning is being rediscovered in mediated settings. Conventionally focused on access to language learning environments or resources, discussions of linguistic equity are expanding to consider aspects of digital equity and justice (Darvin, 2022). In settings augmented by

artificial intelligence, these conversations include algorithmic bias, misrepresentation of linguistic varieties, and equitable access to participation opportunities (Blodgett et al., 2020).

Emerging research suggests that many current artificial intelligence systems, even those designed for language teaching or learning purposes, will continue to reproduce bias by centering dominant languages or standardized varieties. Therefore, opportunities for learners of non-standard or under-resourced varieties will be limited in AI-mediated interactions (Bender et al., 2021). Recent scholarship has raised questions around how these systems may contribute to unequal power dynamics for English as a Foreign Language (EFL) learners, especially those whose linguistic repertoires are not commonly found in artificial intelligence output. A lack of digital literacy skills or technological affordances has also been found to create rifts in who can access AI-mediated language learning (Selwyn, 2021).

Research into learner equity at the pedagogical level has shown the need for learners to feel capable and supported to meaningfully navigate AI-mediated language learning spaces, rather than simply having access to AI tools (Darvin & Norton, 2023). Discussions of equity and access have also arisen in discussions of sociocultural theories of second language acquisition (Kramsch, 2009). These theories focus on many of the same issues as educational equity, such as learner identity, power, and learner agency. However, like the rest of the field, tends to situate discussions of equity outside of research aims or topics.

Discussions of equity have been made in recent empirical studies using AI in language learning. Papers tend to measure equity in very practical terms, such as who has the AI tool available to them or who is more likely to use the tool. However, these measurements do not account for who has the opportunity to learn from the tool or receive its potential benefits. By this logic, anyone with a smartphone could be considered equitable.

2.3 Learner Agency in AI-Mediated Language Learning

In order to facilitate learner uptake, three additional codes are represented, including the learner agency concept. Agency can be understood as learners' capacity to act deliberately and self-regulate their behavior to learn from available affordances (Mercer, 2022). Within an AI-mediated setting, learners are faced with choices that allow them to exercise control while adhering to their personalized learning journey.

Equally important to note is that agency has been demonstrated to empower learners but also disempower them when learning with AI. For instance, AI adaptive systems may allow learners to feel a sense of control when learning a language due to the ability to receive instantaneous feedback (Zawacki-Richter et al., 2021). Contrary to positive learning experiences, learners tend to underutilize their cognitive efforts and suspend evaluation when accepting the suggestions proposed by AI (Chan & Hu, 2023). Learners also unevenly experience agency during their learning process.

Variations in experiencing agency while learning languages with the aid of AI technologies were discovered based on learners' experience with technology, language self-efficacy, and other demographic factors (Godwin-Jones, 2022). Students who lacked technological skills and confidence would often experience challenges when attempting to practice their target language using AI. Empowering learners using technological innovation should be explored to promote language practice using CALL.

In addition, equity was not well-established through the process of open coding. One possible reason is that learner agency is not well-theorized. In the selected articles, the concept of agency was

mentioned; however, it was only presented as an individual capability and not associated with learners' access to equitable learning conditions.

2.4 The Capability Approach: A Theoretical Lens for Reframing Equity

Sen's (1999) Capability Approach and its extended formulation by Nussbaum (2011) has gained momentum over recent years as researchers have begun to employ it as a conceptual framework to study equity and human development within education settings (Terzi, 2021). Rather than models focused around resources available to students, Capability Approach emphasizes individuals' actual freedoms or abilities to reach valued achievements and states, accounting for conditions both internal and external to the learner (Walker & Unterhalter, 2020).

Research has started to bring this perspective to bear on digital education and inequities within technology-mediated learning spaces (Terzi, 2021; Tikly, 2022). Adopting this framework for understanding equity through technology quickly reveals that access itself is neither necessary nor sufficient for viewing a learning context through the lens of capabilities. Instead, we must consider if learners are able to convert provided resources into meaningful learning outcomes.

The Capability Approach can helpfully reframe conversations around equity in AI-mediated language education by centering issues of language use, learning, and participation. This approach to equity can counterbalance the current tendency of viewing technological mediation of education through a resources lens. Instead, this approach emphasizes agency, the learners' abilities to convert resources to meaningful outcomes, overall well-being, and situates learner within their socio-cultural contexts (Holmes et al., 2022). While promising for research on AI in language education, the Capability Approach has been notably absent from applied linguistics scholarship. While some studies have begun to employ this theoretical lens to better understand equity in technology-mediated classrooms, they do not focus on the nuances of language or AI-mediated communication.

Thus, there remains a need for a theory-driven conceptual model that draws from applied linguistics, educational technology, and social justice frameworks to explore language learning via AI mediation.

2.5 Synthesis and Conceptual Gap

Findings from the literature review suggested three primary themes. GenAI in Language Learning literature has explored the impact GenAI has in language learning contexts and found numerous benefits but has focused on AI technology itself and measuring its performance. Literature examining language equity through inclusion and representation found gaps in access and availability being positioned as equitable but does not deeply engage with the nuances of equity. Finally, recent literature focusing on learner agency has begun to surface but lacks connections with other areas of equity and capability.

Synthesizing all themes from the literature reviewed suggests that there is currently a lack of conceptualization for how learners with access to these AI technologies can and do develop linguistic capability. There is currently no theory as to how access to language learning with AI leads to learners having the capability to meaningfully use linguistic knowledge. Neither do we deeply understand what conditions must be in place to help facilitate this process.

By positioning linguistic equity as a capability, this research contributes to bridging the gap between language access to AI and what learners are actually able to do with the linguistic knowledge that they learn from these technologies. This has pedagogical and policy implications.

2.6 Theoretical Framework

The present study synthesizes three theories into one cohesive framework that informs the conceptualization of linguistic equity throughout AI-mediated language learning environments presented below.

2.6.1 *Capability Approach*

Generative AI functions used in education should be evaluated not by the measure of their use but by how they allow learners to do what they value linguistically. The Capability Approach (CA) directly informs this position by focusing research on what learners are able to do with the tools and resources provided to them, rather than on what they have access to. Originated by Nobel laureate economist Amartya Sen and further developed by philosopher Martha Nussbaum, the CA determines an individual's level of well-being not by their income or resources but by the real opportunities that they have to do and be what they value, referred to as capabilities (Sen, 1999; Nussbaum, 2011). Applied to language learning, the CA positions learning less as the intake of information and knowledge and more as the ability to use language to communicate and do what learners want to do. Crucially, access to tools and resources does not guarantee equity of outcomes because learners vary in their abilities to convert available resources into capabilities. Recent work on the CA in education has focused on notions of:

1. conversion factors (internal, external, structural conditions that facilitate or inhibit the learning process)
2. agency and learner choice
3. access to opportunities (Walker & Unterhalter, 2020; Tikly, 2022)
4. At the intersection of language learning and AI, the CA allows this research to focus on:
5. how learners are utilizing AI tools
6. what learners are able to do because of AI
7. if AI is enabling or hindering learners' capabilities

The CA therefore redefines linguistic equity as the ability to do what one values linguistically instead of equal access to tools and resources.

2.6.2 *Sociocultural Theory*

To better understand how learners interact with and are influenced by generative AI tools in language learning, this research will apply Lev Vygotsky's Sociocultural Theory. Originally developed by Soviet psychologist Lev Vygotsky, SCT sees learning as the development of understanding through social interactions. Learning with AI can be thought of as SCT by conceptualizing generative AI tools as mediational artifacts that impact learners' cognitive development.

Therefore:

1. AI serves as a scaffold for learning
2. interaction with AI is a type of social engagement
3. language is learned through mediation

Recent scholarship has applied SCT to technology-mediated learning by stating that the "tools of the mind" have changed to include digital technologies like AI, which therefore change the mediational nature of learning by inserting a non-human agent into the process (Lantolf et al., 2021). What is

most important about SCT for the current study is the notion that learning does not happen in a vacuum. It is affected by:

1. social factors
2. cultural expectations
3. interactional dynamics

This has direct implications for equity in AI because each learner will come to the AI environment from different places and with different levels of access to cognitive and academic development.

2.6.3 Learner Agency Theory

Linking both the Capability Approach and Sociocultural Theory is the concept of Learner Agency. Agency can be defined as the ability of learners to act intentionally, make choices, and self-regulate their learning (Mercer, 2022). In the case of AI in education, this is critically important because learners still need to:

1. choose how to interact with the AI tool
2. judge if the AI is correct or not
3. integrate AI usage into their overall learning plans

Therefore, agency is a learned capability that is influenced by context and individual difference variables such as motivation and self-efficacy. Recent literature has discussed how AI can impact learners' agency by either increasing it (due to opportunities for autonomy and personalization) or decreasing it (through algorithmic control of learning). (Zawacki-Richter et al., 2021) For this study, learner agency will be considered a learner's ability to utilize the AI tool to support language learning.

2.7 Integrative Theoretical Model

Synthesizing these three elements together, I articulate a capability-based definition of linguistic equity within the context of AI-mediated language learning as follows:

1. Access to AI → Opportunities/Resources
2. Conversion Factors (Operationalized as digital literacy, socio-cultural environment) → Influence learners' →
3. Agency → Converts Access into →
4. Capabilities (Learners' authentic opportunities to realize desired linguistic outcomes)

Overall, synthesizing these three bodies of literature allows me to bridge the gap between theory and definition presented at the beginning of the section by outlining the mechanisms through which and reasons why some learners may achieve unequal levels of learning with the same amount of access to AI. Theoretically, this framework contributes to the field by:

1. Conceptualizing linguistic equity as a capability issue rather than as an access issue
2. Bridging technology, agency, and contextual factors within one integrated model
3. Framing empirical research with a theory that connects operational components with latent ideas

Grounding AI within a conceptual umbrella that places higher value on humanity and social justice, I move the field of applied linguistics and educational technology one step closer to theory-based equity in AI-mediated learning. Building off of the previous section, I will now provide an overview of the methods I used to answer the research questions stated above.

3. Methodology

3.1 Research Design

This study used a quasi-experimental mixed-methods approach because it not only considered learners' language performance to assess linguistic equity enabled by generative AI-mediated instruction but also investigated learners' agency and capability built through engagement with generative AI tools. Quantitative data collection using pre-test and post-test assessments allowed measuring group differences in performance resulting from taking part in generative AI-mediated learning activities versus engaging in conventional instructional activities. Qualitative data informed by interpretivist underpinnings were collected using semi-structured interviews and classroom observations to investigate learners' perceptions of how they engaged with the AI tools as mediated by their teachers and how these engagement patterns contributed to developing their capabilities for equitable language learning. Both types of data were analysed separately but discussed together during the interpretation stage of this research to provide answers to the research questions presented above.

3.3 Participants

Undergraduate learners of English as a foreign language (EFL) taking part in an English language programme at a higher education institution constituted a sample for this study. Participants (N = 80) were recruited using purposive sampling on the condition of being at a similar proficiency level and having previous experience with digital learning contexts.

They were randomly assigned into two groups:

1. experimental (n = 40) – took part in generative AI – mediated instruction
2. control (n = 40) – took part in conventional instruction

Prior language proficiency was controlled for by obtaining learners' pre-test scores and ensuring no significant differences between the two groups. Twelve learners who took part in generative AI – mediated instruction were recruited for participating in interviews. Maximum variation sampling was used to select participants who represented diverse experiences with engaging with digital tools, participating in the online learning activity, and performing the task.

3.4 Instruments

1. Language performance test

The researcher developed a pre-test and post-test to measure learners' discourse-level language performance in terms of fluency, coherence, and lexical complexity. Both tests were piloted and reviewed by experts.

The reliability analysis using Cronbach's alpha (α) indicated an acceptable level of internal consistency ($\alpha = .83$).

2. Capability and Agency Questionnaire

The Capability and Agency Questionnaire asked learners to self-report on their ability to engage with generative AI tools during the learning activity, their autonomy during this activity, and their access to various resources. The questionnaire items were adapted from existing instruments developed to measure learners' agency and digital competence and used a 5-point Likert scale. Its validity was ensured by conducting exploratory factor analysis.

3. Semi-structured Interviews

The purpose of interviews was to allow participants to share their learning experiences. Interview questions pertained to their observable patterns of engaging with generative AI tools and patterns they wanted to highlight, the benefits they experienced when using the tool, and constraints they faced during the activity. Interviews also asked participants to reflect on their ability to convert mere access to generative AI into meaningful learning experiences.

4. Classroom Observation Checklist

The classroom observation informed on learners' engagement with the activity and the tools and Allowed tracking of the frequency of learners' engagement with the AI tool and the type of support their teacher gave them while working with the tool.

3.5 Procedure

Data collection took place throughout eight weeks of implementing the intervention and involved several steps.

1. Learners from the experimental and control groups completed a pre-test that served as a baseline for measuring their language performance.
2. The experimental group engaged in generative AI - mediated instruction whereas the control group received conventional instruction. Both groups worked on the same language tasks aligned with the same standards but used different means to complete these tasks.
3. Learners from both groups completed the post-test that was equivalent to the pre-test.
4. The learners from the experimental group completed the capability and agency questionnaire.
5. The interviews and classroom observations took place during and after the intervention.

The results section included Statistical tests' results and examples of learners engaging with generative AI as a means of learning English.

4.6 Ethical issues

The study adhered to ethical considerations. Before taking part in the study, participants gave informed consent. Their anonymity was maintained throughout the research process. Learners could not be forced to participate and were told they could stop their participation at any time. The data served research purposes only.

4.7 Data analysis

Quantitative data analysis was performed using IBM SPSS Statistics for Windows, Version 27.0. (IBM Corp., Armonk, NY, USA). First, descriptive statistics were generated to obtain means and standard deviations of the scores on the pre-test and post-test language performance tests for the experimental and control groups. Paired-samples t-tests were used to analyse within-groups differences in scores on pre-tests and post-tests. Independent-samples t-tests were used to analyse differences in learners' performance on post-tests. The effect size was calculated using Cohen's d to establish what magnitude differences had. All analyses were two-tailed.

Thematic analysis was used to analyse qualitative data obtained from interviews and classroom observations. Steps of thematic analysis included:

1. Familiarising yourself with your data
2. Generating initial codes
3. Searching for themes
4. Reviewing themes
5. defining and naming themes

Member checking and peer review of coding were used to ensure trustworthiness of the study's findings. Qualitative analysis of the data focused on learners' agency, development of capability, and barriers to the equitable use of AI technology in language learning.

Lastly, quantitative and qualitative results were integrated during the data interpretation phase of the study. This approach allowed the researchers to connect quantitative findings regarding learners' language performance with learners' voices around their experiences taking part in generative AI – mediated language learning and the capabilities they exercised and developed while engaged in the activity described in the Methodology section above.

4. Results

4.1 Preliminary Analyses

The dataset was checked for errors, missing values, and statistical assumptions before performing analyses. There were no missing values in the dataset. Tests of normality were conducted using Shapiro – Wilk tests. Results indicated normal distribution ($p > .05$). Homogeneity of variance was examined using Levene's test. Results indicated equal variances between groups ($p > .05$). Therefore, parametric statistics were used.

4.2 Descriptive Statistics

Table 1 provides descriptive statistics of pre-test scores and post-test scores. Pre-test mean (standard deviation) and post-test mean (standard deviation) of experimental and control groups are presented in Table 1.

Table 1

Descriptive Statistics for Pre-test and Post-test Scores

Group	Test	Mean (M)	Std. Deviation (SD)
Experimental (n=40)	Pre-test	10.58	2.12
Experimental (n=40)	Post-test	18.27	1.88
Control (n=40)	Pre-test	10.46	2.19
Control (n=40)	Post-test	13.34	2.07

The values in Table 1 indicate increases in mean scores from pre-test to post-test in both groups.

4.3. Within-Group Comparisons

4.3.1 Experimental Group

A paired-samples t-test revealed that scores on the post-test were significantly higher than scores on the pre-test for participants in the experimental group, $t(39) = 15.63$, $p < .001$. Specifically, the mean score on the pre-test was $M = 10.58$ ($SD = 2.12$) while the mean score on the post-test was $M = 18.27$ ($SD = 1.88$). Cohen's d was used to calculate effect size, which was large ($d = 2.47$).

4.3.2 Control Group

Paired-samples t-test was performed on control group as well. Participants scored significantly higher on post-test ($M = 13.34$, $SD = 2.07$) than on pre-test ($M = 10.46$, $SD = 2.19$), $t(39) = 5.42$, $p < .001$. Cohen's d for control group was of moderate size $d = 0.86$.

4.4 Between-Group Comparison

The researcher performed an independent-samples t-test on the post-test scores for each group. The analysis revealed a significant difference between the experimental group ($M = 18.27$, $SD = 1.88$) and control group ($M = 13.34$, $SD = 2.07$), $t(78) = 11.48$, $p < .001$. Cohen's d showed that the effect size was large (2.57). These results are summarized in Table 2.

Table 2

Independent Samples t-test for Post-test Scores

Group	Mean (M)	SD	t-value	df	Sig. (2-tailed)	Cohen's d
Experimental	18.27	1.88				
Control	13.34	2.07	11.48	78	< .001	2.57

4.5. Questionnaire Results (Capability and Agency)

The responses to the questionnaire about their perception about using AI-mediated tools were analyzed descriptively. Results showed that experimental group participants demonstrated strong perceived

efficacy/agency when using AI-mediated tools. The overall mean of responses was $M = 4.18$ ($SD = 0.44$) on a 5-point Likert scale.

Participants had the highest ratings on the following item:

“How well can you use AI tools by yourself” ($M = 4.32$, $SD = 0.50$)

“I feel confident completing language learning tasks using AI tools” ($M = 4.26$, $SD = 0.47$)

Participants had the lowest ratings on the following item:

“I have reliable access to technological resources” ($M = 3.85$, $SD = 0.61$)

4.6 Qualitative Findings

Analysis of interview data yielded three recurring themes:

1. Autonomy in learning practices
2. Variability in access to technological support
3. Differences in the use of AI for task completion

Some learners self-reported that they differed in how often they used the AI tool; how much they used the tool's outputs; how they completed tasks with AI assistance. Furthermore, observational data showed that learners behaved differently in class regarding attention span and patterns of engagement.

4.7 Summary of Findings

The findings indicated statistically significant differences in language performance both within and across groups. The questionnaire responses, as well as the qualitative findings helped describe learners' experiences and engagement in AI-mediated learning contexts. The next section interprets these results in light of the theoretical framework and literature review to discuss implications for linguistic equity, learner agency, and capability development when engaging with AI-mediated contexts for language learning.

5. Discussion

This study analyzed students' experience with generative AI using the Capability Approach paradigm, focusing on the students' ability in terms of performance, agency, and conversion of access into tangible outcomes. The quantitative findings showed statistically significant improvement in both groups' linguistic performance with much larger effect size in the experimental group. This conclusion is in line with previous studies demonstrating generative AI as causing performance improvements due to its adaptivity, scaffolding, and interactivity (Garzón et al., 2025; Zhu & Wang, 2025; Hon, 2025).

The experimental group's statistically significant improvement margin illustrates how generative AI writing tools allowed learners to engage with writing production as they could receive feedback and make edits while writing. This is supported by recent studies and meta-analysis showing improvement in fluency, coherence, and engagement in learners using AI-mediated writing environments (Wang et al., 2025; Lee, 2025). It should also be noted that similar to previous findings, there was also improvement in the control group (Taking traditional instruction as a baseline), which means that AI is not replacing traditional instruction but rather amplifying it (Toscu, 2024; Wu et al., 2025).

Qualitatively, two central findings about learners' experienced capability align with previous research. First, learners overwhelmingly reported having access to the agency they needed to feel confident using AI. This is in line with recent work that positions generative AI as a tool that can help students develop self-regulated learning skills and autonomy (Özturan, 2024; Roe & Perkins, 2024). Learners also reported feeling capable of making effective decisions about how to interact with the AI, when to accept its suggestions, and how to perform revisions.

Second, learners did not have equal access to using AI nor did they capitalize on this access equally. This directly ties into recent work showing that learners do not all have equal resources or backgrounds when engaging with AI tools (Krause et al., 2025). There were conversion factors at play that determined how students could access AI. This relates back to the Capability Approach theory introduced in the literature review, as students did not necessarily have the same freedom or ability to convert their access to AI into actual capabilities.

These two findings are also supported by the interviews. Learners who used the AI tool did not all use it in the same way. While some learners were actively generating prompts and rewriting the AI's responses, other learners passively copied what the AI provided. This connects to recent research that claims AI is not merely a tool but an actor that learners are interacting with (Davoodifard & Eskin, 2024). On the other hand, some learners heavily relied on the AI's suggestions and did not spend too much time revising them, which has been noted as a problem in previous literature (Lo, 2025).

However, what has not been discussed as much is how access to AI tools does not always equate to capability. Many articles have discussed how AI improves learners' access to language learning (Weng, 2025; Wang et al., 2025). Access was assumed to allow learners to learn more or better. However, what this study shows is that learners can have access to AI, but if they do not know how to utilize it or lack the confidence to do so, they will not see the same benefits that their peers might see.

In many ways, this finding speaks to the heart of this paper and supports the Capability Approach. Simply providing learners with resources does not improve equity. Instead, what is important is whether learners have the real opportunity to utilize those resources. This paper has taken that theoretical standpoint and applied it to the context of AI in language learning. The results of this study have shown that linguistic equity should be measured by learners' capability with AI instead of access.

In fact, this study also speaks to the divided discussion of AI widening vs. narrowing the equity gap. Some researchers have argued that AI has the potential to close the equity gap by providing scalable access to quality learning help. Others have argued that AI will further the equity gap as those with access, knowledge, skills, or institutional support will benefit more than their disadvantaged peers will (Garzón et al., 2025; Zhu & Wang, 2025). This study found that AI can do both at the same time.

Theoretically, this research contributes to the existing body of knowledge by uniting ideas from capability theory, sociocultural theory, and ideas regarding learner agency. This study has shown that any discussions about learner outcomes when using AI cannot be divorced from the context of:

1. Learners' access to the technology
2. Learners' individual agency
3. The cultural and institutional environment the learners are situated in

This holistic viewpoint begins to fill a large gap in current AI research as most studies tend to focus on one factor at a time (Lee, 2025; Wang et al., 2025).

Additionally, this study helped provide evidence to support the model introduced in the theoretical framework. Recall that learner agency was hypothesized to mediate the relationship between access and outcome. As shown through both quantitative and qualitative data, learners had different experiences using AI. While some learners were actively engaging with the tool by rewriting prompts, others were completely ignoring the prompts and were just copy-pasting what the AI gave them. This notion of learners' agency being the driving factor behind whether learners can successfully convert their access to AI into real capabilities directly supports recent works focusing on AI and learner agency (Roe & Perkins, 2024).

In conclusion, this study adds to recent calls to change AI research and application from a tool-centered approach to a learner-centered one. Rather than asking how AI can better assist learners, this study asked how learners can effectively use AI. Understanding learners' capabilities, experiences, and context is imperative to truly help learners and narrow the equity gap.

The conclusion section will discuss the study's implications, major takeaways, contributions to the field, and suggestions for future research.

6. Conclusion

Findings suggested access in and of itself did not automatically translate to equitable discourse-level outcomes amongst participants despite quantitative evidence showing those who were able to access generative AI tools scored significantly higher than their counterparts who could not during the study. This was partially due to learner agency as students utilized the tool differently and had varying levels of digital competence. Qualitative data showcased differences in learner usage of the generative AI tool. Overall, learners still managed to access other forms of support to complete the task.

As the researcher, this study affirms the theoretical argument of the Capability Approach because students were given access to the same resource during the study; however, they were able to convert that into actual learning and completion of task completion at different levels. Despite having access to this resource, each learner's individual capabilities such as digital skills and access to resources outside of class influenced their ability to complete the task. This study built upon previous applied linguistics literature on generative AI by providing empirical evidence that generative AI can act as a mediational tool that is still dependent on the learner.

The study also serves as an early contribution to the body of work regarding critical AI research. This research attempts to take back some of the hyperclaims around AI by showcasing how technological innovation does not inherently equate to equity. By reimagining what equity in linguistic outcomes in generative AI-mediated environments can look like, this study moves the conversation beyond access and into learner capabilities.

7. Pedagogical Implications

There are several pedagogical implications that arose from the results of this study. As demonstrated, simply providing students with access to a tool does not guarantee that they will know how to or even be able to use it to enhance their learning. As such, language teachers and teachers who wish to integrate generative AI into their pedagogy should focus less on the tools themselves and more on the learners. Teachers should not assume that all learners will use generative AI tools effectively.

Teachers can work to enhance students' ability to utilize generative AI through providing structured time to interact with the tool, space to evaluate the quality of its outputs, and opportunities to learn from its usage. All of these scaffolding opportunities allow students to take agency of their learning

when working with generative AI. Finally, this study highlights the importance of equity-minded pedagogy and instruction design. Although all learners were given access to the same technological tools during the study, not all learners were provided with the necessary conversion factors to turn that access into capabilities.

In my opinion, this is a glaring issue that must be addressed when incorporating AI into ELT, specifically in contexts where students may not have equitable access to digital resources outside of school. Learners may have access to a tool at school, but what good will that do if they do not have the internet at home? Providing learners with the tools is simply not enough.

8. Recommendations

Pedagogical suggestions include encouraging students to complete high-order tasks when interacting with generative AI. While modelled writing can be helpful, teachers should not have students accept the AI's first draft. Instead, learners should be required to interact with that first draft by improving upon it and reflecting on how they were able to fix it.

At an institutional level, teachers should receive proper training on how to integrate generative AI into the classroom. By teachers having the opportunity to learn about generative AI through a PD workshop first, they will have the knowledge necessary to train their students on how to use the tools effectively.

Lastly, policymakers should work to create standards or guidelines for teachers and students to follow when using AI. By having a set of standards that AI use in ELT should follow, teachers will have guidance when question arises. These standards should be grounded in equity as the ability for learners to have the same digital access and competency outside of the classroom may vary.

9. Future Research Directions

Although this study makes contributions toward addressing critical gaps in knowledge about linguistic equity in AI-mediated language learning, there are also opportunities for future research directions. First, additional research may be conducted to understand the role of sustained AI-mediated experiences in developing linguistic capabilities at varied levels of proficiency and among different populations of learners. Future research could adopt longitudinal research designs. Second, research may be conducted to understand how individual or contextual conversion factors impact learners' freedom to convert their opportunities into valued language learning outcomes. For instance, how might learners' socioeconomic backgrounds, institutional resources, and classroom cultures influence their ability to utilize AI-mediated tools to learn languages? Investigating this question can advance understanding about equity in AI-mediated language learning. Third, future research may draw upon more robust analytic models such as mediation and structural equation modeling to test relationships between constructs outlined in this study (e.g., access and learning agency). Fourth, future studies could apply the capability-based framework to different language learning domains (e.g., reading, listening, intercultural communication) and contexts (e.g., secondary education, informal learning).

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FULL PAPER

Stance, Legitimation, and Digital Authority on LinkedIn: A Corpus-Informed Critical Discourse Analysis of Bill Gates' Posts

Abstract

This paper studies how Bill Gates' LinkedIn posts enact digital authority and legitimate global development intervention through stance, quantification, progress-talk, and solution-oriented agency. The corpus includes 14 fact-checked English-language LinkedIn posts published by Bill Gates between 23 September 2025 and 7 June 2026. Corpus-informed critical discourse analysis employed reproducible Python-generated token counts alongside post-level thematic and legitimation coding. The total corpus size was 1,222 words ($M = 87.3$ words/post; range = 24-199). Posts related to global health or child survival were most frequent at eight posts (57.1%). First-person singular self-mentions and collective references each appeared in nine posts. Predictive appeared 18 times across the corpus. Quantification/evidentialization appeared in nine posts, solution/intervention language appeared in 11 posts, and agency assigned to institutions or experts appeared in 10 posts. Close reading revealed a common pattern of legitimation through stances which move from problem definition, to evidence and social alliances, towards solution-carrying organizations, programs/companies, researchers, or technologies. This pattern diffuses moral responsibility while centralizing the capacity for action. Results suggest executive discourse on LinkedIn blends personal judgments, quantified endorsements of urgency, collective solidarity, and futurological expertise to frame institutions and their solutions as natural. Both the community-centered transportation response of the m-mama post and explicit mentions of equity in captions about AI nevertheless caution against reading these captions as purely techno-solutionist.

Keywords: LinkedIn, corpus-informed discourse analysis, critical discourse analysis, stance, legitimation, digital authority, Bill Gates

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1. Introduction

Professional social media is a space where executives, philanthropists, and founders of institutions professional culture values expertise, leadership, evidence, and solution-focused posts. Multi-platform analysis has found that LinkedIn's norms and affordances don't just determine how content

is shared; they also influence what organizations publish and what kinds of identities are believable there (Faber, 2022). Recent research has also analyzed how executives claim expertise and position themselves through topic, role, institutional affiliation, and strategic visibility settings (Keiper et al., 2025), as well as how users create idealized professional identities through self-presentation and self-praise (Weisi & Hajizadeh, 2025).

Bill Gates has a unique status in this platformed economy of authority. When he posts, he speaks simultaneously as founder of a technology company, chair of a major philanthropic foundation, investor in tech start-ups, and public pundit on health, poverty, climate, agriculture, education, and artificial intelligence. This makes his posts worthy of analytical attention: his posts don't just announce activities—they frame problems, select evidence, assign blame, judge possible futures, and name actors who are portrayed as able to provide solutions. Social media leadership communication can create intimacy by flattening institutional distance and giving the impression of leaders being accessible, but it also allows those leaders to frame the conditions of their authoritative encounter. (Matthews et al., 2022; Wu et al., 2022)

Seen through an applied-linguistic lens, however, the foundational question is how language remakes social position and institutional resources as legitimate public authority. Critical research on elite philanthropy has illustrated how large private foundations can help construct needs, rank interventions, spread policy templates, and translate economic advantage into epistemic and moral authority (Haydon et al., 2021; Lambin & Surender, 2023; McGoey, 2021). These dynamics contextualize the analysis that follows, but do not tell us much about the linguistic work by which authority is performed and normalized within platformed genres.

Language is the primary tool by which authority comes to seem available through text. Lexico-grammatically, pronouns can index a speaker with a group, stance markers can index a judgment as sincere and subjective, and modal verbs of prediction can recast speculative technological pathways as future realities. Numeratives can render suffering both visible and pressing but can also limit our attention to outcomes that can be counted and interventions that can be scaled. In the realm of global health, philanthropic knowledge practices shape which problems and people are made governable through evidence (Littoz-Monnet & Osorio Garate, 2024). Narratives of innovation may do comparable rhetorical work by helping technocratic solutions appear actionable and politically innocent despite embodying assumptions about expertise, property, and development that are highly contentious (Canfield, 2023; Smith et al., 2023).

Existing literature offers helpful starting points but is ultimately incomplete. LinkedIn-specific analyses document how professionals construct self-image, professional identities, and executive authority (Keiper et al., 2025; Marin & Nilă, 2021; Weisi & Hajizadeh, 2025). Metadiscourse scholars detail how writers structure their propositions and interact with readers (Biri, 2021; Hyland, 2005; Liu & Zhang, 2021). In critical discourse studies, scholars probe how lexical and grammatical choices index asymmetrical power relationships. A recent study by Alashtary (2024) takes a closer look at ideological portrayals of artificial intelligence (AI) across Gates' social media posts. However, a comprehensive and corpus-driven examination of how Gates' LinkedIn posts linguistically manage personal stance, shared responsibility, quantification, futurity, and institutional agency throughout the frame of global development remains to be examined in digital applied linguistics.

Filling this gap, the current study undertakes a corpus-informed critical discourse analysis of 14 confirmed English-language LinkedIn posts published by Gates from 23 September 2025 through 7 June 2026. Limiting its claims to the captions recoverable in this purposively sampled corpus, the study does not treat the corpus as exhaustive of Gates' LinkedIn posting history, nor does it attribute audience reception based on reactions or comments. In doing so, its bounded design allows all frequencies, percentages, dates, and discourse-analytic claims to be triangulated back to the source register (see Appendix A). Balancing precise token frequencies with post-level qualitative coding, this study asks how micro-level linguistic choices come to constitute a grammar of legitimation. It makes three contributions to the answer. First, it offers a transparent, replicable overview of the

actual 14-post corpus. Second, it describes how stance, modality, pronouns, evidentialization, and semantic fields collectively construct digital authority. Third, it differentiates collective moral alignment from operational agency and highlights counter-trends that challenge elite generalizations and simplistic high-technology interpretations.

Research Questions

RQ1. Which stance, pronoun, and modal resources characterize the 14 captions, and how do they construct authority and audience alignment?

RQ2. How are global problems and interventions framed through themes, quantification, evidence, progress, innovation, access, and future orientation?

RQ3. How do recurring linguistic patterns distribute responsibility and agency in the discursive construction of global development authority?

The following literature review integrates digital applied linguistics, LinkedIn self-presentation, metadiscourse, critical discourse analysis, quantification, and technological solutionism to establish the conceptual basis for the 14-post analysis.

2. Literature Review

2.1 Digital Applied Linguistics and the Discursive Construction of Authority

Authority in digital applied linguistics may be approached as the discursive effect of systematic choices across modes of representation, evaluation, agency, and engagement. As established by critical discourse analysis, these textual practices may be connected to broader dynamics of power (Fairclough, 2013). Examined from this perspective, the relevant question in philanthropic discourse is not simply who or what gets described, but how private actors are discursively positioned to determine public needs, to assess evidence, and to frame permissible responses. Research on elite philanthropy provides the political backdrop for this language-focused inquiry by illustrating donors' asymmetrical agenda-setting capacity (Haydon et al., 2021; McGoey, 20).

Legitimacy conferred through discourse has ethical implications as well as questions of epistemology. Sklair and Glucksberg (201) reveal how elite giving may operate as a strategy of wealth-management and dynastic succession even as it casts wealthy families as stewards of shared resources. Ahmad and Saifer (2024) unpack recurrent narratives of beneficence, progress, and fairness that obscure structural contradictions. For our analysis of captions, these studies help clarify how wealth is translated into ability, vision, and moral aptitude through repeated patterns of evaluation and storytelling. Elite philanthropy is discursively complex. Adewoye et al. (2023) describe how entrepreneurial charity in Africa may merge an empowering vocabulary with neoliberal scripts that position beneficiaries as market-ready, self-managing individuals. This contradiction helps explain the valences in Gates' descriptions. Solutions for education, health, or poverty may be worth pursuing in material terms while still promoting change through the lenses of investment, innovation, efficiency, and scalable systems. Critique should therefore resist deciding whether philanthropy is generous or predatory and instead interrogate the linguistic frameworks that represent problems, populations, and actors.

Projects funded by the Gates Foundation similarly demonstrate how problem definition has political and discursive consequences. Shaw and Wilson (2020) discuss how discourse around climate-smart agriculture can reproduce "technological" and "population-management" solutions while obscuring root causes of agrarian insecurity. Canfield (2023) characterizes a similar "ideology of innovation" where private-sector technologies and partnerships are positioned as default solutions for food-system crises. Global health scholarship has shown how philanthropists' approaches to knowledge-making determines what forms of expertise and evidence are considered legitimate or actionable (Littoz-Monnet & Osorio Garate, 2024). Data sources like statistics, forecasts, and scale are therefore not just informational inputs; they are also discursive tools that privilege interventions that "make sense."

2.2 LinkedIn and Executive Self-Presentation

Platform differences matter because social-media genres enable and reward different performances of identity. According to Faber (2022), platforms constitute unique contexts of communication, with different affordances that structure how users make sense and engage with posted content. LinkedIn places primacy on professional relevance, achievement, expertise, and affiliations with institutions. Philanthropic captions on this platform will therefore probably be interpreted not just as moral appeals but also claims of leadership and capability.

Studies of self-presentation on LinkedIn help contextualize Gates' profile in this way. Marin and Nilă (2021) describe LinkedIn personal branding as arising from purposive displays of expertise and professional value. Weisi and Hajizadeh (2025) chart pragmalinguistic strategies of self-presentation and self-praise including indirect ("implicit") strategies that enable people to advertise desirable qualities without seeming boastful. Gates' captions can serve a similar function when judgments of worth, examples of projects, and references to institutional cooperation signal expertise by way of explanation rather than self-congratulation.

Leadership communication is necessarily communication with multiple audiences. Palmieri and Mazzali-Lurati (2021) argue that texts like corporate mission statements have "multiple addressees" and internalize the voices of various stakeholders. One of Gates' captions may reach policymakers, scientists, donors, business executives, health-care professionals, and casual followers. Keiper et al. (2025) examine how LinkedIn users position themselves relative to audience and find that executives vary their language use systematically by role and post topic. Wu et al. (2022) explore how leaders communicate via social media to serve as ambassadors for their organizations. The ambassadorship of Gates is enhanced by his hybrid personal-institutional identity, which makes his voices difficult to disentangle.

Ambiguities of perspective bring pronouns into relief. Fladerer et al. (2021) associate frequent CEO use of we with organizing identity around a collective sense of self, and Labrecque et al. (2020) find that pronoun use influences audience responses to brand messages. But a collective we does not always denote egalitarian participation. Orvell et al. (2022) point out that even small pronoun shifts reframe social relations. By using we, high-status individuals in global-health or international-development discourse may universalize empathy while retaining agency and authority for named organizations.

2.3 Stance, Metadiscourse, and Future Orientation

Metadiscourse refers to "the linguistic devices that writers use to structure their discourse, signal their epistemic stance, and interact with their readers" (Hyland, 2005). Online contexts push these elements into brief but salient texts. Biri (2021) approaches social-media metadiscourse reflexively as a result: contributors are managing their own propositions and relations even as they respond to the conventions of the genre (e.g. spontaneity, transparency, conversationality). The present study does not apply an exhaustive metadiscourse lens to a single author's very small corpus. However, it discusses several elements (self-mention, collectivity, modality, and overt stance) through this lens.

Why do these markers matter? Research into corporate communications suggests reasons. Liu and Zhang (2021) argue that metadiscourse helps construct ethos, pathos, and logos in corporate press releases through its ability to guide readers' interpretations, demonstrate writers' confidence, and build relations with audiences. Selfmentions like I believe, I know, I expect, or I'm hopeful could position reader-facing evaluation as transparent introspection on LinkedIn. Modal verbs that signal ability (can, could) make it easier for writers to position technological promises as within reach. Multiple instances of will can help establish determination while making future benefits feel near. Writer.

Jenkins et al.'s (2020) review of health communication on social media suggests that stance helps as well. Readers may judge credibility based not only on formal indicators of evidence but also on whether they perceive a speaker as sincere, competent, and trustworthy. Competency and reliability can vary by genre and platform among science-oriented discourse; they can be enhanced by the use of familiar evidential practices (Boothby et al., 2021). Gates' co-text blends numerical evidence with hopeful first-person vocabulary, which could allow him to draw on two types of authority: objective proof and personal relatability.

2.4 Quantification, Innovation, and Solutionism

Quantification enables institutions to make claims of working effectively. Numbers distill complex suffering into commensurable outputs, identify trends over time, and render intervention seem measurable. This can be ethically and pragmatically important work, especially when pointing to previously ignored harms. However, what gets measured also becomes privileged by what can be counted and attributed to an intervention. In the Gates' rhetoric, mortality rates, percentage points, targets for clinics, and estimates of lives saved can be marshalled to arguments for urgency while also funneling audiences toward programs that will have countable outputs.

There's also a temporal logic that language of innovation embodies. Phrases like progress, breakthrough, solution, access, and scale create associations between investment now and improvement later. Taylor (2021) describes technological solutionism as a kind of policy thinking that approaches complex social issues as if they have singular technical answers. Sharon (2021) argues that we need normative discussions about justice for data-driven health systems rather than assessing them through lenses of efficiency or innovation alone. These critiques are not suggestions that tech doesn't work. They shift analysis to the political assumptions elided when we treat a technological fix as the commonsense or first solution.

Solution-oriented language can also be managerial, not just high-tech. Smith et al. (2023) examine how 'smart economics' language operates through both empowerment and logics of productivity and calculable return. Community-based transport, delivery systems, and partnerships can fall into the same problem-response framework when arguments for their value are centered around ideas of efficiency, scaling, coordination, and outputs. By drawing this distinction I can look for a broader managerial rationality without mislabeling all interventions as technological goods.

2.5 Critical Discourse, Legitimation, and the Research Gap

Critical discourse analysis interrogates how textual resources both enact and are enacted by relations of power. "Key questions concern the process whereby particular representations become taken for granted..., whose interests are served by these representations becoming taken for granted?" (Fairclough, 2013). Systematic analysis of representations on social media therefore demands rigor in attending to aggregatable forms while maintaining sensitivity to medium-specific framing. Tamássy and Géring's (2022) helpful review demonstrates extensive heterogeneity in the operationalization of discourse analysis for social-media research. Of many important contributions, this paper most strongly aligns with their recommendation for explicit rules governing sampling, counting, and coding choices.

Publication itself does not create legitimacy on social media. Illia et al. (2023) helpfully argue that organizational legitimacy results from heterogeneous evaluations coalescing in alignment. The current study does not analyze comments, and does not attempt to measure audience acceptance. By focusing instead on the discursive resources provided for legitimation, we obviate drawing conclusions about persuasive success from rates of engagement. Discursive availability is not conflated with successful public legitimation.

Few existing studies target Gates as the object of research. Alashtary (2024) draws valuable connections between ideological patterns and Bill Gates' representations of artificial intelligence. Fewer studies conceptualize the relationship among stance, quantification, collective responsibility, and institutional agency across Gates Foundation's numerous lines of policy work. An open question—left here as an applied-linguistic exercise for the reader—is how recurring grammar at the caption level moves from problem to evidence, alignment, solution, authorized agency; where that grammar gives way to sincerest forms of low-tech, community-centered, or equity-oriented care.

3. Methodology

3.1 Research Design and Scope

The study employed corpus-linguistic methods as part of a broader digital applied linguistic investigation. A corpus-informed critical discourse analysis approach was adopted with a small purposive sample. Quantitative analyses provided descriptions of repeated lexico-grammatical features and qualitative analyses drew interpretations from them to show how these features worked together to construct problems, audiences, responsibilities, interventions and legitimate actors. The research questions were descriptive and interpretive not inferential. There will be no statistical claims of generalization to all Gates posts, LinkedIn posts in general, or effects on audiences.

Our final dataset included 14 English-language captions verified to have been posted by Bill Gates' official LinkedIn page ("Bill Gates") between 23 September 20[6] and 7 June 20[7]. The 14 items between these dates were filtered as described above. These 14 items comprise the entire analytic corpus discussed in this paper. The temporal boundaries of the dataset are based on the earliest and latest dated items we could find and verified; we make no claims of yearlong completeness.

3.2 Corpus Construction and Source Verification

Posts were selected based on four criteria: (a) posted on Gates' official account; (b) had English-language caption extractable from the public post page; (c) textually related to global health, child survival, climate or clean energy, AI and development, poverty or philanthropic focus; and (d) had a permalink and publication date. Excluded were content not germane to Bill Gates' professional and philanthropic focus (personal updates, books he was reading, promotions), comments authored by others users, repeated displays of identical posts, and content with captions that could not be recovered from the post page. Posts were compared against the publicly available items on Gates' LinkedIn page as of 26 July 2026. Posts are numbered based on date of publication from BG01–BG14. Table A1 in Appendix A lists the publication date, analytic unit, word count of caption, and permalink for each post. Given that LinkedIn posts can be deleted or otherwise changed at any time, the list here serves as part of the audit trail and delineates precisely which public-facing content served as data for this analysis.

Only the authorial caption is included in the text corpus. Linked articles, titles of article previews, totals of other users' reactions, other users' comments, and profile information automatically inserted into the page were removed. For BG08, which is a video caption, the transcript was not included. This ensures consistency across analytic units and prevents longer length texts linked or uploaded to the posts from skewing lexical results.

3.3 Text Preparation and Descriptive Counting

The 14 captions were stored as Unicode text files and processed using an open-source Python 3.12.13 script. Tokens were delimited as contiguous alphabetic strings that included internal apostrophes, hashtag tokens, or alphanumeric strings containing commas or decimal points. Curly apostrophes were normalized. Common contractions were split to tag pronoun counts ("I' m" became "I" + "am") and modal auxiliary counts ("we' re" became "we" + "are"). Hashtag symbols were counted but discarded from the total word count. Hyphenated tokens were separated into alphabetic units. These

decisions yielded a corpus of 1,222 words. The subsequent descriptive analysis entailed counts of total words, words per post, major themes, pronouns (I, me, my, mine), plural/polysingular forms (we, us, our, ours), ability/permission modals (can, could, may, might), deontic modals (must, should), commitment to prediction (will, would), and an explicitly coded list of epistemic/modaleffective stance items. Counts were also compiled for semantic-fields of progress, innovation/breakthrough, solution, scale/access, partnership/institution, and evidence/data/research. Appendix B lists operationalized forms.

Absolute token frequencies were reported, as well as counts and percentages of posts featuring each individual form. Rates per 1,000 words and measures of collocation were not reported because the corpus size is too small to make claims about lexical distributions from these statistics. Consistent with Brezina et al. (2015), collocational associations will be interpreted qualitatively rather than inferred from raw frequency rankings.

3.4 Qualitative Coding and Critical Interpretation

One primary thematic code and one primary rhetorical configuration was applied to each caption. Themes included global health/child survival; climate/clean energy; AI/development; and foundations. Configurations included numerical humanitarian urgency; technocratic innovation/milestones of progress; aspirational institutions fundraising/trading value; and forward-looking techno-optimism. Posts were organized under the configuration that most closely resembled its overall problem–solution logic, though secondary aspects were noted during close reading. Five binarized legitimation strategies were then coded at the post level: (1) problem or need, (2) quantification/evidentialization, (3) collectivization, (4) solution/intervention, and (5) named institutional or expert agency. Quantification included numbers, numbered goals, or written comparisons. Named agency included specific reference to organizations, companies, expert groups or programs, or technical entities. Posts were not required to contain all five strategies to be included in the analysis. The final stage of interpretation draws on Fairclough's (2013) critical approach to identify ways in which these textual patterns produced new forms of digital authority and normalized specific types of problem–solution relationships. Themes included how responsibility and agency are allocated, the legitimation effects of quantification, the temporality of innovation narratives, and the exclusion of structural or redistributive frameworks. Close readings are sorted by post and include the corresponding BG identifier in case any interpretation should be reviewed (see Appendix A).

3.5 Research Quality, Ethics, and Boundaries

Quality was assured via direct source links, clear inclusion criteria, a defined counting dictionary, a post-level coding matrix, and table-corpus script consistency checks. No intercoder reliability coefficient is provided because a second coder did not independently code the corpus. As such, calculating a reliability coefficient would be methodologically inaccurate. Single-coder study is a limitation which is partially addressed via a clear audit trail. Public communications by a public figure were analyzed in this study. No private data were viewed, no users were contacted, no comments were collected, and no ordinary LinkedIn members were identified in the course of this study. As such, this research consisted of documentary rather than human-participant analysis.

4. Results

4.1 Corpus Profile and Thematic Distribution

After verification, the corpus consisted of 14 captions and 1,222 words overall. The captions ranged from 24 words (BG08) to 199 words (BG09) with an average of 87.3 words per caption. Table 1 displays that global health and child survival made up the largest thematic group with eight posts, making up 57.1%. Climate and clean energy made up 21.4% (three posts), AI and development comprised 14.3% (two posts), and institutional philanthropy represented 7.1% of one post.

Consequently, this distribution echoes the purposive relevance criteria and should not be interpreted as such for all topics posted on Gates’ account.

Table 1
Primary thematic distribution of the 14-post corpus

Primary theme	Posts	%
Global health and child survival	8	57.1
Climate and clean energy	3	21.4
AI and development	2	14.3
Institutional philanthropy	1	7.1
Total	14	100.0

Note. Each post was assigned one dominant theme. Percentages describe only the purposive 14-post corpus.

4.2 Corpus Size and Caption Features

Table 2 outlines the primary corpus descriptives. Nine captions (64.3%) featured at least one numerical expression written as digits. These included everything from mortality counts/percentages to dates/targets/clinic counts/lives saved. BG03 was the only caption containing hashtags, and no caption among the 14 used punctuation in the form of a question mark. Interestingly enough, captions did not ask direct questions despite aligning with audiences through pronouns, stance, and shared-future language.

Table 2
Descriptive characteristics of the caption corpus

Measure	Value
Number of verified posts	14
Corpus word total	1,222
Mean caption length	87.3 words
Caption-length range	24–199 words
Posts with digit-based numerical expressions	9 (64.3%)
Posts containing hashtags	1 (7.1%)
Posts containing a question mark	0 (0.0%)

Note. Word counts follow the tokenization rules in Section 3.3 and Appendix B.

4.3 Self-Mention, Collective Reference, and Modality

Table 3 reports stance and engagement. First person singular self-mention totaled 19 mentions across nine posts, or 64.3% of posts; this is precisely the same post coverage as collective reference, which totaled 16 mentions. The surface forms further clarify the relationship: I was used 16 times, my three times, we 13 times, us once, and our twice. You or your did not occur. By these measures, captions oriented readers toward alignment through a speaker-centered I/we relationship rather than direct address in second person.

Distribution of pronouns was functional rather than interchangeable. BG01, for instance, universalized responsibility for future health outcomes via “the choices we make today.” BG03 similarly transitioned from paralysis afflicting “200,000 children each year” to “we” and the last mile of polio eradication. By contrast, BG02 employed I twice to describe a revision of expert opinion on geothermal energy, and BG10 surrounded thoughts of Foundation–OpenAI partnership with I-forms clustered around thinking, believing, and excitement. Collective pronouns tended to align audiences with moral problem. Singular self-mention more frequently authorized speakers to evaluate and select solutions.

As with engagement, will was the modal verb form, occurring 18 times across eight posts (57.1%). Ability and possibility modal forms can and could occurred 13 times across eight posts. By contrast, explicit forms of deontic obligation were comparatively rare: must appeared twice, in BG04 and BG09. Taken together, these results suggest a preference for framing beneficial futures as predictions (will) or grounded in technical possibility, rather than commanding audiences to bring them about. BG09 was unusually future-oriented, employing will to predict improvements in agriculture, healthcare, and education enabled by AI before arguing that innovations “must reach” people in need.

Markers of epistemic and affective stance were used explicitly 15 times across eight posts. This set includes believe, thinking, know, expect, optimist, optimism, optimistic, hopeful, hopefully, excited, and favorite. These items work to construct Gates’ authority as personalized: he comes across as reflective, emotionally invested in his work, and intellectually flexible enough to revise his thinking when warranted. BG07’s closing comment that “optimism comes with footnotes” was especially important in this regard.

Table 3
Stance, pronoun, and modal resources

Resource	Occurrences	Posts	% of posts
First-person singular self-mention	19	9	64.3
Inclusive/collective reference	16	9	64.3
Ability/possibility modality	13	8	57.1
Explicit deontic obligation	2	2	14.3
Predictive commitment	18	8	57.1
Explicit epistemic/affective stance	15	8	57.1

Note. Occurrences are token counts. Post coverage indicates at least one operational form. Explicit stance forms are listed in Appendix B.

4.4 Progress, Innovation, Evidence, and Access

Table 4 combines selected words into lexical sets or semantic fields. Fields with the greatest spread included progress (seven appearances across six posts), forms of innovation (five appearances across three posts), breakthrough (two appearances), solution (two appearances), and forms of scale/access (seven appearances across four posts). These relatively small raw frequencies become notable in

aggregate: the health, AI, and energy captions used these words to argue for a shared language bridging otherwise distinct policy areas.

The semantic work these words did in context varied. Numerical percentages and reference to a named company increased the potential scale of geothermal energy from a formerly “limited resource” to something that could technically work “almost anywhere” in BG02. BG12 telescoped this forward-looking frame further by listing geothermal, fusion, and geologic hydrogen and tying accessible/becoming-accessible, scaling up, and progress to the idea of a clean-energy future. Access and reach also became prerequisites for benefiting equitably from AI in BG09 and BG10.

Posts leveraged evidence/data terminology rather than distributing it evenly. Evidence/data/language about research comprised 11 appearances concentrated in three posts, particularly BG13 and BG14. BG13 opened with Gates’s “favorite chart,” deemed the reduction in under-5 mortality “the strongest evidence that progress is possible,” and then pivoted with but to contrast that with slower improvement on stillbirth. BG14 mentions research, sharing data, blood tests, researchers, and clinical trials all in one post, along with a reference to Gates’ father. This posts links specialized evidence with family feeling, so that scale becomes as much a scientific limitation as a moral aspiration.

Table 4
Selected semantic fields in the captions

Semantic field	Occurrences	Posts	% of posts
Progress	7	6	42.9
Innovation	5	3	21.4
Breakthrough	2	2	14.3
Solution	2	2	14.3
Scale/access	7	4	28.6
Partnership/institution	4	2	14.3
Evidence/data/research	11	3	21.4

Note. Fields were counted from predefined surface forms; they are descriptive groupings, not statistically derived topics or collocations.

4.5 Rhetorical Configurations

The captions at or above synthesis level clustered around four configurations, shown in Table 5. Quantified humanitarian urgency appeared most frequently and constituted six posts (42.9%). Typically these captions would frame mortality, paralysis, maternal health emergency, or disease burden in numerical terms and escalate their moral implications. Posts featuring technocratic innovation and progress constituted five posts (35.7%) and linked energy or artificial intelligence to availability, innovation, and scalable futurity. Future-oriented optimism and institutional aspiration each constituted two posts (14.3%) and one post (7.1%), respectively. Finally, BG06 centered around institution aspiration and resource mobilization.

BG05 was representative of quantified humanitarian urgency. The caption moved from “4.6 million children” dying to “more than 200,000 additional children” threatened with death to “thousands of classrooms” filled with missing children. From here, the Goalkeepers Report served as an institutional site of evidence. Taglines like “do more with less” reframed decreasing budgets as

problems in efficiency. “Together, we can” opened up moral obligation to act, but did not clarify who would ultimately hold decision-making power.

BG06 centered institutional aspiration. Three numbered points articulated Foundation targets for preventing mortality, infectious disease, and poverty into a twenty-year agenda. Caption discourse moved from “our work” to “I know,” suggesting ownership by the Foundation while converting it to personal knowledge. Resources were treated as conditional, but actors responsible for priority-setting and resource distribution were positioned as the Foundation and its network.

Table 5
Dominant rhetorical configurations

Dominant configuration	Posts	%
Quantified humanitarian urgency	6	42.9
Technocratic innovation and progress	5	35.7
Institutional aspiration and resource mobilization	1	7.1
Future-oriented optimism	2	14.3
Total	14	100.0

Note. Each post received one dominant configuration after post-level close reading.

4.6 Recurring Discursive Legitimation Pathway

Figure 1. Overview of recurrent caption-level pathway constructed from binary coding. Proportion of posts engaging with each attribute are shown in parentheses. Image description:

Of 14 posts, 12 (85.7%) identified a problem/need; 9 (64.3%) employed quantification/evidentialization; 9 (64.3%) invoked collective reference; 11 (78.6%) posited a solution/intervention; and 10 (71.4%) named an institutional, organizational, or expert agent. A single diagram cannot illustrate every caption verbatim. Instead, this figure illustrates a recurrent pattern. Captions sometimes omitted, reordered, or telescoped these stages.

BG10 opened with poverty, hunger, disease, and unequal healthcare access; then framed AI as a gamechanger; and named the Gates Foundation, OpenAI, African leaders, and a target of 1,000 clinics. BG11 opened with maternal emergency and transport delay, quantified response times and lives saved, and positioned m- mama’s community-driven network as the solution for coordinating care. This second example is important because it demonstrates that this grammar is not exclusive to high-tech interventions. Social infrastructure and logistical networks can be legitimized through the same terms of quantifiable needs, coordination, and scalable impact.

No caption explicitly referenced redistribution, public ownership, taxation of private wealth, labor, or democratic decision-making over philanthropic goals. Language around funding-constraints appears in BG04–BG06. Phrases implying equity/access were only explicit in BG09 and BG10. Across the corpus, smarter allocation, innovation, partnership, or delivery of resources remained the dominant modality of response. To be clear, this claim does not mean that Bill Gates might not think those

things are important if prompted outside of these 14 slides. This claim only describes what made discourse prominent across these slides.

Figure 1

Recurring caption-level discursive legitimization pathway



Note. Counts indicate posts containing each mechanism. The pathway is recurrent, not mandatory; captions may omit or reorder stages.

5. Discussion

5.1 Stance and the Performance of Accessible Expertise

The results above provide one answer to research question 1: How was authority and audience alignment constructed through stance, pronouns, and modality? The balanced distribution between singular self-mention and we references – nine posts each – displays Gates’s double personae. On one hand, he came across as a judging individual who thinks, believes, knows, expects, hopes, and revises his opinions. On the other hand, he spoke from within a collectivity, using we references to describe actions and states. These tendencies align with LinkedIn’s professional genre logic; expertise must be established but cannot take the form of outright bragging, which can instead be obfuscated through distancing tactics and appeals to the public good (Weisi & Hajizadeh, 2025). They also build on prior work on executive positioning by demonstrating how personal stance can bolster institutional legitimacy across sectors/topics of policy rather than simply enact a corporate identity role (Keiper et al., 2025).

What is also notable is what’s missing: Gates almost never constructed followers as addressees with you and your. Alignment was most commonly couched in terms of a shared horizon – temporal (most “days” and “years”) and moral (most “shoulds”). “We” are confronted with challenges from climate, make decisions, have protected gains, and will hand off to younger generations. Regarding metadiscourse, the captions were interactional without being interactive in the narrow Q&A sense (Biri, 2021; Hyland, 2005). The zero frequency for question marks and clustering of hashtags in single post lends credence to this reading.

Finally, Gates’s alternation between self and collectivity also nuances optimistic readings of we-referencing. Using we language can build collective identity and foster audience engagement (Fladerer et al., 2021; Labrecque et al., 2020). Yet as this research notes, its political impact is conditional on “co-occurring agency assignments”. Who or what did the “we” own, who was obligated, who would bring about the future? In this corpus, either Gates personally or we owned the problem, the obligation, or the desired future state, while I, the Foundation, companies, researchers, artificial intelligence, and expert partnerships more frequently performed the work of evaluating or delivering the solution. In short, inclusive language narrowed social distance without disrupting the interpersonal hierarchy of authority.

5.2 Quantification and the Moral Organization of Problems

The second framing question asked how problems and interventions were framed. Digit-based numerals appeared in nine posts, and nine more posts were coded qualitatively for

quantification/evidentialization. Mortality totals, % forecasts, clinic numbers to target, lives-saved estimates, and scale of clinical trials translated heterogeneous problems into a uniform language of quantified need and quantified solution. These cues may bolster perceived scientific legitimacy on social media (Boothby et al., 2021), especially when tethered to known reports, graphs, companies, or researchers.

The substantive point is not that these numbers were irrelevant or that they were necessarily deceptive. BG05's mortality numbers and BG11's maternal emergency endpoints both describe real stakes for real humans. The problem is that quantification formats relevance. Littoz-Monnet and Osorio Garate (2024) describe philanthropic knowledge-making as a mechanism of global governance because it makes certain things visible and actionable. Here, in the specific dataset of problem interventions on Gates' official social media feeds, numerically described problems translated smoothly into interventions that philanthropy can pay for, test, coordinate, or scale up.

BG13 enacts its own reproach to measurement. This paired post first congratulated itself on a graph of improvement in child mortality, then clarified that "this graph doesn't tell the full story. For stillbirths, the slope is less steep and we need to do more" (fig. 3). The caption confirms that Gates' Facebook presence is not universally self-congratulatory, and that data can be discursively used to expose gaps as well as accomplishments. That said, the caveated problem is also inserted into a measurable relation with a quantifiably successful benchmark.

5.3 Innovation, Prediction, and Solution-Oriented Authority

The third research question concerned how captions allocated responsibility and agency in discursive constructions of global development authority. The recapitulated pathway above from problem/evidence to collective alignment/intervention/executed solution/named agency helps answer it. Framing a solution/intervention occurred in 11 posts and invoking named institutional or expert agency occurred in 10. This regular grammar positioned private foundations, firms, partnerships, programs, researchers, and technologies as vehicles through which shared moral objectives could be operationally achieved.

Predictive modality amplified that pathway. Will totaled 18 uses, over twice as many as can and could combined. Repeated promises of future action made innovation seem like less of an option and more of an inevitability: AI will help with guidance, health care will improve, tests will help us screen more children, and energy technologies will help us find new solutions. To repeat: the implied progression toward which expertise and investment are positioned strengthens digital authority by making it future-oriented. Canfield's ((20)23) framing of innovation ideology aids explanation here. Technological or market-compatible pathways toward shared values can take on a sheen of forward-facing self-evidence, while structural alternatives can appear stagnant, unrealistic, or simply nonexistent.

That said, the corpus muddies the waters on a totalizing accusation of technological determinism. BG09 clearly stated equitable impacts would not be automatic and that innovators would have to bring AI to those who need it. BG04 advocated for protecting health and development funding instead of prioritizing climate technology above all else. Both of these sentences qualified the merit of innovation by acknowledging political distributions of technology and resource scarcity. The solution, however, was not to renegotiate who controls the terms of the debate. Better access, funding protection, partnerships, and delivery were the proposed antidotes to misdistribution, not political reform. As such, Taylor' ((20)21) critique of solutionism is more usefully applied to the level of problem-response grammar than as an argument that the captions were oblivious to equity.

5.4 The m-mama Transport Post as a Community-Based Counter-Case

BG11 is critical because it is the strongest qualifying example. This was first and foremost an intervention by means of community-based transport network utilizing cars, bicycles, boats, and

horses—it was not the result of laboratory innovation or cutting-edge software. Drivers were positioned as essential agents in operations at the community level. This insight ensures that the solutionism described above (which was prevalent throughout the corpus) cannot be wholly reduced to technological exceptionalism and allowed for local agency to be considered. This did not occur, however, without the caption adhering to key tropes of the managerial grammar. There was a problem that needed solving (delayed emergencies); the program’s legitimacy was provided by quantitative figures (>125,000 responses, ~5,266 lives saved); and value was communicated as minutes that count. Measurable, coordinated solutionism was therefore the relevant common denominator. This case can therefore be aligned with Adewoye et al. (20 23) and Smith et al. (20 23) finding that market-based development discourse has the ability to frame empowerment and localization through efficiency, entrepreneurship, and performance measures.

5.5 Applied-Linguistic and Critical Media Literacy Contribution

By analyzing legitimation work at the micro-level of language, the paper offers contributions to digital applied linguistics and discourse studies. Pronouns, modals, stance markers, evidential resources, semantic fields, and other categories did not appear discretely as stylistic effects. Recurrent bundles instantiated a familiar relationship: someone acting as a contemplative expert observes a quantified issue, forges a group around the timeliness of tackling it, and proposes a solution administered by prepared institutions and flows. Relating lexico-grammatical patterning to forms of social agency is the paper’s primary applied-linguistic takeaway.

For researchers studying communications crafted for heterogeneous audiences, this narrative helps explain how such strategies work. Gates’ captions spoke to widely distributed audiences. They avoided you, summoned intersecting subject positions, and fused personal narrative with scientific authority, humanitarian urgency, and business opportunity all at once. Polyphony like this could be unpacked further to account for how seemingly accessible communication can simultaneously communicate salience to elite audiences such as policymakers, donors, scientists, and business leaders (Palmieri & Mazzali-Lurati, 2021).

Teachers of critical media literacy could also begin analysis there. Readers might ask themselves questions such as: How is the problem quantified? Who does we include? Who judges the evidence? Which solution is foregrounded? Which actors gain operational agency? Which options are foreclosed? These questions don’t ask readers to disparage philanthropy or denounce innovation. They help readers see how voice, authority, and political possibility is allocated.

5.6 Limitations and Future Research

This research is limited by the convenience-sample size. While 14 posts is large enough for transparent close reading analysis, it is too small to claim it analyzes all Gates’ LinkedIn activity or shows changes over time. These posts also were included or excluded based on topic relevance to the research question. Therefore, percentages in this paper should only be understood to describe this sample of 14 posts.

This research considered post captions, not full multimodal LinkedIn activity. Posts’ images, article contents, video transcripts, editing activity, comments, or engagement results are not included in this paper. Therefore, the paper offers no findings related to visual-grammar, intersemiotic translation, or reception studies. This paper’s coding was conducted by one coder. No intercoder reliability statistic can be provided. Future researchers should archive a sample of posts defined a priori that includes allowed screenshots or descriptions of media content, include at least two coders trained on the codebook, preregister visual and linguistic categories, and compare across different world-leading philanthropists or organizational accounts.

Such a study could also quantify if the pathway described in this paper changes when discussing different topics, using different linked-content media, or before and after major political events.

Analyzing comments could reveal whether Gates' followers accepted, challenged, or otherwise redeployed the legitimization resources offered by Gates. Such analysis would be a valuable extension because organizational legitimacy is contingent on audience reaction, not authors' statements alone (Illia et al., 2023).

Despite these limitations, this analysis provides an initial explanation for how Gates uses LinkedIn that is grounded in empirical observations: Gates' post captions construct accessibility, shared sacrifice, quantified harm, and expert efficiency while avoiding discussion of the power structures governing philanthropy.

6. Conclusion

This pilot study took 14 authenticated Bill Gates LinkedIn captions and broke them down to show how stance, modality, quantification, and agency choices pattern to produce technocratic authority online. In 1222 words, Bill Gates mentioned "I" or "we" nine times each and used will futures 18 times. His captions regularly quantify global issues and associate them with progress nouns and access verbs. Solutions quickly follow that refer to the work of foundations, companies, programs, name-dropped experts, or technologies. Overall, the consistent legitimization strategy spreads moral accountability widely but places instrumental agency with identifiable experts and institutions. Qualifiers like the m- m ama caption or his unambiguous use of equity in the AI captions caveat a solely techno-centric interpretation; recurring discourse trend is quantifiable, administrative solutionism. Linking linguistic features to depictions of responsibility and agency gives digital applied linguistics and critical discourse studies an observable, post-by-post analysis. Claims made can be reassessed with the documented 14 post dataset.

Data Transparency Statement

Appendix A includes the full source register for the 14 captions treated in this article. Appendix B details the primary counting/coding rules. Captions are accessible via canonical LinkedIn permalinks where possible, per platform terms. Analysis script + coding matrix may be stored with records of the research for editorial/reviewer reproduction. Corpus does not claim to include all Gates posts made during the time frame.

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Appendix A

Table A1

Complete register of the 14 verified LinkedIn posts

ID	Date	Analytical focus	Words	Source
BG01	2025-09-23	Global health and child mortality	54	Post
BG02	2025-09-30	Geothermal energy	50	Post
BG03	2025-10-18	Polio eradication	42	Post
BG04	2025-10-29	Climate, health, and aid	67	Post
BG05	2025-12-06	Goalkeepers and child mortality	93	Post
BG06	2025-12-20	Gates Foundation aspirations	81	Post
BG07	2026-01-12	Global progress and childhood mortality	93	Post
BG08	2026-01-13	New-year global-health optimism	24	Post
BG09	2026-01-19	AI in agriculture, health, and education	199	Post
BG10	2026-01-23	AI and Horizon1000	86	Post
BG11	2026-03-08	m-mama maternal emergency transport	100	Post
BG12	2026-03-27	Next-generation electricity	109	Post
BG13	2026-05-02	Stillbirths	82	Post
BG14	2026-06-07	Alzheimer's research	142	Post

Note. Focus labels are analytical descriptions rather than reproduced post titles. Word counts refer to captions only; linked articles, comments, and media transcripts were excluded.

Appendix B

Table B1

Operational counting and qualitative-coding rules

Category	Operational rule
Self-mention	I, me, my, mine after contraction expansion.
Collective reference	we, us, our, ours after contraction expansion.
Ability/possibility	can, could, may, might.
Deontic obligation	must, should only; lexical need was not treated as a modal.
Predictive commitment	will, would.

Category	Operational rule
Explicit stance	believe, think/thinking, know, expect, optimist/optimism/optimistic, hopeful/hopefully, excited, favorite.
Quantification/evidence code	Statistics, ordered numerical goals, explicit comparative quantities, reports, charts, tests, trials, data, or researchers used to authorize a claim.
Solution/intervention code	A proposed technology, program, funding action, partnership, delivery system, or named response to the identified problem.
Institution/expert code	A named foundation, company, program, partnership, researcher group, or technical actor represented as capable of action.

Note. All categories were applied to the authorial caption only. A post could receive multiple binary mechanisms but only one dominant theme and rhetorical configuration.



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FULL PAPER

Epistemic Possibility and Textual Source Voice in AI Technology Journalism: A Corpus-Assisted Case Study of May, Might, Could, and Likely, 2022–2026

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Abstract

AI journalism often couples statements about current technical capability with predictions whose realization is uncertain. This exploratory, corpus-assisted case study investigates may, might, could and likely in 20 criterion-based TechCrunch AI articles, chosen as two eligible articles from two fixed 14-day windows each year, 2022–2026. On October 4, 2026 a script was executed to audit the captured canonical pages, raw html, cleaned editorial text and verification logs. Case-insensitive, whole-word searches in headlines and editorial bodies yielded 40 target tokens. Was was the most frequent form ($n = 16$, 40.0%) and occurred in nine articles, but only 7 of the 16 occurrences (43.8%) were epistemic; the other nine were capacity or affordance. Epistemicity was found in 10 of the 12 may tokens (83.3%) and all the might and likely tokens. Of these, 29 (72.5 %) were epistemic. One watermarking article in 2023 accounted for 8 of the 40 tokens, so removing it dropped the proportion of all target tokens in 2023 from 22.5% to 3.1%. Two blinded machine-assisted coding passes agreed on 35 of 40 semantic codes (87.5%; $\kappa = .679$). This is an algorithmic audit diagnostic, not human inter-rater reliability. The findings are descriptive, entirely auditable, and limited to this small, purposively bounded corpus.

Keywords: epistemic modality, uncertainty, artificial intelligence, technology journalism, corpus-assisted discourse studies, modal verbs, source attribution

Introduction

Public prognostication has entered the realm of artificial intelligence (AI). Technology reporting is about systems whose capabilities, commercial trajectories, regulatory consequences, and social effects are often unknown at the time of writing. This means journalists should report what might be important without claiming it already is. For this task, one resource is epistemic modality. Epistemic modality encodes the degree of commitment to a proposition and distinguishes between observation, inference, prediction, and scenario building.

Lab studies suggest that expressing uncertainty doesn't have to destroy trust. The five experiments, including a BBC News field experiment, conducted by Van der Bles et al. (2020) found that explicit uncertainty increased perceived uncertainty but led to small reductions in trust, mostly for verbal rather than numerical formats. Figure 1. Map showing the research area. In a precision medicine case study, Ratcliff (2021) found that press releases tended to omit research limitations, while some news reports included caveats. Capurro et al. (2021) found uncertainty to be a master frame in coverage of the early COVID-19 pandemic in Canadian newspapers, as readers sought to make sense of emerging evidence and policy responses (p. These results do not offer a one-size-fits-all rule for AI journalism, but they do point to uncertainty being conveyed through identifiable textual choices.

AI reporting has a peculiar semantic problem. Often claims about what a system can do include predictions about what could happen as a consequence of that system. Thus, a surface search for possibility markers can conflate epistemic assessment with ability, affordance, and circumstantial enablement. Carretero (2023) manually distinguished epistemic from non-epistemic forms and tagged the source voice in newspaper discourse, demonstrating the need for contextual checking in lexical retrieval. Hollmann et al. (2024) also found that, in a corpus of Japanese undergraduates, could was frequent but overwhelmingly expressed ability rather than epistemic possibility.

The AI news study has largely focused on frames, actors, sentiment, headlines, or narratives. Artificial Intelligence: Potential and Dangers for Meta-Journalistic Reporting, Shaikh Moran. 2022. Roe and Perkins (2023) argue that the UK's stories about ChatGPT and AI create a duality between systemic/immediate threat and social opportunity. Nguyen and Hekman (2024) analyzed a sample of 3,098 items and found that debate about AI news grew more critical over time. After the release of Chatbot, Ryazanov et al. (2025) observed a tenfold increase in attention and a stronger association between AI and risk/hazard. Cross-national and actor-centered studies also noted variation in frames, sentiment, and source standing (Ittefaq et al., 2025; Zai et al., 2025). After analyzing 25,595 news articles about AI, they found a strong future orientation and a slight preference for opportunity over risk.

These macro-level studies do not consider whether a given prospective statement is grammatically qualified, whether a modal refers to technical capability rather than probability, or whether an assessment is part of reporter narration or attributed source discourse. This more targeted measurement problem is tackled in the present study on a small, time-stratified sample of specialist technology journalism. Rather than estimating language change across technology journalism as a population, it is explicitly exploratory, testing the validity of four candidate markers and how sensitive descriptive patterns are to article composition.

Research Questions

RQ1. What are the frequencies, shares, and article-level incidence of may, might, could, and likely in the sampled AI technology journalism?

RQ2. To what extent does each marker express epistemic uncertainty rather than ability, technical capacity, circumstantial possibility, or a fixed expression?

RQ3. How does the distribution of the four markers vary across the 2022–2026 sampling periods, and how sensitive is the pattern to document-level concentration?

RQ4. Among epistemic occurrences, how are assessments distributed between journalist-text and attributed-text loci, and how sensitive is that distribution to quotation-rich articles?

Literature Review

Contextual Analysis of Epistemic Modality

Epistemic modality is concerned with the speaker or writer's evaluation of the possibility, probability, evidence or truth of a proposition. Speakers and writers express it through modal auxiliaries and a wider range of lexical and grammatical resources. For instance, Carretero (2023) examined epistemic modal and evidential expressions in 400 articles published in The Guardian in two stages of the COVID-19 pandemic. The study manually distinguished between epistemic and non-epistemic instances and between writer, direct-report, and attributed voices. The procedure is relevant to the present study because the same surface form can be assigned different semantic functions. The four focal forms occupy different positions in this system. May and might tend to describe a situation as possible without commitment. Likely describes probability in adjectival or adverbial constructions. Could is more polyfunctional. In a corpus of Japanese undergraduates, Hollmann et al. (2024) report that only 3 of 148 instances were epistemic, while 143 expressed ability. Technology journalism has a similar pressure to classify. Its reports regularly speak to what software, models, devices or users can technically do. Thus a dictionary of uncertainties with only a form may contain capacity claims as epistemic hedges. Contextual analysis also requires transparent choices of methods. Curry et al. (2024) found that ChatGPT altered input and produced false concordance inferences in replication tests, showing that model-generated interpretation cannot replace direct corpus evidence. Gillings and Jaworska (2025) likewise show that, in discourse-topic identification, the analytical method and available textual context can affect the topics identified and labeled. Consequently, the present design separates deterministic retrieval from contextual classification and retains a token-level audit trail.

Uncertainty, Attribution and Textual Origin

Uncertainty in journalism can be deployed to buttress claims and signal the limits of evidence. The result depends on the way it is communicated: numerical and verbal expressions do not evoke the same trust reactions (van der Bles et al., 2020) and limitations can be lost or restored as information passes through dissemination stages (Ratcliff, 2021). Uncertainty can also be an organizing frame rather than simply a lack of knowledge in fast-moving events (Capurro et al., 2021).

Source attribution is a textual difference which is useful for annotation. Reporter narration or direct or explicit quotations of source discourse may contain uncertain propositions. Attribution can foreground the source's assessment and background the journalist's evaluative role (White, 2012), but does not necessarily transfer pragmatic responsibility. Thus, the textual-locus variable codes for where an assessment occurs in the text, not for reporter endorsement, belief, or legal or moral responsibility.

Actor-focused AI-media research encourages attention to provenance. In AI reporting, Zai et al. (2025) found that economic and scientific actors had high standing, and that journalists themselves provided considerable contextualization. Dominant were progress and economic-consequence frames; underrepresented were ethics and morality. One way to study how journalists encode such source visibility in the grammar of single forecasts is through token-level attribution analysis.

AI News: Potential, Danger and Forward Focus

AI news often shows discursive ambivalence. Moreover, Cools et al. (2024) found that between 1985 and 2020, two elite U.S. newspapers provided more hopeful than pessimistic coverage, with ethical dilemmas prominently featured in dystopian frames. Early headlines about ChatGPT in the UK, according to Roe and Perkins (2023), 'mixed warnings of imminent, systemic danger with societal promise'. Nguyen and Hekman (2024) analyzed 3,098 articles from The New York Times, The Guardian, Wired, and Gizmodo and found that discourse around AI became increasingly critical over time, particularly regarding risk references to surveillance, data bias, cyberwar or cybercrime, and information disorder.

The evidence base grew after ChatGPT arrived, but researchers' methods have changed. Ryazanov et al. (2025) reviewed 5846 articles and found that interest in AI increased tenfold in the six months after ChatGPT's release; fears about AI and perceptions of it as a threat also increased. Ittefaq et al. (2025) examined framing, sentiment, and trends in newspapers from 12 countries from 2010 to 2023. To identify possible future directions, Jhan and Kuriakose (2026) reviewed 25,595 AI-related headlines published from August 2024 through December 2025. Wang et al. (2026) identified two general perspectives on AI in journalism—optimistic and pessimistic—in American, French, and Chinese media.

These studies show the benefits of prospective evaluation but tend to use documents, headlines, topics, or frames as units of analysis. They do not determine whether a given modal evaluates a proposition or characterises an affordance or occurs in reporter and not source discourse. This larger project can be enhanced by a corpus-based study of local form-meaning relations.

Method

Design and Scope

The study used a corpus-assisted case study design consisting of a mixture of deterministic lexical retrieval, contextual semantic coding and descriptive quantitative analysis. The retrieval unit was a single instance of one of the four target forms. The unit of analysis was a news story. This is an exploratory study and makes no claims that 20 articles are representative of TechCrunch, or English language technology journalism, or AI discourse more broadly.

Sampling and Corpus

The sampling frame was TechCrunch's public AI category (category ID 577047203; <https://techcrunch.com/category/artificial-intelligence/>) enumerated via the publisher's WordPress REST endpoint. The observation period was from 1 January 2022 to 31 August 2026; 2026 was thus a partial-year stratum. Article text and metadata were provided by canonical article pages. Appendix A lists all 20 retained sources, and Appendix B lists the archived source, extraction, and verification artifacts.

All strata used two fixed inclusive 14-day windows: Window 1, March 1–14, and Window 2, August 1–14. The windows were established before token collection and are about 5.5 months apart, both within the partial 2026 stratum. For each window, we queried the category endpoint in ascending order of publication date and recorded the exact query URL and the result position for each candidate.

An article was considered AI-focused if its primary subject was an artificial intelligence (AI) technology, an AI system or model, machine learning, generative AI, autonomous robotics, or the governance, business, research, or deployment of such a system. It had to be identifiable in the headline, dek, or lead and developed substantively in the editorial body; a passing reference to AI, or to a company known only in passing to use AI, didn't qualify. Eligible items were English editorial news, analysis, feature, interview, or roundup posts published by TechCrunch with a stable editorial body. Sponsored/partner material, event promotion, newsletters, podcasts, profile pages, video-only or gallery-only pages, duplicates, and pages without an accessible canonical article page were omitted.

The four target forms were not reviewed for eligibility. The first two articles identified by the AI-focus and article-type checks within a one-year window were selected in ascending order of displayed-publication-date; ties on the same date were resolved by canonical URL. If fewer than two eligible articles were available, we moved the window forward one day at a time up to seven days, noting the departure. No such extension was needed. All 20 final canonical URLs are stored in the source register along with selection ranks.

Table 1

Corpus composition and audited target-token yield by sampling period

Year	Article	Coverage	Target tokens
2022	4	Mar. 1–14 & Aug. 1–14	15
2023	4	Mar. 1–14 & Aug. 1–14	9
2024	4	Mar. 1–14 & Aug. 1–14	3
2025	4	Mar. 1–14 & Aug. 1–14	7
2026	4	Mar. 1–14 & Aug. 1–14	6
*			
Total	20	—	40

Note. The sample contains four articles per stratum. The equal article count supports only descriptive, article-balanced comparison. *2026 is partial-year coverage through August 31.

Retrieval and Source Reconstruction

All retrieved canonical pages were retrieved on October 4, 2026. Each page returned HTTP 200 on the first request and on one reload; the final canonical URL, redirect chain, retrieval timestamp, raw-HTML filename, and content hash are recorded in `source_register.csv` and the per-page access logs. The `REST` field `post.content.rendered` was used by the publisher to identify editorial content. The cleaned corpus kept the headline and the `p`, `h2`, `h3`, `li`, and `blockquote` text from that field. Scripts, styles, figures, asides, navigation, advertising, subscription prompts, recommendation modules, author bios, boilerplate, and comments were filtered out. The raw HTML and cleaned text were archived in the supplementary reproducibility package; thus, this study is reconstructing the live-page version as captured, not claiming the wording seen at first publication.

Token retrieval was scripted using Python 3.12. The code employed whole-word, case-insensitive regular expressions (`\bmay\b`, `\bmight\b`, `\bcould\b`, and `\blikely\b`) to match each cleaned headline and editorial body. For each result, Supplementary Data S1 provides the exact retrieval pattern, paragraph number, character offsets, sentence snippet, three-block context, canonical URL, capture time, and text hash. The script generated 40 valid tokens: 12 may, 7 might, 16 could, and 5 likely. An instance of ‘likely’ within ‘unlikely’ would not satisfy the word-boundary expression; calendar-month uses of ‘May’ would be preserved by the script but coded as non-epistemic if present. We report raw counts and article incidence, not normalised rates, because this small corpus is for contextual auditing, not rate estimation.

Coding in Context

The binary semantic and textual-locus rules were completed prior to coding the regenerated corpus. Each token was read in relation to its sentence and the surrounding editorial blocks. An epistemic token evaluates the truth, probability, inference, prediction or possible realisation of a proposition. Ability/capacity, affordance, and circumstantial or practical enablement are not separate count categories, but one umbrella code: ability/capacity refers to what an actor or system can do; affordance refers to a function made available by a design; and circumstantial or practical enablement refers to what conditions make an action feasible. A token may fit more than one of these examples but receives one non-epistemic code. The umbrella also includes fixed/conventional expressions. During manuscript revision, the relation between those examples was clarified, and no subcategory was added, and no token code changed. The distinction was particularly important for could: a claim that a system could generate images was coded non-epistemic when it meant “was capable of generating,” while a claim that an outcome could occur was coded epistemic when it meant “it was possible that. The fixed expression, as the case may be, would be retained in lexical retrieval but coded as non-epistemic.

Textual locus is the only operational term for the textual location of an epistemic assessment. Journalist-text locus is reporter narration without explicit external attribution. Attributed-text locus: a direct quotation or an explicitly attributed paraphrase of an external source. Textual locus was coded only for epistemic tokens; it does not measure endorsement, responsibility, or private belief on the part of a writer. The broader phrase textual source voice is used only as a conceptual description, not as a distinct coding variable.

Table 2

Operational coding framework

	Do	C	Rule	Reading
main	ode			
antic	Sem	E	Grades a proposition’s truth, probability, inference, prediction, or possible realization.	Possible or probable proposition.
antic	Sem	N	One umbrella: ability/capacity, affordance, enablement, permission, or fixed expression; examples are not separate subcounts.	Capacity or feasibility, not probability.
ual locus	Text	J	Epistemic assessment in reporter narration without explicit attribution.	Journalist-text locus.
ual locus	Text	A	Epistemic assessment in quotation or explicitly sourced paraphrase.	Attributed-text locus.

Note. E = epistemic; N = the single non-epistemic umbrella code; J = journalist-text locus; A = attributed-text locus. Textual locus is assigned only to epistemic tokens.

Audit, Coding, and Machine-Assisted Duplicate Check

Candidate enumeration, page retrieval, HTML capture, editorial-text extraction, hash generation, token retrieval, and aggregate calculations were all scripted. For contextual coding, we used the pre-finalized protocol in Table 2. All 40 token records were coded in two independent, blinded machine-assisted passes: gpt-5 as the primary pass and gemini-3.1-pro-preview as the duplicate pass. They received the

same protocol and context, but not the other pass’s labels. The supplement includes all decision notes, both coding files and the full prompt, and unprocessed model outputs.

The duplicate pass is not human second coding; its agreement statistics are not human interrater reliability. As an algorithmic audit diagnostic, the two passes agreed on 35 of 40 semantic classifications (87.5%; Cohen’s $\kappa = .679$). Of the 27 tokens both passes tagged as epistemic, textual-locus labels agreed for all 27 (100.0%; $\kappa = 1.000$). Five disagreements were adjudicated against the published protocol by inspecting the archived context; each preliminary label, final decision, and rationale is shown in adjudication_log.csv. A substantive limitation is that we still lack independent human coding, so we present the results as exploratory machine-assisted classification, rather than as a validated human-coded estimate.

Analysis

In the analysis raw frequency, share of all target tokens, article incidence, yearly distribution, semantic status and textual locus among the epistemic tokens are reported . Significance tests are not reported, as tokens are nested within articles that are purposively bounded, and the corpus is not a probability sample. We conduct a document-concentration sensitivity analysis, removing the single 2023 watermarking article with eight target tokens. This shows the impact of one document on descriptive totals.

Results

General Distribution and Incidence of Articles

There are 40 valid target tokens on the audited pages. Could is the most frequent form (16 tokens, 40.0%), may is second (12, 30.0%), might is third (7, 17.5%), and likely is fourth (5, 12.5%). Could is the most common document, appearing in 9 of the 20 articles (45.0%). These are counts of raw forms and not measures of epistemic function.

Table 3

Frequency, share, and article incidence of the four target forms

Marker	Tokens, n	Share	Articles	Incidence
may	12	30.0%	6/20	30.0%
might	7	17.5%	5/20	25.0%
could	16	40.0%	9/20	45.0%
likely	5	12.5%	4/20	20.0%
Total	40	100.0%	—	—

Note. The incidence of an article is the number of sampled documents that contained it at least once, not a rate per word, normalized or otherwise.

Distribution over sampling time

The five strata are descriptively different: 2022 contains 15 target tokens, 2023 contains 9, 2024 contains 3, 2025 contains 7 and the partial 2026 stratum contains 6. These numbers do not support a temporal trend at the population level. The 2023 total is document-sensitive: one watermarking article accounts for 8 of its 9 tokens. The effect of excluding that document is shown in Figure 1 and Table 7.

Table 4

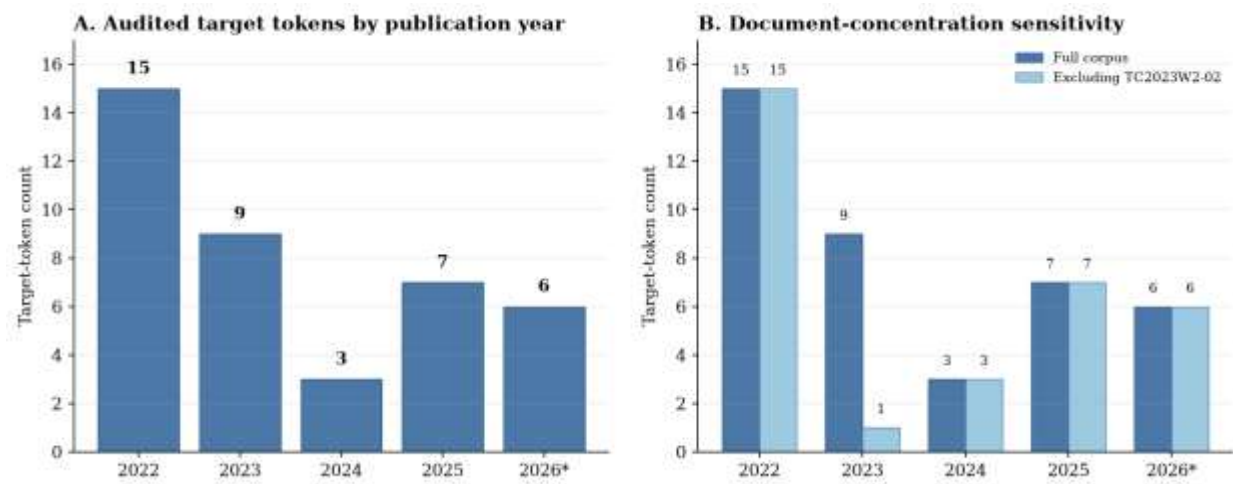
Distribution of target forms by publication year

Year	may	might	could	likely	Total	Token ns/article
2022	5	3	5	2	15	3.75
2023	1	3	4	1	9	2.25
2024	0	1	1	1	3	0.75
2025	3	0	4	0	7	1.75
2026*	3	0	2	1	6	1.50
Total	12	7	16	5	40	2.00

Note. *2026 covers January 1 through August 31. Tokens per article is an article-balanced descriptive index, not a word-normalized rate.

Figure 1

Temporal Distribution and Document-Concentration Sensitivity



Note. Panel A shows raw audited counts for four sampled articles per stratum. Panel B excludes the eight-token 2023 watermarking article (TC2023W2-02). *Reflects partial-year coverage for 2026.

Epistemic and Non-Epistemic Usage

Contextual coding showed that 29 of the 40 tokens (72.5%) were epistemic and 11 (27.5%) were non-epistemic. All might and likely tokens were epistemically. Of the 12 may tokens, 10 (83.3%) were epistemic; Could was less specialised: 7 of 16 tokens (43.8%) were epistemic, with 9 being ability, technical-capacity, or affordance uses. Thus, a form-only approach would more than double the observed epistemic count for could in this corpus, from 7 to 16.

Table 5

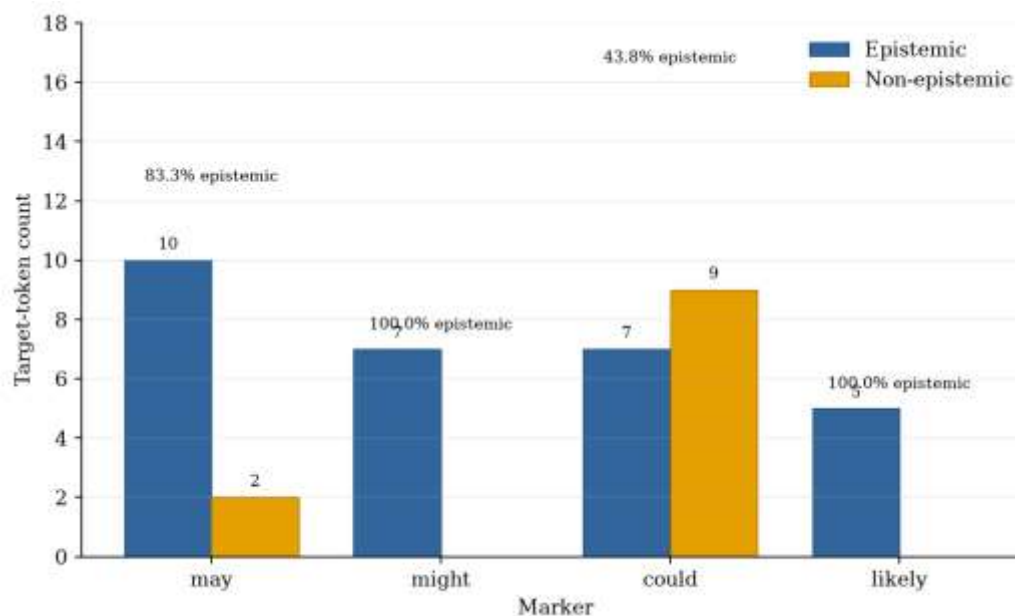
Semantic classification of the four target forms

Marker	Epistemic	Non-epistemic	Total	Epistemic %
may	10	2	12	83.3%
might	7	0	7	100.0%
could	7	9	16	43.8%
likely	5	0	5	100.0%
Total	29	11	40	72.5%

Note. Semantic decisions derive from the finalized protocol and the adjudicated 40-row S1 dataset. The reported machine-assisted agreement is an audit diagnostic, not human interrater reliability.

Figure 2

Epistemic and Non-Epistemic Uses by Target Form



Note. Counts are based on the 40-row adjudicated token dataset. Percentages above the bars are epistemic shares within each form.

Epistemic Assessments: Textual Locus

Of the 29 epistemic tokens, 20 (69.0%) are of journalist-text locus and 9 (31.0%) are of attributed-text locus. The 2025 stratum has the largest share of attributed text (4 of 5 epistemic tokens), but the pooled distribution is still descriptive and sensitive to document composition. These categories are for locating the textual site of the assessment, not the endorsement, belief, or responsibility.

Textual locus of epistemic assessments by sampling period

Year	Journalist-text	Attributed-text	Total epistemic
2022	9	1	10
2023	6	1	7
2024	1	1	2
2025	1	4	5
2026*	3	2	5
Total	20	9	29

Note. *2026 is partial-year coverage. Textual locus is assigned only to epistemic tokens.

Document concentration sensitivity

8 of 40 (20.0%) target tokens provided by the 2023 Steg.AI watermarking article (TC2023W2-02). Without it, the 2023 share of all tokens moves from 22.5% (9/40) to 3.1% (1/32). The change in the textual locus is smaller: journalist-text tokens decrease from 20 of 29 epistemic tokens (69.0%) to 15 of 23 (65.2%), and attributed-text tokens increase from 9 of 29 (31.0%) to 8 of 23 (34.8%). The article is judged as valid. The sensitivity analysis shows document dependence, not a reason for exclusion.

Table 7

Document-concentration sensitivity analysis

Indicator	Full corpus	Watermarking article excluded
All target tokens	40	32
2023 target tokens	9	1
2023 share of target tokens	22.5%	3.1%
Epistemic tokens	29	23
Journalist-text epistemic	20 (69.0%)	15 (65.2%)
Attributed-text epistemic	9 (31.0%)	8 (34.8%)

Note. The sensitivity analysis describes dependence on one eight-token document; it does not treat that document as invalid.

Discussion

Form Frequency Does Not Determine Epistemic Function

The main finding is a mismatch between frequency and contextual function. The most common and most widely distributed form is *could*, but 9 of its 16 uses are non-epistemic. This pattern fits the construct-validity problem discussed by Hollmann et al. (2024): *could* may be frequent because it refers to ability or technical affordance, not epistemic uncertainty. That ambiguity is structurally plausible in AI journalism: the beat repeatedly describes what models, devices, infrastructure, and users can do.

The four markers are, therefore, not interchangeable entries in a dictionary of uncertainty. *Might* and *likely* are purely epistemic in this corpus, *May* is largely epistemic (10 of 12), and *could* requires contextual disambiguation. This is a local descriptive result, but it supports validating *could* in context before aggregating it as an uncertainty marker.

Capacity and prediction are two different items of analysis.

Descriptions of current system capability that slide into predictions about future consequences are common in many AI reporting articles. A capacity statement and an uncertain forecast may share the same modal form, but make different claims. A form-only count thus mixes technological affordance (what an actor or system is able to do) with epistemic commitment (how likely a proposition is presented as being). Contextual coding preserves the separation of those two analytical objects.

The Document Effect of the 2023 Watermarking Article

The raw annual totals do not show a monotonic trend, but the 2023 value is still document sensitive. Eight of the nine 2023 tokens are in a single watermarking paper. Removing that document drops 2023 from 9 of 40 tokens to 1 of 32. The defensible conclusion is not that 2023 was different from other years in the population, but that one quotation-rich or technically detailed article can dominate a small corpus's time-stratified descriptive total.

This conclusion does not conflict with larger studies showing changes in AI news after ChatGPT. Ryazanov et al. (2025) find a tenfold increase in attention and a stronger danger/risk association; Ittefaq et al. (2025) present a longitudinal comparison of frames and sentiment across 12 countries; and Jhan and Kuriakose (2026) find strong future orientation in headlines from 2024–2025. Those studies have used different sampling frames and units. The present case shows that the frequency of four individual forms can depend heavily on article type, topic, and source structure.

Textual Provenance Is Not an Epistemic Attribute

The textual-locus code indicates whether the journalist-text or the attributed-text receives an epistemic assessment. In the full corpus, journalist-text tokens outnumber attributed-text tokens (20 vs 9), and removing the eight-token article only slightly shifts the balance. The code is a record of textual location, not a measure of author belief or endorsement.

The interpretation should be restrictive. White (2012) demonstrates how attribution can foreground source evaluation and background reporter voice, whereas Stenvall (2012) shows responsibility can remain shared or ambiguous. Here the code cannot reveal a journalist's private belief or show endorsement. But it provides a clear measure of textual provenance that future work can use to distinguish industry executives, financial analysts, researchers, regulators, civil-society actors, and anonymous sources.

Methodological Contributions and Limitations

This work presents an auditable workflow between local modal semantics and descriptive AI-media analysis. It begins with a fixed source frame, deterministic candidate selection, canonical URLs and page captures, a specified editorial-text layer, target forms fetched with a documented regular expression, and one contextual record per token. The workflow then separates semantic status from textual locus, stores duplicate machine-assisted codes and adjudications, and reconstructs each table reported in the released token file. These steps make the results inspectable rather than asserted.

There are major limitations. Twenty purposively bounded articles from one specialist outlet cannot provide population-level estimates, and 2026 coverage is partial. Publisher pages are mutable; the archive keeps the captured version, not necessarily the original wording on the day of publication. The study reports raw counts instead of word-normalized rates. Most importantly, the authors used machine-assisted, not independently human, duplicate coding; the agreement statistics are diagnostic only. A confirmatory extension should preregister the sampling frame, archive historical page versions, use consistent word denominators, and obtain independent human double coding with reported agreement, before testing population-level claims.

Conclusion

This exploratory case study demonstrates that may, might, could, and likely are not interchangeable measures of uncertainty in AI journalism. The most common form in this 20-article corpus is could, but 9 of its 16 uses refer to ability, capacity, or affordance rather than epistemic possibility. One 2023 document also accounts for a fifth of all target tokens, suggesting the need for a document-concentration check. The accompanying source register, page images, extraction logs, 40-row token file, blinded coding outputs, adjudication log, and aggregate scripts allow for an exact audit of these descriptive findings. These results are preliminary due to the small size of the corpus and the lack of human interrater reliability.

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Appendix A. Data Sources and Retained Article Register

The primary discovery source was TechCrunch's public AI category (category ID 577047203), accessed through the publisher's WordPress REST posts endpoint. The category's public description identifies coverage of artificial intelligence, machine learning, generative AI, large language models, text-to-image/video systems, speech technologies, and predictive analytics. The category endpoint was queried separately for each fixed window in ascending publication-date order. The canonical article page is the primary source for identity and page-level verification. The supplementary source_register.csv retains the exact category query URL, result position, visible and JSON-LD date, final canonical URL, retrieval timestamp, two HTTP status checks, author, text hash, and archive file paths for every record.

Table

A1

Retained article sources (full retrieval timestamps and verification fields are in source_register.csv)

Sample	Sa on date	Publicati on date	Author	Article title and final canonical URL
C2022W1-01	T 01 00:13 (site)	2022-03- Lunden	Ingrid	Starship Technologies raises another \$42M to fuel the growth of its fleet of self-driving delivery robots https://techcrunch.com/2022/03/01/starship-technologies-raises-another-42m-to-fuel-the-growth-of-its-fleet-of-self-driving-delivery-robots/
C2022W1-02	T 01 07:18 (site)	2022-03- Miller	Ron	Zero Systems gets \$12M Series A to bring automation to professional services https://techcrunch.com/2022/03/01/zero-systems-gets-12m-series-a-to-bring-automation-to-professional-services/
C2022W2-01	T 01 06:47 (site)	2022-08- Sawers	Paul	UiPath acquires London-based NLP startup Re:infer https://techcrunch.com/2022/08/01/uipath-acquires-london-based-nlp-startup-reinfer/
C2022W2-02	T 02 05:58 (site)	2022-08- Kamps	Haje Jan	It's paintbrushes at dawn as artists feel the pressure of AI-generated art https://techcrunch.com/2022/08/02/ai-art-generated/
C2023W1-01	T 01 09:32 (site)	2023-03- Sawers	Paul	Sesamm bags \$37M to give corporates ESG insights using natural language processing https://techcrunch.com/2023/03/01/sesamm-bags-37m-to-give-corporates-esg-insights-using-natural-language-processing/
C2023W1-02	T 01 10:00 (site)	2023-03- Wiggers	Kyle	Addressing criticism, OpenAI will no longer use customer data to train its models by default https://techcrunch.com/2023/03/01/addressing-criticism-openai-will-no-longer-use-customer-data-to-train-its-models-by-default/
C2023W2-01	T 01 00:01 (site)	2023-08- Singh	Manish	Ola's Aggarwal sets eyes on AI, semiconductor design https://techcrunch.com/2023/08/01/bhavishh-aggarwal-ola-ai-semiconductor/

Sample	Sa on date	Publicati	Author	Article title and final canonical URL
C2023W2-02	T 01 04:01 (site)	2023-08- Coldewey	Devin	Steg.AI puts deep learning on the job in a clever evolution of watermarking https://techcrunch.com/2023/08/01/steg-ai-puts-deep-learning-on-the-job-in-a-clever-evolution-of-watermarking/
C2024W1-01	T 01 02:30 (site)	2024-03- Singh	Manish	Elon Musk sues OpenAI and Sam Altman over ‘betrayal’ of nonprofit AI mission https://techcrunch.com/2024/03/01/elon-musk-openai-sam-altman-court/
C2024W1-02	T 01 09:32 (site)	2024-03- Wiggers	Kyle	AI chip startup Groq forms new business unit, acquires Definitive Intelligence https://techcrunch.com/2024/03/01/ai-chip-startup-groq-forms-new-business-unit-acquires-definitive-intelligence/
C2024W2-01	T 01 00:53 (site)	2024-08- Mehta	Ivan	Zuckerberg says Meta will need 10x more computing power to train Llama 4 than Llama 3 https://techcrunch.com/2024/08/01/zuckerberg-says-meta-will-need-10x-more-computing-power-to-train-llama-4-than-llama-3/
C2024W2-02	T 01 04:33 (site)	2024-08- Lomas	Natasha	The EU’s AI Act is now in force https://techcrunch.com/2024/08/01/the-eus-ai-act-is-now-in-force/
C2025W1-01	T 01 06:00 (site)	2025-03- Temkin	Marina	OpenAI’s startup empire: The companies backed by its venture fund https://techcrunch.com/2025/03/01/openais-startup-empire-the-companies-backed-by-its-venture-fund/
C2025W1-02	T 01 09:59 (site)	2025-03- Ha	Anthony	DeepSeek claims ‘theoretical’ profit margins of 545% https://techcrunch.com/2025/03/01/deepseek-claims-theoretical-profit-margins-of-545/
C2025W2-01	T 01 04:00 (site)	2025-08- Zeff	Maxwell	Google rolls out Gemini Deep Think AI, a reasoning model that tests multiple ideas in parallel https://techcrunch.com/2025/08/01/google-rolls-out-gemini-deep-think-ai-a-reasoning-model-that-tests-multiple-ideas-in-parallel/
C2025W2-02	T 01 06:21 (site)	2025-08- Bellan	Rebecca	Vast Data in talks with Alphabet’s CapitalG, Nvidia to fund round at up to \$30B valuation https://techcrunch.com/2025/08/01/vast-data-in-talks-with-alphabets-capitalg-nvidia-to-fund-round-at-up-to-30b-valuation/
C2026W1-01	T 01 06:00 (site)	2026-03- Madori Davis	Dominic-	SaaS in, SaaS out: Here’s what’s driving the SaaS apocalypse https://techcrunch.com/2026/03/01/saas-in-saas-out-heres-whats-driving-the-saaspocalypse/

Sample	Sa	Publicati	Author	Article title and final canonical URL
	T	2026-03-	Anthony	Anthropic's Claude rises to No. 1 in the App Store following
C2026W1-02	01 06:48 (site)	Ha		Pentagon dispute https://techcrunch.com/2026/03/01/anthropics-claude-rises-to-no-2-in-the-app-store-following-pentagon-dispute/
	T	2026-08-	Anthony	Sam Altman is still making the case for parenting via ChatGPT
C2026W2-01	01 10:07 (site)	Ha		https://techcrunch.com/2026/08/01/sam-altman-is-still-making-the-case-for-parenting-via-chatgpt/
	T	2026-08-	Anthony	YouTuber Hank Green says his AI usage is 'not healthy'
C2026W2-02	01 12:45 (site)	Ha		https://techcrunch.com/2026/08/01/youtuber-hank-green-says-his-ai-usage-is-not-healthy/

Appendix B. Verification, Editorial-Text Extraction, and Audit Package

Accessibility was assessed on the canonical article page in a non-authenticated HTTP session. A record passed only if it returned an HTTP 200 both initially and after one reload, and exposed a readable headline, author, publication date, and editorial body without login, subscription, or payment. The 20 selected records met those conditions. The access log for each page preserves the requested URL, final resolved URL, redirect chain, timestamps, status codes, and content hash.

Editorial content was separated from page furniture by using the publisher REST post.content.rendered field and retaining the headline plus paragraph, heading, list-item, and blockquote blocks. Scripts, styles, figures, asides, navigation, advertising, subscription prompts, recommendations, author biographies, boilerplate, and comments were excluded. Raw canonical-page HTML and the resulting clean text are both archived. Token retrieval, aggregate calculations, and figure generation were scripted; contextual coding was conducted through two blinded machine-assisted passes followed by protocol-based adjudication. The supplement preserves every intermediate and final output.

Table B1

Reproducibility files supplied with the manuscript

Artifact	Contents and verification use
source_register.csv	20 article-level records: discovery queries, final canonical URLs, capture times, status checks, authors, AI-focus rationale, filenames, and SHA-256 hashes.
raw_html/ and clean_text/	One direct-page HTML capture and one cleaned headline-plus-editorial-body text file per article.
access_logs/ and api_json/	Per-page HTTP/reload logs and publisher API records supporting date, text, and extraction checks.
S1_tokens.csv	40-row token dataset with canonical URL, retrieval time, text hash, offsets, sentence snippets, three-block context, both preliminary codes, final decision, and adjudication note.
coding_protocol.md, primary_coding.csv, duplicate_coding.csv, adjudication_log.csv, coding_agreement.json	Finalized rules, blinded machine-assisted passes, all five resolved disagreements, and agreement diagnostics explicitly not presented as human interrater reliability.
aggregate_tables.csv, results_summary.json, scripts/	Recomputed manuscript tables, result summary, and executable collection, retrieval, coding, adjudication, and figure scripts.

Note. The complete reproducibility package is released with the manuscript. Because live publisher pages can change, re-analysis should begin from the supplied captures and hashes; a changed live page must be reported as a changed version rather than silently substituted.



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FULL PAPER

Technology-Enhanced Home Language Practices in Bilingual Families: An Integrative Review of Parental Mediation and Child Language Development

Abstract

Digital media are now embedded in bilingual family life, yet evidence remains fragmented across family language policy, digital literacy, parental mediation, and child-language research. This integrative review synthesises a verified core corpus of 17 empirical studies published between 2021 and July 2026. The corpus covers general home digital-media use, digitally supported shared reading, and polymedia or transnational communication. Descriptive mapping and convergent narrative–thematic analysis show that digital technologies can broaden access to heritage and societal languages through e-books, educational applications, audiovisual media, messaging, video calls, and social media. However, access alone did not reliably produce developmental gains. More favourable opportunities for vocabulary learning, narrative comprehension, oral participation, literacy, and heritage-language use occurred when parents or other family members supported co-use, questioning, explanation, translation, modelling, feedback, and responsive communication. Passive or background exposure was associated with fewer conversational turns. Child agency, bilingual proficiency, socioeconomic resources, parental digital literacy, language status, and content availability moderated these relationships. Only six studies directly assessed child-language behaviour or performance, and all four intervention or technology-design studies were short term and lacked delayed unaided assessment. The review proposes a recursive practice–mediation–context–outcome framework and distinguishes interaction-generating from interaction-displacing technology use. Because archived search exports and screening records could not be accessed, this synthesis is framed openly as a bounded integrative review, not as an exhaustive systematic review.

Keywords: bilingual families; child language development; digital media; family language policy; heritage-language maintenance; parental mediation

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1. Introduction

Bilingual children's language development is shaped by more than face-to-face interaction, print literacy, and parents' language choices. Digital practices are also a part of everyday family life. Video chats, messaging services, streaming services, e-books, educational apps, games, and social media allow children increased access to heritage and societal languages both synchronically and diachronically. Family language policy can thus unfold not only through traditional means but through digital media as well, highlighting how parents adopt technologies, regulate access, select language input, co-view or engage with their children, and connect with family members abroad (Little, 2020; Palviainen & Räisä, 2023; Said, 2021). Research on transnational families further demonstrates how parental language ideologies, migration histories, language status, and institutional factors impact whether home languages are maintained, balanced, or replaced (Curdts-Christiansen et al., 2023).

Existing research does not suggest that technology is inherently beneficial or harmful to children's language development. One meta-analysis found that increased screen time was generally associated with children's lower language abilities. This trend shifted when the media was educational in nature or parents watched with and engaged their children, however, both were associated with more positive outcomes. These findings highlight that mediation and learning context matter more than screen time alone (Madigan et al., 2020). These findings are particularly important for bilingual families. While technology cannot replace necessary resources for learning a language, such as books or teachers, it can serve as a valuable supplemental tool for kids who have limited access to materials, speakers, or instruction in a heritage language. Research with English–Mandarin bilingual families found significant disparities between children's English and L1 digital environments, suggesting that family socioeconomic status and the societal prestige of each language contributed to uneven digital resources and activities (Sun et al., 2022a; Sun et al., 2023).

Small-scale observational and experimental studies provide additional insights into how parent involvement impacts children's learning experiences. When navigating digital books in both Maltese and English, children were more likely to engage with the story and fluidly switch between their two languages when their parents were involved (Mifsud et al., 2021). Audiovisual enhancements supported preschoolers' attention during storybooks and subsequent story retelling in Mandarin–English bilinguals, but these enhancements did not benefit children with lower bilingual proficiency equally (Sun et al., 2022b). A randomized trial tested a similar hypothesis among Mandarin speakers in China: adult-child dialogic interaction was necessary for gains in story comprehension and retelling after listening to bilingual storybooks, but enhanced storybook prompts did not lead to increases in English vocabulary (Yang et al., 2022). Preliminary evidence with Polish–Norwegian bilingual children supports these conclusions more broadly. How parents spoke and acted with their children may have been more influential than the language of the digital book (tagged in either the child's L1 or L2) (Tunkiel & Bus, 2022).

Qualitative interviews and quantitative surveys have enriched our understanding of family language practice in recent years. Some multilingual families in Luxembourg use digital devices for language and literacy education, but not all of them and their habits differ by parent educational levels, home languages, and children's interests (Obojska & Vaiouli, 2025). Turkish parents living in Australia reported providing

digital media in Turkish and English to their children, though many also expressed confusion over appropriate apps and media (Ozturk & Ohi, 2026). Azerbaijani families used digital devices and sought multilingual content for similar reasons, though health concerns and guilt over limits also motivated their media choices (Savadova & Gillen, 2026).

Research at the intersection of technology and young children's language learning has tended to fall within the fields of family language policy, digital literacy, parental mediation, bilingual language development, and technology and early-childhood education. Studies are often constrained by small, location-specific samples, reliance on parental reports, treatment packages, or a single language combination. They also operationalize parental mediation in different ways and assess different language outcomes. With this in mind, we view technological input as a dynamic relationship. Technological affordances, parental mediation, parental language ideology, child agency, and sociolinguistic context interact to influence children's language learning. In this review, we synthesize what is known about parental mediation of digital language input for young children, discuss how specific mediation behaviors are related to vocabulary acquisition, oral language skills, narrative skills, literacy, biliteracy, and heritage-language maintenance, identify key knowledge gaps by geography, method, and theory, and propose two mechanisms—interactional intensity and linguistic alignment—to account for differences in development among children with similar levels of screen exposure. The study addresses the following research questions:

1. What forms of technology-enhanced home language practices are used in bilingual families, and how do parents mediate children's engagement through content selection, co-use, instruction, monitoring, restriction, and language-management strategies?
2. What relationships are reported between technology-enhanced home language practices, parental mediation, and children's vocabulary, oral proficiency, narrative ability, literacy, biliteracy, and heritage-language maintenance?
3. How do children's age, bilingual proficiency, agency, socioeconomic background, parental language ideology, language status, and sociocultural context influence reported outcomes, and what methodological, geographical, and theoretical gaps remain in the existing evidence?

2. Literature Review and Conceptual Background

2.1 Technology within the Bilingual Family Language Ecology

Research on bilingual families has generally focused on parents' beliefs, language-management practices, and patterns of interaction in households where family members are physically together. That perspective is increasingly insufficient, as communication now takes place across devices, platforms, modes, locations, and generations. In their systematic review of 163 migrant family language policy studies, Bose et al. (2023) found that language practice was still predominantly conceptualised as face-to-face communication, whereas only 11% of the reviewed studies incorporated digital communication. This finding indicates that the family cannot be regarded as a fixed nuclear unit located in one place. Grandparents, relatives, teachers, and community members may now participate in children's language socialisation through video calls, instant messaging, online instruction, and social media. Technology-enhanced home language practice is therefore treated as part of a broader bilingual ecology rather than as an optional addition to offline parenting.

This ecological perspective also requires consideration of polymedia, through which families select among interconnected technologies according to their linguistic goals, relationships, emotions, convenience, and children's preferences. Wang and Hamid's (2024) interviews with 15 Chinese–Australian parents showed that digital media supported heritage-language learning, cultural affiliation, and transnational family relationships. At the same time, parents reported concerns about inappropriate content, excessive use, and children's resistance to heritage-language resources. Technology therefore functioned both as a language-learning resource and as a space where family authority and language preferences were negotiated. This dual role is significant for bilingual development because technology's affordances are determined not only by access but by how it is situated in families' everyday routines, relationships, and language ideologies.

2.2 Parental Mediation as Digital Family Language Policy

Parental mediation has traditionally been categorised into discrete strategies: restriction, monitoring, active discussion, co-use, technical control, and parental modelling. Emerging research, however, suggests that these groupings are not mutually exclusive nor static. Shin and Lwin (2022), for example, compared 316 parents from Singapore and 315 parents from Australia to see how mediation related to parents' beliefs about digital media, digital literacy, and parental self-efficacy. Variations between these two nationally-grouped samples also demonstrated how mediation is impacted by cultural norms, parental confidence, and the broader digital ecology. Restriction alone, then, cannot account for parental approaches to children's media use.

Goodall et al. (2025) also discovered that parents with children between birth and three years old navigated digital opportunities and perceived threats via dynamic, overlapping, and context-dependent strategies. Instead of adhering to one type of mediation, parents shifted their approaches depending on the device, content, activity, child, and context. While this study did not focus exclusively on bilingual homes, it has implications for how we conceptualize digital media in this context. A bilingual parent might allow their child to video call with grandparents, co-watch a heritage-language show, limit access to entertainment videos, and have the child play one educational game within a single day. All of these activities also include decisions about the language(s) spoken, whether translations are given, and if the child is corrected, pushed to reply, or asked questions in the heritage or societal language. Parental mediation is thus described as simultaneously linguistic, pedagogical, relational, and protective.

Understanding parental mediation this way helps clarify how the same amount of screen time can yield different developmental prospects. A child playing independently on heritage-language videos is exposed to a different linguistic environment than one who watches the same content while their parent pauses to define new vocabulary, asks questions, encourages prediction, or relates the program to their own experiences. Restrictive mediation may also help children spend more time communicating with parents, but it could also reduce children's access to limited heritage-language resources. Accordingly, the relevant unit of analysis should not be screen time alone. The focus should be on the mediated digital activity itself—its language and content, how participants interact, the purpose of parental involvement, and its connection to later conversation or literacy practices.

2.3 Digital Exposure, Interaction, and Language Development

Naturalistic research cautions against assuming that digital exposure automatically produces language learning. Cycyk and De Anda (2021) analysed home recordings from 30 Mexican immigrant families with toddlers under three years of age. Digital media represented approximately 14% of the recorded language

environment, although exposure varied considerably among families. Greater media exposure was negatively associated with children's vocalisations and adult-child conversational turns but was not associated with the total number of adult words. The findings suggest that media may reduce children's opportunities to practise expressive language even when adult speech remains present. Moreover, child-directed programming was less likely to be available in Spanish, illustrating how the form and language of digital content may shape heritage-language opportunities differently.

Ferjan Ramírez et al. (2022) reached a related conclusion in their investigation of 37 bilingually raised Latinx infants. Based on day-long audio recordings, electronic-media exposure was associated with reduced parentese, fewer parent-infant conversational turns, and fewer infant linguistic vocalisations. The language of the electronic media was also related to the language used by the parents around the child. These findings point to an interactional view of language learning: technology has developmental value when it prompts responsive communication rather than taking its place. That distinction matters when assessing technology-supported practices at home, since it shifts the focus away from how much digital exposure children receive and toward the quality of the language participation around it.

Home-literacy research similarly indicates that bilingual outcomes depend on language use patterns and types of literacy support. Bratlie et al. (2025) followed 320 dual-language learners in Norway ages 22–68 months and identified three profiles based on patterns of first- and second-language use, spoken proficiency, and home literacy materials/supports in each language. Children in the profile characterized by greater amounts of first-language use and stronger literacy environments for both languages demonstrated relatively high proficiency in both the home language and societal language. That finding speaks to the zero-sum assumption that investment in the home language must come at the expense of the societal language. This study was not conducted exclusively in the digital sphere, but it still offers useful implications for how children learn with technology. Digital books, story applications, and online communication may benefit children most when they supplement a bilingual environment rather than replace human interaction.

Studies exploring technology design can help us understand how software and applications can be structured to encourage interactivity. He et al. (2025) developed a bilingual conversational agent embedded in electronic books for Spanish-English Latine families. When deployed during one week of home-use with 15 families, the agent stimulated bilingual verbal interaction, more substantial parent-child conversation, and Spanish vocabulary development. Notice that its impact arose from supporting a joint activity between parent and child rather than acting as a separate digital tutor. The sample size and duration were still quite small, though, preventing the researchers from identifying long-term retention rates, generalization to unassisted communication, or continued development of the heritage language. That limitation underscores a broader methodological trend: promising technologies get tested during short interventions, then researchers do not verify whether participants maintain those language gains after digital supports are withdrawn.

2.4 Heritage-Language Maintenance, Child Agency, and Contextual Inequality

Digital materials and applications may matter more where heritage-language speakers, books, schools, and culturally interesting materials are scarce or unavailable. Guskaroska and Elliott (2022) surveyed Macedonian diaspora parents and found broad enthusiasm for using technology to help maintain that language. Parents described having less time than they wanted, minimal exposure to Macedonian outside

the home, and limited access to culturally interesting digital resources made for children. It was easier to find materials suitable for adults than young children, which matters if parents struggle to find developmentally appropriate content. This does not mean technology is the problem or solution: either perfectly matched educational materials already exist online or they cannot be programmed into an app. Krajka and Gabryś-Sławińska (2022) instead explored a telecollaboration program where social media helped connect Polish speakers with heritage learners in remote Brazilian communities. Heritage-language maintenance was possible where local opportunities to learn Polish were limited or unavailable. Online communication did not automatically create access to that language and its associated culture, however. Platform-mediated conversations needed to be organized around collaborative tasks if learners were to benefit. Students did not learn Polish by logging into a computer program. This conclusion echoes our broader understanding that technology becomes educational through purposeful mediation and interaction. Family mediation of a digital language need not fall strictly along parental lines. Romanowski (2022) found that Polish fathers living in Australia played an unexpected role in guiding their children's heritage-language learning. He did not merely study fathers; he looked at how Polish-speaking dads contributed to their children's bilingual development. Fathers both maintained family traditions and adapted their approach when interacting with children through digital media (Romanowski, 2025). In both studies, heritage-language mediation flowed in both directions. Children influenced how their parents used technology for purposes of language learning just as parents regulated their children's language use. This work challenges common assumptions about which family members guide children toward a heritage language. Mothers do play a major role, but digital technology lets children shape those interactions too. Code-switching within apps or online conversations does not always represent a failure to separate languages. As children and parents negotiate technology use, code-switching can facilitate understanding, maintain conversation flow, and mark a bilingual identity.

Technology lets kids push back too. Wang and Hamid' (2024) interviews included cases where children's digital interests conflicted with their parents' language preferences. When children wanted to access certain apps or digital genres, parents held the ultimate say. Their language policy could still adapt to incorporate children's desires if they so chose. Parents negotiated how strictly to apply those rules. If policies were too rigid, children could resist language-socialization efforts; more flexible mediation led parents to incorporate popular digital genres into children's heritage-language activities. Heritage languages get some support from children's everyday technology use, then, but not all of the same kind or in the same direction. Children can exercise agency by choosing content to engage with, switching apps/platforms, requesting certain languages, and refusing materials that fail to interest them.

The research on heritage languages points to adaptability in another way. Bilgory-Fazakas and Armon-Lotem's (2025) qualitative interviews suggested that language maintenance was most resilient when it emerged through the intersection of family dedication, cultural identification, and pragmatic adjustments over time. Adaptable mediation strategies may therefore depend on mixing heritage- and societal-language content to fit the moment. Parents could switch the applications they use, translate read-alouds or video content, combine online and offline activities, or pivot in response to children's developing identities. Flexibility does not weaken consistency. A dedication to bilingual development can survive lots of changes to how that commitment gets realized through day-to-day activities.

Many other factors influence this process. Contextual inequalities influence how caregivers mediate children's technology use as well. Mediation quality varies with parents' digital literacy and educational background, but it also depends on parents' available time, income/resources, connectivity, and access to heritage-language materials/books. Limited funds can make the difference between relying on freely available videos, paying for interactive applications, using paid digital books, or scheduling live lessons. Commercial support for a language also varies by how widely it is spoken, leaving some languages with few high-quality resources or recordings. Screen time itself cannot account for why children use technology or what they learn from it.

2.5 Conceptual Gap and Analytical Proposition

Technology both increases children's access to a heritage language and competes with opportunities to converse. It connects siblings and distant relatives but sometimes introduces family tension. Devices promote bilingual literacy development while also risking too much solitary use. Studies showing both positive and null effects of technology do not imply that devices make no difference to children. They indicate that the category of "technology use" is too broad to explain differences in children's heritage-language development. Technology use becomes meaningful through the dynamic relationships between how it affords language learning, how children and parents distribute their time across languages, quality of digital materials, parental mediation, children's agency, family relationships, and sociolinguistic context.

Here, we identify a gap in theory and method. Family language policy describes parents' beliefs and stated practices without frequently testing children's language development. Language-development research measures children's exposure but often does not account for parents' beliefs about language, mediation style, or cultural contexts. Technology interventions test particular applications, yet rarely examine delayed retention, transfer to unaided communication, dependency, or long-term heritage-language maintenance. Much of the evidence is also derived from small samples, parent-reported data, single language pairs, and relatively well-resourced migration contexts. Children's perspectives, fathers, extended relatives, lower-resource languages, and families in the Global South remain comparatively underrepresented.

Most importantly, previous research has not sufficiently integrated digital practices, parental mediation strategies, contextual moderators, and specific developmental outcomes within one analytical framework. It remains unclear which combinations of co-use, active explanation, monitoring, restriction, language selection, and transnational interaction are associated with vocabulary, oral proficiency, narrative ability, literacy, biliteracy, and heritage-language maintenance. This review addresses this unresolved issue by synthesising process, context, and outcome evidence and by conceptualising technology-enhanced home language practice as a relational and developmentally situated phenomenon.

3. Method

3.1 Review Design and Epistemic Scope

This study used an integrative review design to connect quantitative, qualitative, and mixed-methods evidence across applied linguistics, family language policy, early-childhood education, communication, and developmental research. Integrative review is appropriate when a field is conceptually fragmented and contains heterogeneous designs that cannot be reduced to a single effect estimate (Whittemore & Knafl, 2005). The review therefore prioritised conceptual integration, evidential directness, and explanation of contextual variation rather than statistical pooling.

The analysis distinguished a core evidence corpus from contextual literature. The core corpus contained 17 empirical studies that directly examined technology-supported language practices in bilingual or multilingual families. Additional reviews, methodological papers, and related empirical studies were cited in the Introduction and Discussion to frame the argument, interpret the findings, and assess transferability; they were not counted in the corpus frequencies.

3.2 Corpus Identification, Eligibility, and Verification

The corpus was bounded by four concept domains: bilingual or multilingual families; digital technology or digitally mediated communication; parental or family mediation; and child language, literacy, language use, or heritage-language maintenance. Eligible reports were peer-reviewed empirical journal articles published from January 2020 to July 2026. They involved children from birth to 18 years raised with two or more languages and examined a home, family, or transnational family context. Technologies included digital books, applications, tablets, streaming and video platforms, games, messaging, social media, video calls, conversational agents, and interconnected polymedia.

A report was retained when family participation or mediation was substantively analysed. Relevant mediation included co-use, co-reading, questioning, explanation, translation, instruction, content selection, monitoring, restriction, modelling, language choice, or organisation of communication with distant relatives. Studies restricted to classroom technology, monolingual samples, general screen duration without a bilingual or family-language component, or non-language outcomes were outside the core corpus. Mixed monolingual–bilingual samples were eligible only when findings for bilingual participants could be identified.

During final manuscript preparation, the bibliographic identity, DOI, publication year, journal, population, family context, technology, and eligibility of each core study were rechecked against publisher records or authoritative bibliographic metadata. One omitted reference—Bus et al. (2023)—was restored. The original database exports, deduplication file, title-and-abstract decisions, and full-text exclusion log were not available. Accordingly, no PRISMA flow counts are reported and no claim of exhaustive or reproducible database coverage is made. The review should be read as a transparent synthesis of a verified, theoretically relevant corpus rather than as a comprehensive systematic search.

3.3 Data Extraction and Coding

A structured extraction matrix captured author and year, country or transnational setting, sample size and age, language configuration, design, technology or platform, form of family participation, mediation strategies, child agency, language-related outcomes, contextual moderators, and reported limitations. The coding scheme combined deductive and inductive logic. Initial mediation codes—active mediation, co-use, restriction, monitoring, modelling, instructional scaffolding, language management, and transnational-relational mediation—were derived from the research questions and parental-mediation literature. Additional practices and contextual conditions were added when they recurred across studies.

Studies could receive multiple mediation, outcome, and moderator codes. For the descriptive distribution in Figure 2, however, each report was assigned to one dominant technology cluster: general home digital-media practices, digital shared reading, or polymedia and transnational communication. Dominant focus was assigned according to the study aim, primary data source, and central analytical claims. Although this

single-assignment rule makes frequency reporting transparent, it does not suggest that the clusters are mutually exclusive in family life.

3.4 Synthesis and Evidence Appraisal

Descriptive counts covered publication year, region, study design, age group, technology focus, and the directness of the child-language evidence. Quantitative results were summarised according to their direction, reported size, and consistency. Qualitative results, by contrast, were brought together through iterative coding that developed descriptive and analytical themes, following the logic of thematic synthesis (Thomas & Harden, 2008). The final convergent synthesis mapped underlying practices, mediation, contexts and outcomes together. Findings that contradicted one another were preserved rather than averaged into an overall technological effect. Strength of evidence was rated without averaging the findings into an overall quality score. Five dimensions informed our interpretation: whether the measure directly assessed child language versus relied on parent report, the rigor of the research design, the sample size, the validity of the measure, and short- or longer-term horizons. For example, we gave more weight to the developmental impacts measured by direct recordings or assessments of children rather than parents' perceptions of their children. We were cautious in our interpretation of intervention impacts when the technology exposure was short-term, the samples were small, when intervention delivery occurred in the home without full reporting of fidelity to protocols, or when impacts on unaided child skills were not reported after some time. Evidence describing family language practices, in other words, was not considered causal evidence of those practices on development.

3.5 Transparency and Ethical Considerations

The review examined published studies and did not collect identifiable data from human participants. Institutional ethical approval was therefore not required. Rigour was supported through explicit separation of core and contextual evidence, bibliographic verification, preservation of negative and null findings, transparent single-assignment rules for descriptive categories, and direct acknowledgement of the missing search archive. All numerical summaries in the Results are traceable to the 17-study characteristics table in Appendix A.

4. Results

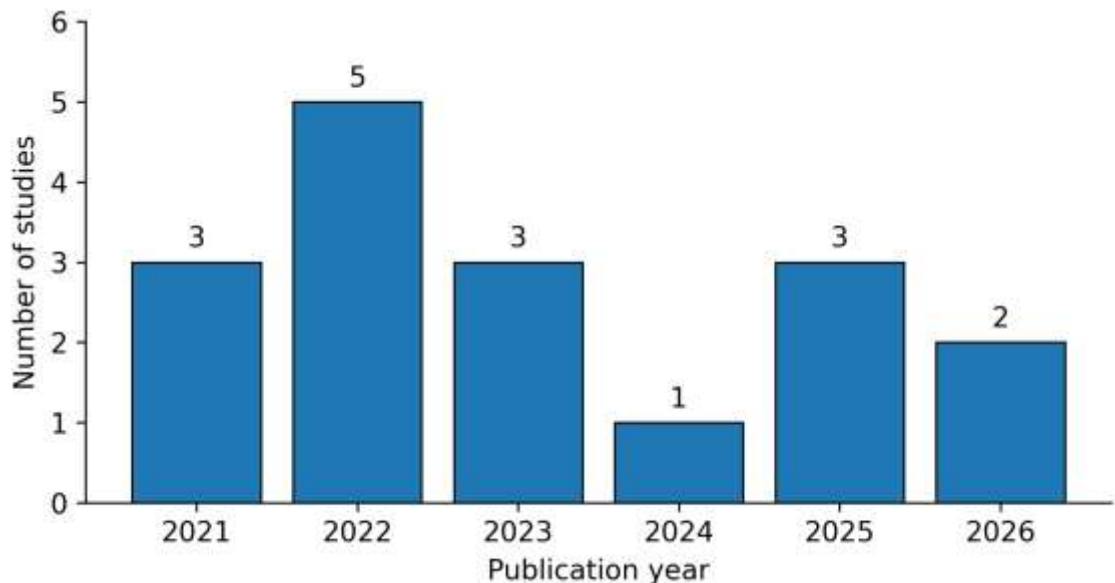
4.1 Corpus Profile

The verified core corpus comprised 17 peer-reviewed empirical studies published between 2021 and 2026. The smallest studies examined two multilingual families, whereas the largest surveyed 1,002 children. Designs included family case studies, interviews, surveys, naturalistic recordings, digital-reading experiments, and technology-design evaluations. Appendix A identifies the population, design, technology, and principal contribution of every core study.

The studies were distributed unevenly across the six-year publication period. Three studies were published in 2021, five in 2022, three in 2023, one in 2024, three in 2025, and two in 2026. The largest number appeared in 2022, representing 29.4% of the corpus. As illustrated in Figure 2, publications remained relatively consistent after 2021, although the small corpus does not support conclusions concerning broader publication trends.

Figure 1

Publication Distribution of the 17-Study Core Corpus



Note. Counts refer to one primary publication per core study. The 2026 count covers publications available by July 2026.

The corpus represented 11 clearly identifiable national settings: the United Kingdom, Malta, the United States, Singapore, China, Norway, Finland, the Netherlands, Australia, Luxembourg, and Azerbaijan. One other study examined Macedonian diaspora families living in settings that did not fit within a single national context.

Of the studies, six took place in Europe, four in Asia, three in North America, and three in Australia. One drew on a transnational diaspora sample. None of the verified studies was based in Africa, South America, or the Arab region. This left the evidence base centered largely on relatively well-resourced migration and multilingual settings, where access to digital infrastructure was comparatively strong.

Twelve studies—70.6% of the corpus—centered mainly on children from infancy to about seven years old. By contrast, just five involved school-age children, mixed-age families, or participants beyond early childhood, leaving technology-enhanced home-language practices among older children and adolescents underrepresented.

The corpus comprised five primarily qualitative studies, five quantitative observational or survey studies, four experimental, quasi-experimental, or technology-design interventions, and three mixed-methods studies. Table 1 summarises its publication, geographical, methodological, age-related, and technological characteristics.

Table 1

Profile of the 17-Study Core Corpus

Characteristic	Category	Studies, n	Percentage
Publication year	2021	3	17.6%
	2022	5	29.4%
	2023	3	17.6%
	2024	1	5.9%
	2025	3	17.6%

Characteristic	Category	Studies, n	Percentage
	2025	3	17.6%
	2026	2	11.8%
Geographical region	Europe	6	35.3%
	Asia	4	23.5%
	North America	3	17.6%
	Australia	3	17.6%
	Transnational diaspora sample	1	5.9%
Research design	Qualitative	5	29.4%
	Quantitative observational or survey	5	29.4%
	Intervention or technology-design study	4	23.5%
	Mixed methods	3	17.6%
Primary age group	Infancy to approximately seven years	12	70.6%
	School-age or mixed-age groups	5	29.4%
Principal technology focus	General home digital-media practices	7	41.2%
	Digital books and shared reading	5	29.4%
	Polymedia and transnational communication	5	29.4%

Note. Percentages are calculated from the 17 verified core studies. Each study was assigned to one dominant region, design, age group, and technology-focus category for descriptive reporting.

The methodological profile of studies was quite varied but did show a clear imbalance: far more studies documented family practices than directly assessed children's language development. Eleven studies, 64.7% of included studies, focused mainly on topics other than language development: parental beliefs, digital media practices, mediation strategies, language choices, or family experiences. Only six, representing 35.3%, used direct observations or assessments to measure children's language performance.

Seven studies, 41.2% of the corpus—included fewer than 25 children, parents, families, or parent-child dyads. Questionnaires, interviews, parental accounts, or similar self-report methods formed the main basis of ten studies. Although these approaches provided valuable context on parental mediation and family language policy, they offered only limited support for causal claims about children's language development.

4.2 Directness and Strength of Child-Language Evidence

The six studies focused directly on child-language indicators included two naturalistic recording studies and four studies involving intervention or technology design. Their samples, methods, main findings, and interpretive limitations are presented in Table 2.

Table 2

Studies Providing Direct Evidence of Child-Language Outcomes

Study	Sample	Design or technology	Main language-related finding	Main limitation
Czyk and De Anda (2021)	30 families	Naturalistic home recordings	Greater media exposure was associated with fewer child vocalisations and conversational turns	Observational design; causality could not be established
Ferjan Ramírez et al. (2022)	37 infants	Day-long audio recordings	Electronic-media exposure was associated with reduced parentese, conversational turns, and infant vocalisations	Small sample and correlational evidence
Tunkiel and Bus (2022)	14 children	Bilingual digital-story reading	Reading first in Polish did not produce a clear advantage in Norwegian vocabulary learning	Very small sample and no delayed assessment
Yang et al. (2022)	107 dyads	Bilingual discussion prompts during e-book reading	Prompts improved story comprehension and retelling but not English vocabulary beyond the comparison condition	Immediate outcomes only

Study	Sample	Design or technology	Main language-related finding	Main limitation
Bus et al. (2023)	41 children	Dutch-only versus multilingual digital books	Heritage-language availability did not independently increase home reading as expected	Limited sample and reliance on home implementation
He et al. (2025)	15 families	Bilingual conversational agent	The agent encouraged bilingual engagement, parent–child dialogue, and Spanish vocabulary learning	One-week intervention and no delayed unaided test

Note. Direct evidence refers to observational indicators or assessment-based measures of children’s language behaviour or performance, rather than parental perceptions alone.

The two naturalistic studies reached largely similar conclusions. Children with more passive or background media exposure had fewer opportunities to take part in expressive language. Still, neither study demonstrated a direct causal link. Family interaction patterns, parental availability, child characteristics, and household routines could have shaped both the amount of media exposure and the extent of conversational participation.

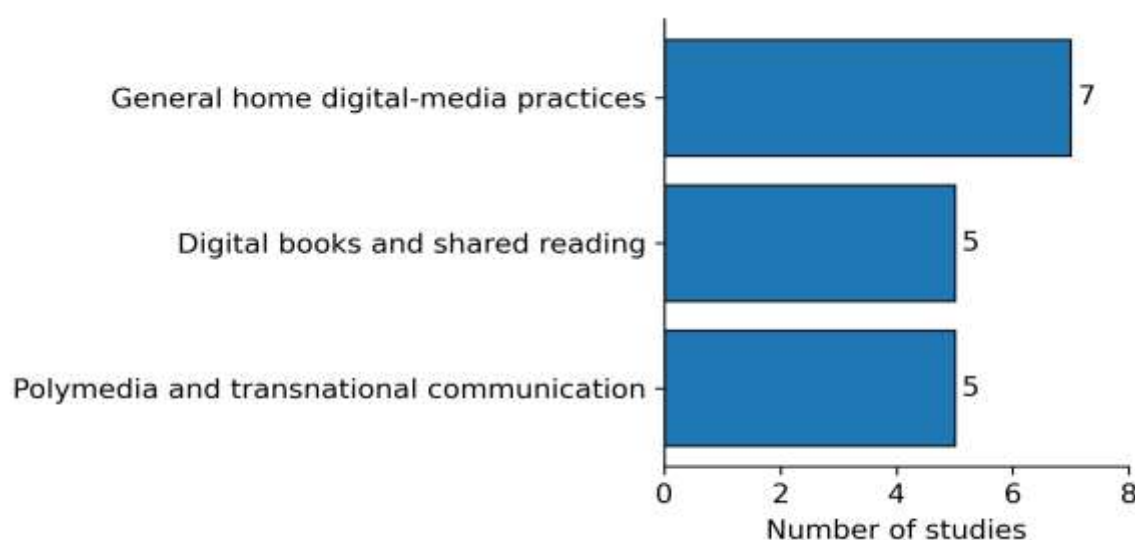
The four intervention studies offered more direct evidence, though their reach was constrained by small samples and brief treatment periods. Sample sizes ran from 14 children to 107 parent–child dyads. None conducted a delayed unaided post-test to determine whether gains in vocabulary, comprehension, or narrative ability persisted once the technological support was removed. The evidence therefore supports conclusions about immediate interactional opportunities more strongly than conclusions about sustained bilingual development.

4.3 Technology-Enhanced Practices and Parental Mediation

The first research question examined the digital practices used by bilingual families and the ways parents mediated children’s participation. Three broad clusters were identified: general home digital-media practices, digital shared reading, and polymedia or transnational communication. Their numerical distribution is presented in Figure 3.

Figure 2

Principal Technology Focus Across the Core Corpus



Note. Each study was assigned to one dominant technology cluster for descriptive reporting; studies could contribute to multiple mediation, outcome, and contextual themes.

4.3.1 General Home Digital-Media Practices

Seven studies, representing 41.2% of the corpus, investigated multiple forms of home media. These included television, online videos, tablets, streaming services, educational applications, music, digital games, e-books, and video calls.

The studies showed that bilingual families did not encounter equivalent digital environments in each language. In Singapore, Sun et al. (2022a) used data from 141 bilingual children to develop the QQ-MediaSEED questionnaire, which measured the quantity and quality of digital-media use, social participation, content design, and parental mediation. The results revealed differences between children's English and mother-tongue media environments. A related study of 162 English–Mandarin families found that digital materials became more common during the COVID-19 period, although English resources still outnumbered Mandarin resources. Resource distribution varied by socioeconomic status as well. Families with greater resources described richer conventional literacy environments, while families with fewer resources depended relatively more on digital materials. In Luxembourg, researchers assessed questionnaire responses from 209 multilingual families (Obojska & Vaiouli, 2025). Parents often utilized educational applications, videos, and online games for language and literacy development. Digital media was generally viewed as easy-to-use resources by parents who were concerned with how long children spend using screens, age-appropriate activities, and the quality of media. Researchers interviewed 34 Turkish–Australian parents of young children (Ozturk & Ohi, 2026). Close to three quarters of preschool-aged children were using tablets multiple times weekly. Children and parents sang with digital devices, called relatives, or watched videos online more frequently than reading e-books together. Five multilingual families living in Azerbaijan were longitudinally tracked for 15 months (Savadova & Gillen, 2026). Language brokering behaviour included parents turning to digital resources to promote their children's multilingual futures, while also limiting their children's access due to fears over their well-being and too much screen time. Both forms of mediation coexisted.

4.3.2 Digital Shared Reading

Five studies (29.4%) focused on digital books, interactive stories, multilingual e-books, or conversational agents delivered as part of electronic reading activities. Shared reading with digital enhancements offered the most transparent benefits when specific technology features prompted parent–child conversation.

Mifsud et al. (2021) observed four Maltese–English families interacting during digital-book reading. Parents and children spontaneously produced both English and Maltese while reading together. Verbal interaction included explanation, elicitation, making connections to experiences, child-directed speech, and instructional supports.

Yang et al. (2022) randomized 64 parent–child pairs to receive bilingual discussion prompts and 43 pairs to read the same story digitally without prompts. Children who received prompts showed significantly better story comprehension and retelling abilities than those who did not, while both groups had similar gains in English vocabulary. Prompts influenced deeper narrative processing more obviously than learning individual words.

Tunkiel and Bus (2022) did not observe a significant benefit of reading a digital story aloud in Polish prior to rereading it in Norwegian with 14 Polish–Norwegian bilingual children. Presentation of the material in

the home language alone did not enhance children's second-language learning without additional repetition, engagement, or scaffolding.

Bus et al. (2023) randomly assigned 41 bilingual students to receive Dutch-only or multilingual digital books to take home. Simply providing children with digital books in the heritage language did not significantly increase their home reading practice as expected. Access to the books was therefore not enough without caregiver involvement, buy-in, and inclusion into daily life.

He et al. (2025) piloted a bilingual conversation agent with 15 Spanish–English speaking families for one week. The technology promoted bilingual oral engagement, parent–child communication, and use of Spanish words. Rather than standing alone as independent instruction, its main benefit was facilitating co-engagement between family members.

4.3.3 Polymedia and Transnational Communication

Five studies, accounting for 29.4% of the corpus, examined messaging, social media, video calls, online communication with relatives, or interconnected combinations of platforms. These practices were associated more frequently with heritage-language use, family relationships, identity, and intergenerational participation than with standardised developmental outcomes.

Said (2021) examined two multilingual families in the United Kingdom and found that parents used digital technology to expand children's heritage-language environments and involve geographically distant relatives in everyday communication.

Palviainen and Räisä (2023) surveyed 1,002 children attending Swedish-medium schools in Finland. Texting was the most frequently reported family application practice. Languages other than Finnish and Swedish were used in 17% of the participating families, although children were less likely to write digitally in languages with limited educational support or unfamiliar writing systems.

Wang and Hamid (2024) interviewed 15 Chinese–Australian parents. Digital polymedia supported Chinese-language use, cultural affiliation, and family intimacy, but parents also reported children's resistance, unsuitable content, and concerns about excessive media engagement.

Romanowski (2025) examined digital communication involving three Polish–Australian fathers, each communicating with two school-age children through Messenger over three months. Code-switching supported clarification, humour, relational closeness, and continued Polish participation. Mixed-language communication therefore sometimes functioned as interactional scaffolding rather than evidence of complete heritage-language displacement.

4.4 Relationships with Child Language Development

The second research question addressed the relationship between parental mediation, technology-enhanced practices, and children's language outcomes. The evidence did not demonstrate a uniformly beneficial or detrimental technological effect. Instead, developmental opportunities varied according to whether digital activities promoted passive exposure or contingent interaction.

Passive and background media exposure was associated with fewer child vocalisations and conversational turns in the two naturalistic recording studies. In contrast, practices requiring children to answer questions, retell stories, communicate with relatives, or participate in shared reading produced more favourable opportunities for expressive language use.

Vocabulary results were inconsistent. The bilingual conversational-agent study reported positive Spanish vocabulary development, whereas bilingual discussion prompts did not produce vocabulary gains beyond the comparison condition. Reading a digital storybook first in Polish also did not boost children's Norwegian vocabulary significantly. These variations suggest vocabulary learning results from multiple exposures, opportunities for production, corrective feedback, previous proficiency levels, and whether the technology's features aligned with what researchers tested.

Improvements were more consistent for story comprehension and retelling. Conversational prompts helped children make sense of and retell stories in bilingual books, while joint digital reading asked children to explain and predict story events and relate them to personal experiences. However, studies only looked at short-term results.

Findings on literacy and biliteracy skills were more preliminary. Digital books, subtitles, family text messages, and app-mediated communication gave kids opportunities to read and write, but studies seldom directly evaluated children's literacy skills in both languages. Heritage- language maintenance was often implied by access to and self-reported use of technology, family involvement, and frequency of communication instead of longitudinal proof of proficiency.

4.5 Contextual Moderators and Research Gaps

Our third research question asked how technology-enhanced practices are conditioned or influenced. Child's age, bilingual skills and agency, socioeconomic status, parental ideology, language status and resource availability were a few of the conditions we identified.

Digital content commercially available often included more societal-language input than heritage language. This imbalance was particularly salient in the case of English–Mandarin families living in Singapore. Parents who supported languages with fewer commercially available resources also reported difficulty finding materials that were culturally appropriate, developmentally suitable, and interesting for their children.

Child preferences affected the home digital ecology: selection, acquiescence, negotiation, or refusal of parents' efforts. Heritage-language apps and programs were used inconsistently when children perceived them as old-fashioned, overly didactic, or irrelevant to their interests. Family members may mediate their children's language development more sustainably when enabling the child's desired language skills serves a pragmatic purpose in genres, platforms, or styles of communication that matter to children.

Parents and children differed in the resources they had at their disposal. Socioeconomic status influenced not only possession of technology devices but connectivity, subscriptions, hard-copy materials, time available to parents, and technological literacy. The so-called digital divide was demonstrated at multiple levels: possession of communication devices, quality of language content available, and families' ability to support children's productive use of technologies.

We found three gaps. Of our 17 studies, only half directly measured children's language behavior or proficiency; the rest were primarily focused on parents' reported practices, beliefs about mediation, strategies, or other experiences.

None of our four intervention- or technology-design studies followed children's progress beyond the initial study period. Together, they still leave us wondering whether vocabulary acquisition, story comprehension,

or improved narrative skill with digital support translates into children's ability to communicate effectively when the technological supports are removed.

Finally, In addition, the research corpus is focused on relatively few language groups and global regions. 16 of our 17 studies took place across Europe, Asia, North America, or Australia. One looked at bilingual Russian-German children but sampled from a transnational diaspora; we located no verified studies from Africa, South America, or the Arab region.

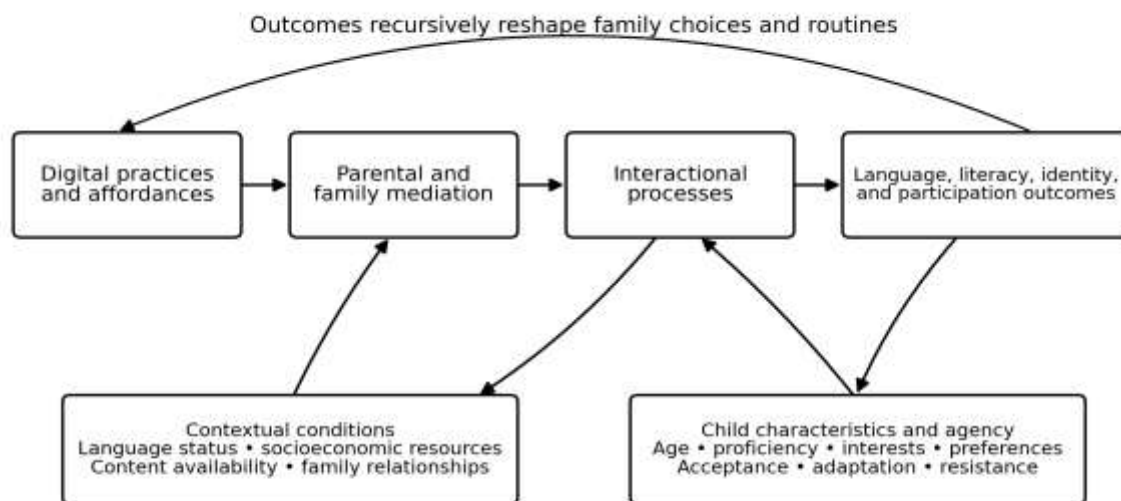
Similarly, family members' participation in children's digital experiences was not balanced. One study looked exclusively at father-child Medias; only a handful investigated grandparents, siblings, or extended family members as agents of children's digital language exposure. Finally, because 12 of our studies focused on young children, we know less about technology-enhanced learning and use among older children and adolescents.

4.6. Integrated Practice–Mediation–Context–Outcome Framework

Here we present an Integrated Practice–Mediation–Context–Outcome Framework that evolved from our analyses. It is represented visually in Figure 3, with selected examples of each component operationalised in Table 3. Contexts and parental decisions funnel down into home routines and practices. As noted earlier, practices and outcomes are recursive.

Figure 3

Recursive Practice–Mediation–Context–Outcome Framework



Note. Digital affordances are not treated as direct causes of development. Their effects are mediated through interactional processes and conditioned by language status, resources, family relationships, child proficiency, and agency. Outcomes recursively reshape subsequent choices and routines.

Table 3*Integrated Practice–Mediation–Outcome Synthesis*

Digital practice	Principal mediation strategies	Main developmental opportunities	Main risks or limitations
Digital shared reading	Co-reading, questioning, translation, explanation, prediction, feedback	Vocabulary exposure, comprehension, retelling, emergent literacy	Distracting features, insufficient repetition, short-term assessment
Streaming and online video	Content selection, co-viewing, discussion, repetition	Receptive input and cultural exposure	Passive use may displace conversation
Educational applications and games	Selection, instruction, monitoring, modelling	Vocabulary practice, engagement, early literacy	Uneven quality and limited evidence of independent transfer
Video calls	Organisation, prompting, translation, encouragement	Oral interaction, heritage-language use, family relationships	Participation depends on proficiency and relatives' responsiveness
Messaging and social media	Modelling, monitoring, code-switching, written feedback	Literacy practice, identity, transnational participation	Societal-language dominance and safety concerns
Conversational agents	Joint use, prompts, correction, discussion	Verbal engagement and short-term vocabulary learning	Small samples, brief interventions, no delayed testing
Multiple-platform polymedia	Flexible language management and platform selection	Heritage-language access, cultural affiliation, family intimacy	Parental uncertainty, child resistance, excessive use

Note. The table summarises recurring patterns rather than causal effects. Individual studies could contribute to more than one row.

In sum, the results suggest a practice–mediation–context–outcome model. Technology affords multilingual input, audiovisual scaffolding, repetition and retrieval practice, digital skills development, and contact with remote speakers. However, these affordances do not automatically lead to development. Much depends on how parents mediate technology use; the language(s) and quality of the content; children's proficiency and sense of agency; family dynamics; socioeconomic means; and each language's status in society.

When children actively discussed concepts, read with others, asked and answered questions, translated and explained language, and communicated with engaged speakers, they were provided richer opportunities for language development than by mere exposure. However, given the limited number of studies assessing direct outcomes, we cannot yet say which mediation practices lead to long-term gains for which language combinations and in what sociocultural contexts.

5. Discussion

5.1 Interaction-Generating and Interaction-Displacing Technology Use

Five studies focused on general home digital-media use; 8 described digitally supported shared book reading; and 4 explored polymedia practices or transnational communication. Overall, children gained opportunities to hear their heritage language as well as the dominant societal language. However, bilingual outcomes were not uniformly positive or linked directly to device usage. Developmental benefits instead depended on content quality, degree of adult engagement, child involvement, and placement within larger family routines.

We view this as indication that the important distinction is between interaction-displacing and interaction-generating digital use. Language-screen time created opportunities for children to interact with parents when caregivers asked about digital content, responded to children's questions or comments, translated unknown words or passages, retold stories with young children, or exchanged messages with supportive relatives. Language-screen time displaced interaction when it replaced dialogue, joint reading, or child-

directed conversation. Taylor et al.'s (2024) meta-analysis reaches a similar conclusion. The researchers reported a weak yet statistically significant positive correlation between adult-child digital co-use and learning outcomes, though they cautioned that small samples and study homogeneity limit generality.

The distinction might also explain why studies reported mixed effects on language outcomes. Passive exposure and background use gave children less opportunity to speak. Digital storybook reading and interactive communication pushed them toward comprehension, retelling, and verbal interaction. New evidence suggests that children's linguistic and pragmatic skills may be predicted more accurately by content quality and parental mediation tactics than by cumulative screen time (Toth et al., 2026). Conversely, one exploratory investigation linked greater digital-media exposure with poorer expressive-language skills among 237 Portuguese preschool children. This association held when children spent more screen time or failed to balance media activity with conversation (Monteiro et al., 2024).

Screens may be used competitively or collaboratively. For this reason, we do not endorse screen time as a meaningful variable of bilingual language development. Two children may spend the same time on tablets while encountering different languages and communicative opportunities. Screens alone while watching television programmes in the societal language. The other child could read caregivers could scaffold vocabulary and send messages to grandparents in the heritage language. Future research should therefore centre the mediated episode. What language was used? What was its purpose? Was the experience interactive? Who else was involved? How much time was spent? How did the digital experience connect to conversations and interactions offline?

Parental mediation served multiple purposes and took varied forms. Families navigated devices and selected media just as they made language choices, supervised children, explained words, modelled interaction, initiated conversations, enforced limits, checked backgrounds, and facilitated family chats. Mediation bridged the cognitive, cultural, and moral objectives associated with each of those activities. For bilingual families in particular, those choices bore explicit language implications.

Parental mediation can overlap with conceptualisations of family language policy. Traditionally, researchers have defined active mediation, co-use, supervision, and restriction as separate constructs. However, family decisions about mediation are embedded in family language policy. Parents select certain media in language-specific ways; others they avoid. They may coax children into messaging grandparents or translate app instructions. Each decision makes available specific languages for learning and communicating. Digital mediation, we propose, should be studied as an enactment of bilingual family language policy rather than treated as isolated technology management strategy.

Separate findings from Amman highlight similar concepts. Alkouri and Aldhafeeri (2026) surveyed parents of young children about their technology habits. Results suggested that most caregivers implemented passive mediation strategies, such as rules regarding digital-device usage and time limits. Few parents actively managed their children's engagement with digital content via co-viewing or discussion. As such, the authors urged greater emphasis on mediation instead of restriction. Though their study did not focus exclusively on bilingual families, it addresses bilingual development in important ways. Limiting screen time or device access does not equal mediating language learning.

Mutual trust and understanding between parent and child may also influence digital mediation. Positive parent-child relationships were associated with digital parental awareness in a recent study by Toran et al. (2024). Digital parental awareness included both appropriate technology usage and protection from digital-

risk behaviours. Digital negligence and negative parental modelling, by contrast, were linked to less favourable ones. This evidence suggests that parents' own technology practices influence the interactional environment in which children encounter language. The linguistic value of a digital activity may therefore be reduced when parents are physically present but distracted, unresponsive, or engaged with their own devices.

Our findings consequently challenge the classification of families as simply restrictive, permissive, or active. The same parent may restrict entertainment content, encourage a heritage-language video call, jointly read an electronic book, and permit independent use of an educational application. Mediation changes across activities, children's ages, language proficiencies, and immediate family circumstances. This fluidity corresponds with Sanjani et al.'s (2025) argument that plurilingual family language policies should be conceptualised along a continuum rather than through fixed and mutually exclusive categories.

5.3 Digital Shared Reading and Interactional Design

Digital shared reading generated the clearest evidence of immediate developmental benefits in the reviewed corpus. Bilingual prompts, parental questioning, translation, explanation, and conversational-agent support were associated with stronger engagement, story comprehension, retelling, or short-term vocabulary learning. However, making digital books available in two languages alone did not reliably increase how often children read or improve their vocabulary. These results also highlight the distinction between access alone versus purposeful engagement resulting in pedagogical value.

Additional research aligns with these conclusions. Taylor et al. (20 24) found that adult-child co-use was positively associated with learning from digital media, although effect sizes were small. Kalil et al. (20 26) recently ran a randomised trial lasting 11 months with 289 families from low-income communities. Providing a tablet with access to a dedicated digital library increased children's language abilities by 0.29 standard deviations. Benefits were significantly higher for kids with lower baseline language abilities. This device only allowed access to a reading application, which may have decreased distractions from other forms of media available on general-purpose tablets.

While this may seem contradictory to the conclusion earlier in this section that simple access is ineffective on its own, we would highlight the difference in how the interventions were designed. The researchers did not simply give families tablets; instead, children were given over 200 books on a device dedicated to reading for several months. Access in this study was a prolonged engagement with rich language rather than just the tablet itself. Future work should consider specifying the type of media accessed, what other platforms are available for use, what languages are available for the child, and the duration of the access period rather than grouping all types of "tablet access" or "app access" together.

Similarly, exposing children to new words is not the same as learning them. Jointly reading digital books and answering wh-questions can aid vocabulary acquisition if children learn and begin using new words actively. Exposure to novel vocabulary alone will not ensure kids remember those words. Much like learning to read, children must meet high-frequency words regularly in oral language before they can read them on a page (Wagner et al., 2006).

Integrating these media into children's daily routines requires support, which aligns with research on family literacy practices. Breeze and Halbach (20 24) outlined four major qualities of successful family-literacy programs: fostering family involvement, ensuring accessibility of materials and messages, being responsive to language differences, and promoting partnerships between families and educators. Translated

into terms of digital reading, these findings advocate for digital materials to be paired with strategies for caregivers to help them facilitate conversation about stories, relate narratives to their lived experiences, and motivate children to speak both languages through play and daily life.

5.4 Digital Homescapes, Transnational Literacy Practices, and Children's Agency

Children also used video chats, messaging apps, social media, and combinations of these platforms to learn from and meaningfully communicate with parents, extended family members, and friends. Time spent reading or browsing offered children a chance to ask questions, receive explanations, and broaden their understanding through digital reading.

All five studies focused on polymedia use found that children think about and use their heritage languages more often when they engage in transnational communication. Using a heritage language regularly with native speakers helped children develop larger vocabularies and become more skilled language users. Using digital media for transnational communication gave children more opportunities to use their heritage languages.

While we focused on two primary outcomes of polymedia use (heritage-language development and literacy learning), we observed multiple benefits of children's transnational digital communication. For children participating in our studies, transnational communication strengthened family relationships, increased their exposure to different dialects and cultures, and boosted their interest in continuing to learn and use their heritage languages.

Researchers have begun to describe these multi-dimensional spaces as digital homescapes. Yu and Curdt-Christiansen (2026) explored how Chinese-speaking immigrant families in Germany created digital home-language literacy environments through story machines, children's apps, smart speakers, instant messaging, and other digital tools. Their findings demonstrate that digital tools acquire meaning through their physical placement, family routines, parental ideologies, and children's preferences. Technology is therefore not an external intervention added to family life; it is part of the material and symbolic environment through which family languages are organised.

We argue that heritage-language maintenance should consequently be evaluated through more than exposure frequency. Digital communication may sustain relational motivation even when children's productive proficiency remains limited. A child who sends mixed-language voice messages to a grandparent may not demonstrate balanced bilingual proficiency, but the interaction can preserve an emotional reason to continue using the heritage language. Such practices may become foundations for later development, particularly when adults accommodate children's proficiency without abandoning the heritage language altogether.

Nevertheless, the reviewed studies generally inferred heritage-language maintenance from access, frequency of use, parental reports, or continued family communication. Few measured proficiency longitudinally. The evidence can therefore establish that technology creates opportunities for heritage-language participation, but it cannot yet determine whether these practices prevent attrition or produce sustained literacy over several years. Future research should distinguish among digital exposure, interaction frequency, language choice, measured proficiency, cultural identification, and long-term maintenance.

The results also demonstrate that children are not passive recipients of parental plans. They choose the platforms and programmes they want, push back against heritage-language materials they find unappealing, move between languages, and help determine whether family practices continue. Parental mediation is

therefore only partly effective when digital activities fail to match children's interests, identities, and developing competence.

Zhan (2025) supports this interpretation, arguing that multilingual children should be recognised as co-makers and co-managers of family language practices. Their literacy activities may include private writing, social communication, research, emotional expression, and teaching languages to parents or peers. Through digital literacy, children can also initiate practices that adults previously organised for the most part.

Borghetti et al. (2025) similarly found that children's stated language preferences shaped their parents' family-language practices, while social actors outside the family and ideological pressures sometimes prompted increased use of the majority language. This supports our conclusion that family language policy emerges through negotiation among parents, children, schools, communities, and media environments, rather than being imposed solely by adults.

Evidence from Saudi families who returned after living abroad points to a similar conclusion. Alzeer (2026) found that parents' commitment to bilingualism alone did not determine their children's language outcomes. What mattered was the interaction of school language, children's proficiency and agency, and Arabic's dominance after the families returned to Saudi Arabia. For the present review, this is especially significant: digital support at home functions within a broader institutional setting. Even intensive mediation by parents may not be enough when schools, peers, and public life consistently favor one language.

We therefore resist interpreting code-switching or children's preference for the societal language as automatic evidence of failed parenting. Strategic language mixing may support comprehension, maintain participation, and prevent communication from breaking down. However, flexible bilingual practice should not become an unexamined pathway through which the societal language continually replaces the heritage language. Longitudinal interactional research is required to distinguish code-switching that scaffolds heritage-language participation from code-switching that accompanies progressive language displacement.

5.5 Socioeconomic, Linguistic, and Developmental Inequalities

The reviewed evidence showed that technology-enhanced language practices were shaped by socioeconomic resources, parental digital literacy, available time, internet access, subscription costs, and the commercial visibility of each language. The digital divide should therefore be understood as a difference in the quality and mediability of digital resources, not merely in device ownership.

Families maintaining commercially dominant languages can generally access more electronic books, applications, subtitles, automated speech tools, and age-appropriate audiovisual materials. Parents supporting lower-resource languages may depend on informal videos, user-generated materials, or communication with relatives. Even when devices are available, families may still struggle to find high-quality content suited to children's proficiency and interests. The inequality that follows is not only technological; it is also linguistic, cultural, and pedagogical.

In their study of 1,894 Chinese adolescents, Lou et al. (2024) found that parental education, family circumstances, and mediation strategies were associated with adolescents' digital literacy. Active mediation and supervision had a positive association with digital literacy, suggesting that parental guidance can narrow resource-related differences, though it cannot remove them. The findings also indicate that mediation remains relevant beyond early childhood, when it is likely to become more negotiated and supportive of adolescents' autonomy.

Kalil et al. (2026) nevertheless found that thoughtfully designed home technology may narrow certain developmental inequalities. The digital-library intervention helped most when children began with weaker language skills. This suggests that digital provision can compensate for existing disadvantages when resources are curated, maintained, accessible, and tied to a specific developmental activity. Simply providing children with devices, without appropriate linguistic content or family supports, will likely not lead to similar outcomes. Importantly, the geographical distribution of studies included in the corpus further magnifies this concern. 16 out of 17 studies were conducted in European, Asian, North American or Australian contexts; no study originated from Africa, South America or Arab countries. Consequently, our evidence-base mostly reflects outcomes for families with relatively high levels of connectivity and institutional resources, and access to commercially-supported languages. To begin addressing this gap in Arab communities, Alkouri and Aldhafeeri' (20 26) study investigated language choice in Jordanian homes; much more research is needed in African, Arab, Indigenous, refugee, and resource-scarce multilingual contexts. Finally, the age-range of children included in this review limits its developmental scope: 12 out of 17 studies involved children under roughly age seven. During this period, young children depend on adults for mediators to engage in co-use (e.g., joint attention, repetition, and instant feedback). By contrast, adolescents and older children decide more on their own what platforms to use, with whom to communicate (and how privately), and what language(s) to use. Parental mediation is therefore likely to evolve from direct involvement to discussion, supervision, establishment of family rules around digital media, guidance around digital literacy, and support for autonomous decision-making. Some work with adolescent populations supports this hypothesis: Lou et al. (20 24) found that active mediation and supervision were both positively related to adolescents' digital literacy. By contrast, co-use did not show a similar positive trend when the different dimensions of mediation were investigated together. Zhao et al. (20 26) reached similar conclusions in their study of primary- and secondary-school students: the quality of parent-child relationships mediated the associations between parental mediation and use of digital devices. In other words, approaches to co-use that benefit young children cannot be assumed to work with older children and teens. Correlational research with bilingual adolescents is beginning to explore how parental mediation relates to children's language practices and daily lives (Crafter et al., 2020; Dawil et al., 2021). However, more longitudinal research is needed on how parental mediation and children's autonomy change during development. Studies could, for instance, investigate how responsibility for language choice evolves across childhood and adolescence—including decisions around content, safety, and how to maintain family relationships. Adolescents' private message exchanges, digital communities, video games, and creative practices may also provide important opportunities to use the heritage language in ways that differ from joint book-reading, for example.

5.6 Methodological Priorities for Future Research

The methodological conclusions themselves warrant caution. Only six out of 17 studies focused on children's language behavior or performance; others concentrated primarily on parental reports, beliefs, practices, or family experiences. All four intervention or technology-design studies were conducted over the short term, and none used a delayed unaided assessment. Therefore, the conclusions we can draw about digital practices are stronger than those about promoting lasting language development; the evidence is more persuasive when describing digital opportunities for interaction than when assessing long-term language development.

We need longitudinal studies that shadow families over time and that include multiple forms of evidence: objective logs of device usage, recordings of parent–child interaction, interviews with various family members, young children’s own accounts, and standardized assessments in both the heritage language and societal language. Also, we need to look at outcomes beyond children’s immediate performance while supported and include delayed unaided measures of vocabulary, narrative production, oral interaction, reading, and writing. Taylor et al. (20 24) similarly identified small sample sizes and a lack of methodological variety as critical limitations in the literature on adult–child digital co-use. Three-group designs would be particularly informative. Researchers could compare passive or independent digital exposure, parent-mediated digital use, and comparable non-digital interaction. Such designs would clarify whether observed benefits arise from the technology, adult scaffolding, increased exposure, or the combined activity. Researchers should also record intervention fidelity, including whether parents used prompts as intended, how often children accessed the resource, and which language was actually used. Greater consistency is also needed in operationalising parental mediation. Categories such as active mediation, co-use, restriction, monitoring, translation, and language management frequently overlap. We propose that studies report the observable behaviours occurring within each activity rather than assigning families to a single general mediation style. This approach would enable the field to identify which combinations of questioning, explanation, modelling, translation, feedback, and child choice are associated with particular outcomes.

5.7 Theoretical and Practical Implications

The review contributes a practice–mediation–context–outcome framework for explaining technology-enhanced home language development. We propose that the model should be understood as recursive rather than linear. Technology affords particular forms of input and interaction; parents mediate those affordances; children respond through participation, adaptation, or resistance; and these responses subsequently reshape parental choices and family routines.

Two constructs are especially important within this model. The first is interactional intensity, referring to the extent to which a digital activity elicits contingent, sustained, and cognitively meaningful communication. The second is linguistic alignment, referring to the correspondence among the language of the technology, the family’s language objectives, the child’s proficiency, and the language used during interaction. A highly interactive application may provide limited heritage-language benefit when its content and discussion occur mainly in the societal language. In contrast, exposure to HL content may not be productive if children are passively watching without comprehension or engagement. Implications for parents and educators. We conclude with some thoughts on how parents, educators, and technology creators can best support children’s bilingual language development through technology. Rather than recommending prescriptive rules about screen-time, families would benefit from guidance around the type of activities children engage in: selecting developmentally appropriate content in the languages children speak, asking open-ended questions, encouraging children to recall events rather than simply watching, connecting digitally based content to offline activities and concepts, and setting up authentic conversations with family members. Technology designers can support this process by embedding flexible bilingual supports, designing culturally sensitive content, creating streamlined interfaces with minimal distractions, and building features that invite adult participation rather than replacing it. Creators and policy makers should also focus attention on lower-resource languages, which are greatly underserved by existing

commercial products. In sum, we believe that technology will have its greatest impact when it supports the interactions through which children learn, use, and think about language. In the case of bilingualism, technology can help by expanding—not replacing—who can meaningfully participate across different languages, generations, and places.

5.8 Limitations of the Review

One limitation is the corpus' limited evidentiary basis. Although we bibliographically and substantively checked all 17 included core studies, the original search exports and screening archive were unavailable. Therefore, we cannot assess the sensitivity of our search nor prove it identified all eligible studies. Studies also varied on populations, language pairs, technologies, and outcome measures used, preventing a pooled estimate of effects. Another limitation is within the evidence. Studies typically focused on practices or parental perceptions rather than children's language development itself. The four interventions were short term, and none included delayed testing without assistance. The framework therefore points to plausible mechanisms and recurring associations, but it should not be read as a causal model. Its propositions still require prospective testing in more geographically and linguistically diverse contexts.

6. Conclusion

This integrative review examined how digital technologies, parental mediation, and contextual conditions intersect in bilingual family language development. Across 17 verified empirical studies, technology expanded access to heritage and societal languages through digital books, applications, audiovisual media, messaging, video calls, and transnational communication. Yet access alone was insufficient. The most favourable opportunities for vocabulary, narrative comprehension, oral participation, literacy, and heritage-language use occurred when digital activity generated contingent interaction through co-use, questioning, explanation, translation, modelling, feedback, and communication with responsive relatives. Passive or background exposure was more likely to displace conversational participation. The proposed practice–mediation–context–outcome framework therefore positions parental mediation as digital family language policy and treats child agency, language status, resource inequality, and content availability as constitutive rather than peripheral factors. Because direct developmental evidence remains limited and short term, future research should use longitudinal, multi-method designs with delayed unaided assessment in both languages. Technology is most educationally valuable when it strengthens human relationships, active language production, cultural belonging, and sustained participation across generations and locations.

Ethical Approval

Not applicable. This review analysed published research and involved no primary data collection from human participants or animals.

Data Availability

All evidence analysed in this review is contained in the cited publications. The characteristics and coding basis of the 17-study core corpus are reported in Appendix A.

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Appendix A

Table A1

Characteristics of the 17 Core Studies

Study	Context and sample	Design	Principal technology or practice	Principal contribution to the synthesis
Cyck & De Anda (2021)	United States; 30 Mexican immigrant families with toddlers	Naturalistic home recordings	General digital-media exposure	Greater exposure was associated with fewer child vocalisations and conversational turns; no causal inference.
Mifsud et al. (2021)	Malta; 4 Maltese–English families	Video observation, questionnaires, interviews	Parent–child digital-book reading	Joint reading supported bilingual engagement, explanation, discussion, and experiential connections.
Said (2021)	United Kingdom; 2 multilingual families	Family case study and interaction recordings	Digital media and transnational communication	Technology expanded heritage-language environments and participation by distant relatives.
Ferjan Ramírez et al. (2022)	United States; 37 bilingually raised Latinx infants	Day-long audio recordings	Electronic-media exposure	Exposure was associated with reduced parentese, conversational turns, and infant vocalisations.
Guskaroska & Elliott (2022)	Macedonian diaspora; 23 parents	Phenomenological survey and follow-up interviews	Digital tools for heritage-language maintenance	Parents reported strong motivation but insufficient time, exposure, and engaging resources.
Sun et al. (2022a)	Singapore; 141 bilingual children/families	Questionnaire-development study	Home digital-media ecology	QQ-MediaSEED captured quantity, quality, social participation, design, and parental mediation across languages.
Tunkiel & Bus (2022)	Norway; 14 Polish–Norwegian children	Pilot digital-reading intervention	L1/L2 sequencing in digital stories	Reading first in Polish did not clearly improve Norwegian vocabulary; no delayed assessment.
Yang et al. (2022)	China/United States; 107 parent–child dyads completing the study	Randomised controlled mixed-methods study	Bilingual e-book discussion prompts	Prompts improved comprehension and retelling but not vocabulary beyond the comparison condition.
Bus et al. (2023)	Netherlands; 41 bilingual children	Home digital-book intervention	Dutch-only versus multilingual books	Heritage-language availability alone did not increase reading as expected; vocabulary growth was similar.
Palviainen & Räisä (2023)	Finland; 1,002 children aged 9–12	Exploratory questionnaire survey	Family messaging and app-mediated communication	Texting was common, but lower-status languages and unfamiliar scripts constrained digital writing.
Sun et al. (2023)	Singapore; 162 English–Mandarin families	Cross-sectional survey	Digital and conventional home language resources	English materials were more abundant; socioeconomic and language status shaped access.
Wang & Hamid (2024)	Australia; 15 Chinese–Australian parents	Qualitative interviews	Polymedia and heritage-language maintenance	Digital media supported Chinese use, affiliation, and intimacy but also produced resistance and content concerns.
He et al. (2025)	United States; 15 Spanish–English Latine families	One-week home technology-design study	Bilingual conversational agent in e-books	The agent stimulated bilingual dialogue and Spanish vocabulary use; no delayed unaided test.
Obojska & Vaiouli (2025)	Luxembourg; 209 multilingual families	Survey	Digital language and literacy practices	Applications, videos, and games were accessible learning spaces moderated by resources and parental concerns.
Romanowski (2025)	Australia; 3 Polish-speaking fathers and 6 school-age children	Three-month digital interaction analysis	Messenger and code-switching	Code-switching supported clarification, humour, relational closeness, and continued Polish participation.
Ozturk & Ohi (2026)	Australia; 34 Turkish–Australian parents of preschoolers	Survey	Home digital-literacy practices	Joint singing, video viewing, and calls were more frequent than shared e-book reading; parents requested guidance.
Savadova & Gillen (2026)	Azerbaijan; 5 multilingual families followed for 15 months	Longitudinal qualitative study	Home digital-media mediation	Facilitative and restrictive strategies co-occurred as parents balanced multilingual aspirations and well-being.

Note. Core studies met the population, family-context, technology, and language-related eligibility criteria. Contextual studies cited elsewhere in the manuscript were not included in these descriptive counts.

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FULL PAPER

"Digital Transformation in English Language Teaching: The Impact of Artificial Intelligence on the Future of Humanities"

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Abstract

Pushed by the Artificial Intelligence (AI), the rapid digital transformation has significantly affected English language teaching by loading a pressure on teaching methods manipulating the role of both, teacher and student. The present paper investigates the role of AI driven language application and platforms, digital classrooms, and personalized learning systems in changing learning approaches and the future of education. By reviewing recent researches, this paper emphasizes the opportunities and challenges offered by digital transformation in language teaching. Discussing basic issues like ethical consideration, teacher preparing, and equitable access. The final results indicate that the adopting of AI through a human-centered approach, can improve learner autonomy, culture awareness, and essential digital literacy, using this transformation a means to amuse innovation in language teaching.

Keywords: English Language Teaching (ELT), Digital Transformation, Artificial Intelligence (AI), Pedagogical Innovation, Humanities Education, Technology Integration.

1.1. Introduction

The overview of education has been driven mainly by the force of digital transformation in the 21st century. However, certain factors like the progress in artificial intelligence, data analytics, and automation have sped up changes in the way knowledge is generated, accessed, and spread across various fields. One of the fields that affected deeply is English Language Teaching (ELT), because of the AI-based tools that progressively used to help in instructional design, assessment, personalized learning, language practice, and the way of interaction between teachers and students. As systems around the world change toward digitally enhanced learning. These new approaches, like the ones in "Education 5.0" aim to use technology to break down barriers, in education. The goal is to improve teaching methods and support the physical well-being of students. This new model puts the learner at the center. Since it has been known to everyone that according to the latest learning approaches, the teacher is no longer the source or the centre of the educational process, instead he is more like an orchestral leader. The digital modern tools emphasis that fact. Make it all about learner and since it's available and accessible especially to those who live in remote areas or faces educational problems or can't engage in regular schools.

According to Ahmed et al. (2023) a combination of technology usage with modern teaching methods that has been used by AI and that made a revolution about how we teach. That big usage of different intelligence in ELT raises a great question about the future of humanities and civilization that once built on creativity and deep thinking. What is left to human to do since machines now can write texts, grade examinations, simulate conversations, and design lessons to each student? Despite the help of AI to learners or teachers, it generates new problems about independency and fairness, about the declining of a human thinking or the existence of human values. (Crompton et al., 2024; World Bank Group).

With the increasing independency of AI tools in schools and the shift that it makes with education, it has become a crucial duty to look at that change in both, ELT methods and their aims in education. The present study gives a look at this shifting put on the spotlight on the effect of AI in education and the future of humanities. by using papers and reviews of literature with comparison studies, the present study gathering information about cons and pros of using AI in English learning and classrooms. It especially focuses on how AI-powered tools affect the steps of learning and the role of both teacher and students, the way of testing or securing, and student's engagement. wrapping up the study with checking the far that AI can raise or lower human skills.

1.2. Research questions:

- 1- How far is the effect of AI or digital tools usage in education?
- 2- What are the positives and negatives that AI brings to education?
- 3- What is the potential impact of AI on humanities, education, and values?

1.3. research limitation

Since this study is descriptive, no new information was gathered; the analysis only uses information from written sources. The findings are meant to show how important it is to keep human-focused ideas in learning places that use technology. It also aims to help the discussions, about using AI in education in a responsible way.

2. Theoretical Background

2.1 Digital Transformation in Education

The careful addition of technologies, such as AI that compute big data and immersive platforms into teaching, learning and how schools are run is called "digital transformation" in education. This change has led to active, flexible and student-centered ways of learning. Global frameworks, including those from groups like the World Bank (Cobo et al.) show how digital transformation changes the way education is delivered, how students get involved in learning, and how schools come up with new ideas to meet the needs of society and the economy.

Education 5.0 is the recent phase of education where re-humanised learning combines smart technology. This phase of education goes beyond just putting lessons online, but also it creates environment where the student is the centre of learning (Ahmed et al. 2023). By using teaching methods, the 5.0 phase can help students being creative, building a preferable set of learning, working together, and solve problems. These modern methods use technology like AI and smart system. All of this creates new changes in learning shows that digital innovations which makes things faster should also improve the quality of learning. Another part of transformation is making education easier to reach through mobile devices, virtual spaces and open learning materials. Teachers now take on roles as guides to help understand data and designers of learning environments that use technology. This shift makes it possible to use AI tools in areas, like ELT where being able to change and offer learning is very important.

2.2 Artificial Intelligence in Education

AI is changing education by allowing machines to do tasks that used to need thinking like understanding language, spotting patterns, making choices, and giving feedback. AI can help make tasks tailor learning to each person and bring new ideas into both teaching and learning, and conducting many learning settings that suit studies (Motlagh et al. 2023; Al Matari, 2023). AI in education can be sorted into:

- 1- Intelligent Tutoring Systems (ITS) give analysis of how learners do and offer feedback that changes with each learner.
- 2- Natural Language Processing (NLP) tools that aid writing, summarizing, translating and talking practice include text generation models such as ChatGPT.
- 3- Learning analytics tools watch how students act and predict how well they will learn.
- 4- Automated grading tools check student work for ideas, correct grammar and proper pronunciation.
- 5- Smart assistants manage to support classroom control, lesson planning, Customised feedback for each student.
- 6- According to Inter-American Development Bank, AI is not just a tool, it is a start to change the education system; it lets universities build learning that adapts to each person and initiates ways to decide based on data (Arias Ortiz et al. 2025).

Based on these advances, the rejection to AI in education is no longer good decision, nevertheless, scholars caution that AI must be used right; taking care of ethics, privacy, with keeping human control (e.g., Al Matari, 2023).

2.3 AI in English Language Teaching (ELT)

By introducing technologies into education, AI has great effect on the process of learning; it enhances education, personalised learning, and give students chances to practice. Extensive review of recent studies (Crompton, Edmett & Ichaporia 2023; Syuhra et al. 2025) shows that AI improves language skills in a variety of ways:

a. Improving the Four Language Skills Instruction:

Listening: It helps students of better understanding the spoken language by platforms that specialised with Interactive listening and others with automated speech recognition (ASR) tools.

Speaking: students who use AI chatbots and pronunciation tools are allowed to practice speaking and get instant feedback on their fluency and accent.

Reading: based on students' level tools like text simplifications and systems with adaptive reading can adjust content to make reading more manageable.

Writing: tools and systems that can give feedback, analyze grammar, coherence and style manages to help students improve their writing step by step.

All of which, provide fulltime personalized assistance that traditional teaching methods often cannot compete.

b. Customization and Flexible Education:

Contrasted to typical classroom learning AI present adaptive learning systems like AI tutoring models, where they change the difficulty of tasks by adjust the pace and give feedback based on the students' performance. According to the studies, students show that adoptive learning systems increasing engagement and accelerate learning outcomes (Bardia & Agrawal 2025).

C. Support for Teachers and Pedagogical Improvement:

The dominant fear about using AI in schools rises a resistant question: will AI replace teacher in school? according to Edmett et al. (2024) AI does not take over teachers' role, instead it supports it by helping them produce the burden; handling daily routine work such as planning lessons, creating tasks, and monitoring student progress, while teachers manage to focus more on humanistic part in education like encouraging, given support, giving creative instructions, and addressing deeper learning needs. In summary, AI strengthens teaching rather than replacing it.

d. Increasing Educational Possibilities Beyond the Classroom:

To study free of time and place is what AI apps and intelligent virtual tools with online learning environment offer to students. This flexibility and ongoing learning are inline with global trends like education 5.0 and the transformation towards digitalisation. By using that type of learning, students gain autonomy and develop skills outside classroom (Ahmad et al. 2023).

3. Reviewing Related Works

Based on the type and extent of the materials used, the review is divided into four thematic threads.

3.1 Systematic Reviews of AI in ELT

In order to map the terrain of AI integration in ELT and determine the range of tools used as well as the depth of their pedagogical consequences, systematic literature reviews have been essential. In a thorough analysis commissioned by the British Council, Crompton, Edmett, and Ichaporia (2023) looked at a variety of AI applications for teaching English. Their results demonstrate how AI tools

facilitate a range of tasks, such as content adaption, intelligent feedback, speech training, and grammatical correction. They stress that by allowing students to participate in self-paced, customized practice, AI greatly enhances learners' autonomy.

In a same vein, Syuhra, Sofyan, and Rosalina (2025) carried out a systematic review of AI systems created especially for ELT settings. According to their review, which divides AI-based solutions into administrative, instructional, and assessment-related tools, AI enhances learning outcomes when incorporated into a system that is pedagogically grounded. But they also highlight issues with teacher readiness, technology constraints, and moral dilemmas. When taken as a whole, these evaluations highlight how AI is now a fundamental element in the development of contemporary ELT techniques.

3.2 AI in International Education Contexts

/Future-focused evaluations of how AI is changing education systems around the world have been prepared by a number of international organizations and multilaterals. A global overview of AI use in education is provided in the World Bank Group Report (Cobo et al.), which highlights the opportunities it brings for enhancing access, efficiency, and personalization. The report argues that AI can change the state of education precisely in countries that seek to modernize their learning systems and bridge the digital gap. It also emphasizes the role of law in controlling the use of AI to be fair and responsible.

Similarly, AI in Education: "Building the Future Through Digital Transformation" (Arias Ortiz et al. 2025) A published paper from the Inter- American Development Bank gives an overview about the role of AI is re-shaping major facts in education like the educational relationships, student role and services, and teacher practices. The report points out the fact that institutions must be prepared and equipped with new technologies in order to make AI truly work in education. it calls for the investment in digital infrastructure, ongoing training for teachers, with emphasis on building strong ethical standards.

3.3 Comparative and Applied Studies on AI in Education

A comprehensive overview made by comparative studies clears the effect of AI tools in reshaping educational environment. One of which is the study by Motlagh et al. (2023) which made a comparison between well-known AI text generation apps like ChatGPT, Bing Chat, Bard and Ernie. Their findings shows that each tool has its strengths, in one way or another, but overall, they conclude that AI apps are getting better in creating coherent content, giving feedback, and supporting academic writing. This investigation provides clear insights about how AI assistance could support educators and learners in ELT Settings, precisely with developing content and writing assistance.

Another study by Bardia and Agrawal (2025) about using MindCraft, reveals that AI creates good learning experience, especially, with limited resources places (like Rural India). Their research shed the light about how AI powered mentoring apps can offer equal access to education, meet individual learning needs, and raise motivation. In special ELT context, where the students often need different levels of instructions, this kind of tailored support is an effective solution.

In Malaysia, Jalaluddin et al. (2025), made a practical study focusing on methods of teaching that depends on AI. Their study shows how national plans are made to include AI in infrastructure, curriculum designs, and assistant systems. they state that when AI is used with clear goals and powerful teaching philosophy, it can lead to a significant long-lasting improvement.

These studies combined together to show that the role of AI in education goes far beyond helping with language learning; it even affects the practical institutions and offers expanding ways to improve the excellence of education universally.

3.4 Studies on Preparing for Future ELT Practices

The fact that, in recent future, AI can transform English language teaching instructions and the needed skills to both students and educators. Crompton et al. (2024) examined the affordance and difficulties of applying AI in ELT. They list some advantages like better adoptability, higher engagement, and more accurate assessment. Nevertheless, they also warn about the problems that combined AI usage, including algorithmic bias, technology reliance and the requirement to overcome digital literacy among teachers.

The British Council's Artificial Intelligence and English Language Teaching: Preparing for the Future by Edmett and colleagues in 2024 offers advice on how teachers might adjust to new trends in a more practical setting. The paper emphasizes that rather than taking the place of teachers AI should be seen as a collaborator in the educational process. It also lists focused skills that are still essential in ELT despite the quick development of technology like creativity, teamwork and critical thinking.

Lastly, earlier studies like Zmyzgova, Polyakova and Karpov (2020) offer viewpoints on the role of AI as a catalyst for the digital revolution of education. By demonstrating how early conceptual frameworks influenced AI-enhanced learning systems, their analysis aids in placing current advancements in context.

4. Methodology

4.1 Research Design

In order to examine current trends, practices, and effects of digital transformation and artificial intelligence (AI) in English language teaching (ELT), this study uses a descriptive research design. The descriptive approach offers a thorough framework for examining how AI technologies are affecting the future of humanities-oriented language pedagogy since the objective is to describe and synthesize insights from current scholarly sources rather than test hypotheses or change variables.

The present study is based on published works including, papers and reports from responsible organizations, contemporary journals and empirical researches about AI and digital learning. These sources provide reliable proof of how AI tools, digital platforms, and technology-enhanced pedagogies are changing ELT.

4.2 Data Collection

Since the study is grounded in literature, information was gathered using:

- 1- AI applications in EFL contexts are covered in peer-reviewed journal articles (e.g., Elgamal & Abu-Ayyash, 2024; Bjekić et al., 2019; Popenici & Kerr, 2017)
- 2- Reports and reviews of education from reputable organizations (e.g., Edmett et al., 2024; British Council, 2024)
- 3- Empirical research on the application of smart classrooms, mobile-assisted instruction, digital platforms, and intelligent tutoring systems in language learning. theories pertaining to AI ethics, automation, and cognition

Among the requirements for inclusion are :
Sources released in 2023–2025. Relevance to digital transformation, AI, or EFL instruction, academic or institutional legitimacy, full text accessibility for qualitative idea extraction

4.3 Data Analysis

A qualitative theme approach was used in the analysis. Every source was examined to extract

concepts pertaining to:

AI-powered ELT tools, Frameworks for digital transformation, Effects on students, Effects on educators, AI's drawbacks and restrictions in ELT.

After that themes were arranged into parts that served as the foundation, for Chapters 4 and 5. These themes were then combined according to recommendations.

By highlighting trends, convergences and contrasts within the literature this type of theme synthesis helps the research paint a picture. It shows how AI is changing ELT and what this implies for the humanities future.

4.4 Research Procedures

The study approach comprised the following steps:

- 1- Choosing the topic. Setting its limits: ELT, AI and digital transformation.
- 2- Gathering the required sources.
- 3- Grouping the sources into applied, empirical and conceptual categories.
- 4- Obtaining pertinent information and proof from every source.
grouping the books according to themes.
- 5- Combining the results into sections that are analytical and descriptive.
- 6- Utilizing patterns found in the literature to draft the discussion and conclusions.

4.5 Limitations of the Study

Descriptive literature-based research has limitations even though they offer wide insights:

- 1- The research reflects what has already been studied when it is dependent on previous investigations.
 - 2- Practical contextual interpretation may be limited by a lack of field data, such as teacher interviews and classroom observations
 - 3- Generalization may be impacted by the assessed sources' differences in study environments.
 - 4- Certain conclusions may alter soon due to the rapid evolution of AI technologies.
- Despite these drawbacks, the study upholds academic integrity by depending only on reliable, current, and validated sources

5. Findings (Literature-Based Results)

5.1 AI-Powered Tools Improving Language Acquisition

Through a variety of methods and technology, artificial intelligence (AI) emerges as a key catalyst for revolutionizing EFL learning throughout the studied sources:

5.1.1 Systems for Intelligent Tutoring (ITS)

Assembling the verified sources. The growing importance of systems that customize education is highlighted by sources, like Edmett et al. (2024) And other AI-based ELT studies like: examining the behavior of students, changing the difficulty of the work, giving feedback, automatic progress monitoring. In EFL settings these technologies have enhanced reading, writing and grammatical performance.

5.1.2 Automated Evaluation and Feedback

Research keeps proving that AI-driven writing assessment systems give quick scoring and helpful tips to make vocabulary and grammar better and look at how students organize and connect ideas. These AI-driven writing assessment systems help learners spot and fix their weaknesses and also give them

more freedom when they write. Meanwhile AI-based assessment also helps teachers by taking care of everyday grading and giving feedback (Crompton et al. 2024).

5.1.3 Recognition of Speech and Pronunciation Training

One of the modern pronunciation tools are those based on AI. These tools are seen as useful means to aid people improving their pronunciation. These tools or apps check the way learners say words then they find mistakes in pronunciation immediately then give correct examples of the same word's pronunciation. Because of this immediate feedback, learners can fix their errors quickly. Furthermore, this way helps them improve their speaking smoothly over time. They also make learners feel more confident when they speak in situations where they usually feel nervous or hesitate (Syuhra et al. 2025).

5.2 ELT Learning in Digital Environments

According to the research sources, digitally enriched environments are replacing traditional classroom models rapidly, especially through below:

5.2.1 Learning Management Systems (LMS)

Learning management systems (LMS) are tools that equipped with AI in order to do many educational processes like, planning lessons, online discussions, and managing assessments. Due to the existence of all these features in one place, LMS make learning to be easier and capable to change and adopt. They also help student-center teaching methods to be applied by letting students get learning materials, finishing tasks, and take part in learning activities according to their actual needs. In short, LMS are important for making learning to be more personal and effective (Ahmad et al. 2023).

5.2.2 Mobile-Assistance Language Learning (MALL)

To be free of the commitment to time and place, unlike regular schools, MALL allows learners to study on their smartphones or tablets whenever and wherever they want. It also opens up chances for students to keep practicing a language outside formal classrooms. MALL tools usually use AI and games to make learning fun and interactive. Furthermore, it encourages learners to practice regularly. due to this MALL manage to keep students engaged with their studies with high motivation. (Syuhra et al. 2025).

5.2.3 Digital Infrastructure and Smart Classrooms

With accordance to recent resources, whiteboards are becoming widely spread and more common in educational settings. Also, there are automation to classrooms with AI powered multimedia. All of which help classrooms to be interactive and give multimedia content. Together they build new learning environments where they fit learning preferences and make learning to be more flexible and engaging (Cobo et al. 2024).

5.3 The Effect of AI on Teachers' Roles

As it is been said and emphasized ed that AI is changing teacher's roles rather than replacing them. This shift is clarified below :

5.3.1 Transition from Information Provider to Learning Facilitator

Traditionally, teacher's role was about giving information, but that fact has been changed. Teachers now facilitate learning and development. They guide students through learning processes to gain thinking skills, understanding how to use tools well, and teach them how to look at data and information from AI systems to decide what is real or important (Edmett et al. 2024)

5.3.2 New Competencies and Professional Development

As technology is rapidly moving and changing, teachers need to be updated and trained in order to adjust to technology. The recent resources emphasize that educators need to develop new skills like mastering technological ecological content knowledge; they need to improve their knowledge about AI in order to judge digital tools (Crompton et al. 2024).

5.4 The Effect of AI on Students

5.4.1 Enhanced Motivation and Involvement

Digital platforms and AI tools can help students stay motivated and involved with their studies. They also, allow the students to have control over their learning and move from materials in their preferred rhythm. Furthermore, students get instant feedback that keeps them active and focused. This instant feedback shows them where they stand and what they need to work on (Syuhra et al. 2025).

5.4.2 21st-Century Skill Development

AI-supported education can help students build and develop essential 21st century skills like, critical thinking and problem-solving skills. Multimedia learning activities, for example, can also help students to be more creative and motivate them to interact with information more efficiently. These abilities, nowadays, are the most important in an environment that is being shaped by artificial intelligence (Cobo et al. 2024).

5.5 Humanistic and Ethical Issues

5.5.1 Machine vs. Human Decision-Making

Using AI in education raises up worries about the extended dependency on automated grading which also questioning the fidelity or the bias that might be built into AI systems. There is a serious concern that human knowledge and judgement might lose their value when AI is excessively used (Crompton et al. 2024).

5.5.2 Maintaining Humanistic Principles

Humanities educators say that AI should help boost creativity not take it. They also believe AI should support empathy, understand cultures and make good moral choices. Therefore, teachers are still very important, in teaching these values and make sure that technology helps not takes over the human dimension of education (Cobo et al. 2024).

5.6 AI's Difficulties and Restrictions in ELT

The recent resources highlight some problems that accompanied using AI in ELT. One of which is lacking availability of up-to-date technology and some regions. Another problem concerns teacher training where there always insufficient training to update teachers; skills of using AI tools. Furthermore, there are serious worries about privacy and safety of information. Finally, there are concerns about the possibility of mistakes or bias in AI feedback (Crompton et al. 2024). Solving these problems is very important to get the maximum benefits of AI in ELT.

6. Discussion and Conclusion

6.1 Discussion

The outcomes of the literature study reveal that the digital revolution and AI are profoundly changing ELT and that these changes carry consequences for the humanities.

AI is a tool that helps with adaptive assessment, personalized learning and boosts teacher productivity according to several sources (Crompton et al., 2023; Edmett et al. 2024; Syuhra et al. 2025). In line, with the goals of Education 5.0 (Ahmad et al., 2023) and accepted digital education frameworks (Cobo et al., 2023; Arias Ortiz et al. 2025) AI innovations encourage student autonomy and involvement.

6.1.2. Impact on Pedagogy

Teachers can move from teaching facts to learner-centered approaches; helping students learn better by using systems, like Intelligent Tutoring Systems (ITS) and tools that processing language and AI assessment platforms. While AI takes care of routine jobs, teachers are becoming more like guides and helpers focusing on skills like being creative, thinking deeply and making good choices. This change does not mean that human teaching is gone. Instead, it shows how technology and human education can work together better (Edmett et al., 2024; Bardia & Agrawal 2025).

6.1.3. Opportunities for Learners

I see how AI helps students to learn in ways that fit each student's pace and style. AI gives students tools for pronunciation, writing and conversation practice that give personalized feedback. This feedback keeps students' skills growing. AI also shows students multimodal resources through AI-integrated platforms. These platforms build 21st-century abilities, like digital literacy, problem-solving and self-regulated learning (Motlagh et al., 2023; Jamaluddin et al. 2025).

6.1.4. Challenges and Ethical Considerations

Despite artificial intelligence brings benefits to ELT researches points out difficulties and ethical worries that come with its growing use. Relying much on technology could mean fewer chances for teachers to use their own judgment and connect with students in person. There are also concerns about how personal data is handled and whether AI systems carry hidden biases. These issues make it important to think carefully about how to use AI

Another problem is that not all schools have the access to digital tools. Some places lack internet connections or up-to-date devices. Teachers may also not be trained enough to use AI effectively. This can stop AI from being used, especially, in areas where resources are already limited.

These problems show that human-centered values must stay strong in education. Things like empathy, creativity and understanding of cultures should remain at the heart of teaching and learning. They shouldn't be pushed aside just because new technologies are available. Studies, by Crompton et al. (2024). Zmyzgova et al. (2020) Support this view.

That means using AI in English language teaching needs planning. We need guidelines that mix technology with thoughtful ethical choices. The goal should be to make AI a helpful tool—something that supports teachers and helps students learn better—not something that takes over the part of teaching.

6.1.5. Implications for the Humanities

Beyond language acquisition, AI has an impact on the humanities as a whole. AI tools can help with research, content creation, and textual analysis, but they also call into question the value of human interpretation and creativity. According to the literature, humanities instructors need to make sure that AI enhances humanistic inquiry rather than reduces it, maintaining abilities like cultural literacy, ethical reasoning, and critical thinking (Crompton et al., 2024; Edmett et al., 2024).

6.2. Conclusion

In summary, this descriptive study shows how AI and digital transformation will be crucial in

determining ELT's future while also having an impact on the humanities as a whole. Important lessons include:

By offering individualized, flexible, and multimodal educational experiences, AI improves learning outcomes.

With an emphasis on higher-order cognitive and creative skills, teachers' roles are changing to include mentorship and facilitation .

While using AI-driven technologies to supplement traditional training, learners acquire essential 21st-century abilities .

Humanistic and ethical issues continue to be crucial, including close consideration of prejudice, privacy, and the maintenance of human-centered ideals .

To optimize the benefits of AI, institutional and policy-level support—including infrastructure, teacher preparation, and alignment with educational objectives—is crucial.

This research needs to be carried out with care to protect the values of the humanities while showing how AI can change the way English is taught. The best way to do this is, by looking at what happens in classrooms over time comparing cultures and studying how AI affects thinking skills and the ability to understand human experiences. All of these things should be studied more in the future.

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FULL PAPER

Bundled Incentive Interventions for Rural Physician Retention: Evaluating Whether Combined Scholarships, Housing Support, and Workload Reforms Reduce Burnout.

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Abstract

Rural and underserved communities continue to struggle to keep enough physicians, limiting people's access to primary care. This review looked at ten recent studies from both wealthier and lower-income settings to understand which approaches help recruit and retain doctors in these areas.

Education-based programs showed the clearest signs of improving retention. Financial incentives and policy requirements had mixed results, and seemed to work better when paired with other forms of support. Heavy workloads, limited independence, professional isolation, and weak ties to the community were linked to burnout and doctors' plans to leave. Mentoring, career opportunities, supportive workplaces, and social connection appeared to help doctors stay.

Overall, the findings suggest that retention efforts should combine several approaches and fit the needs of each community, rather than rely on a single solution. The evidence is still limited: studies often used different measures, provided little detail about how programs were carried out, and rarely tracked results over the long term. More rigorous, long-term research is needed to learn which combinations work best in different settings.

Keywords

Rural physician retention; Recruitment and retention strategies; Professional support

1.Introduction

People living in rural and remote areas often have less access to primary care. One reason is that health systems struggle both to attract physicians to these communities and to give them reasons to stay. The problem is becoming more pressing as demand for care grows, populations age, chronic illnesses become more common, doctors retire, and working conditions and burnout worsen.

Whether physicians remain in rural areas depends on more than financial incentives. Career opportunities, workload, workplace support, living conditions, family needs, and connection to the community all matter. Recruiting doctors alone may not be enough if the job does not offer sustainable workloads, career development, suitable housing, family support, and a sense of belonging.

Many approaches have been tried, including education programs, service requirements, financial incentives, and professional support. But evaluations are inconsistent, and studies often provide little information about whether these strategies lead to long-term retention. A focused review of recent research can help show which approaches have the strongest evidence, how local conditions affect their success, and what information is still missing for workforce planning and policy.

1-1Key Studies to Anchor the Review

• Study Focus	• Main Contribution	• Why It Matters
• Global determinants review	• Six retention domains	• Core conceptual base
• Canada integrative review	• Relational, multi-level retention model	• Strong recent synthesis
• U.S. scoping review	• Retention outcomes poorly reported	• Shows evaluation gap
• Philippines mixed-methods	• Dynamic local and work determinants	• LMIC implementation relevance
• China cohort	• Post-obligation retention tracked longitudinally	• Rare long-term evidence

Figure 1: Illustrative studies to anchor a systematic review on rural physician retention

1-2Review Gap

Although many approaches have been used to recruit and retain physicians, the research is scattered across regions and often has methodological limitations. Reviews from the United States and other countries find that programs frequently omit retention results or measure them in different ways, making it hard to compare approaches. Research also rarely tracks physicians' decisions to stay or leave over

time. Short follow-up periods and inconsistent definitions of recruitment and retention add to the problem.

Recent studies suggest that combining strategies may work better than offering the same incentive everywhere. Moderate financial support may be more effective when paired with career opportunities and other non-financial benefits. Rural training programs, local mentors, and residency placements based in rural communities may also help physicians stay, since some leave underserved areas to pursue specialist training elsewhere.

2-Literature Review

The literature review examines why rural physicians leave, how retention programs are designed, and how burnout contributes to turnover. It suggests that single incentives may not be enough. Instead, combining scholarships, housing support, and changes that make workloads more manageable may help physicians stay (Kumar & Clancy, 2020; Cosgrave, 2020; Coumans & Ciller, 2026).

2-1Background: Rural Maldistribution and Retention

This section outlines evidence on geographic maldistribution, systemic retention gaps, and the operational limits of recruitment-only policies for rural healthcare staffing.

2-2Geographic Workforce Maldistribution

Severe geographic disparities in healthcare staffing persist globally, concentrating critical personnel in urban centers while leaving rural and remote populations underserved.

- Rural populations face marked disparities in healthcare access, as roughly 20% of the United States population lives in rural areas but only 10% of physicians practice there.
- Nursing workforces mirror this imbalance, with rural regions maintaining only 64.1 registered nurses per 10,000 residents compared to 97.9 in urban settings.
- Resource-limited regions experience pronounced gaps, where 89% of the population in states like Bihar resides rurally despite only 40% of health workers being placed there.

2-3Systemic Rural Retention Gaps

Attracting health workers to underserved settings does not guarantee sustained staffing, as isolation, demanding conditions, and resource deficits trigger high post-placement turnover.

- Health workers frequently relocate from underserved communities immediately after completing their mandatory service periods or return-of-service obligations.
- Chronic primary care shortages are exacerbated by health facility vacancies reaching up to 64.2% for primary center assistants and 21.8% for medical officers.
- Workplace attrition is driven by social and professional isolation, lack of basic clinical supplies, insufficient housing, and unpredictable schedules.

2-4Limits of Recruitment-Only Policies

Isolated recruitment initiatives fail to establish a stable workforce because they focus on initial entry while neglecting the ongoing workplace supports required to sustain long-term practice.

- Policy interventions predominantly target initial recruitment, with one national review identifying 218 recruitment-focused programs compared to only 24 dedicated exclusively to retention Russell et al. (2021).
- Coercive or single-factor approaches show limited long-term impact, as standalone financial incentives demonstrate inconsistent retention outcomes across low- and middle-income nations.
- Sustainable workforce development requires bundled and multifaceted strategies integrating living infrastructure, manageable workloads, rural background selection, and supportive management environments Noya et al. (2022).

Synthesizing these findings demonstrates that overcoming rural maldistribution requires moving beyond transactional recruitment quotas toward comprehensive retention environments that support clinicians throughout their careers.

2-5 Rural Maldistribution and Retention

This section outlines evidence on geographic maldistribution, systemic retention gaps, and the operational limits of recruitment-only policies for rural healthcare staffing.

2-6 Geographic Workforce Maldistribution

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2-8 Theoretical Frameworks for Rural Workforce Retention

Evaluating bundled retention packages requires synthesizing three complementary theoretical domains: holistic multi-domain frameworks, occupational stress mechanisms, and program-level theories of change.

Multi-Domain Retention Models

Multi-domain frameworks explain retention as an ongoing interaction between professional environments, personal roles, and geographical attachments.

- The Whole-of-Person Retention Improvement Framework (WoP-RIF) establishes that retention depends on three interconnected domains: Workplace/Organizational, Role/Career, and Community/Place.
- Preconditions for retention require feeling supported at work, having clear advancement pathways, and developing a genuine sense of belonging in the community.
- Persistent social alienation and community detachment prompt health professionals to leave rural positions regardless of whether remuneration is favorable.

Occupational Stress Mechanisms

Stress and motivational frameworks explain how unbalanced working conditions erode individual well-being and trigger voluntary turnover intentions.

- Rural understaffing generates heavy workloads for remaining clinicians, reducing job satisfaction and causing self-perpetuating cycles of turnover.
- Turnover intentions intensify when an unaddressed gap emerges between clinicians' professional expectations and their lived experience of practice demands.
- Retention is contingent on balancing extrinsic work requirements with supportive leadership, orientation support, and manageable practice systems.

Theory of Change Implementation

A theory of change conceptualizes how complex multi-component retention interventions translate organizational resources into sustained workforce stability.

- Realist program theories map how specific contexts, operational drivers, and organizational mechanisms interact to generate intended workforce retention outcomes.
- Sustainable implementation of multi-component retention packages requires high-level executive championship and strategic integration of human resources.
- Bundled non-financial supports, including paid transitional housing and structured clinical supervision, address baseline establishment needs to stabilize early-career practitioners.

Together, these frameworks provide a rigorous theoretical architecture linking structural inputs like scholarships, housing, and workload caps directly to reduced clinician burnout and sustained retention.

2-9Determinants of Rural Physician Retention

Rural physician retention depends on an interplay of financial packages, career progression pathways, physical infrastructure, practice workloads, clinical autonomy, and community integration. This synthesis examines these determinants across economic and career incentives, workplace and infrastructural demands, and community-level social ties.

2-9-1Economic and Career Progression Factors

Financial remuneration serves as an initial recruitment motivator, but its capacity to sustain retention diminishes without concurrent opportunities for professional development and upward mobility Noya et al. (2022).

- In a discrete choice experiment of 315 family physicians, a 50% salary raise strongly drove rural uptake, yet monetary increments exhibited rapidly diminishing marginal utility beyond a critical threshold.
- Physicians frequently trade direct income for career progression; Vietnamese clinicians were willing to forfeit 48.36% of their salary for urban postings but accepted rural positions if granted accelerated promotion pathways.
- A 5-year prospective cohort tracking 2,041 rural Chinese general practitioners demonstrated that unaddressed financial debt during medical school tripled post-contract attrition, highlighting the protective role of educational debt relief Cosgrave (2020).

2-9-2Infrastructure, Workload, and Practice Autonomy

The physical work environment and daily clinical schedule directly determine whether clinicians experience burnout or remain in rural practice, with excessive workload standing as a primary tipping point.

- In a survey of 722 rural doctors, working beyond 50 hours weekly more than doubled the likelihood of anticipated turnover, driven primarily by non-clinical filing and outpatient service overloads.
- Practice autonomy fosters retention when paired with supportive supervision, but isolated autonomy without institutional backing creates emotional fatigue and overwhelm.
- Severe facility deficiencies, erratic locum coverage, and dilapidated housing undermine morale, whereas functional clinical infrastructure and reliable administrative leadership consistently mitigate emotional exhaustion.

2-9-3Community Integration and Relational Factors

Social relationships and personal belonging frequently override institutional conditions in long-term retention decisions, determining whether clinicians permanently root themselves in rural localities Russell et al. (2021).

- In South Australia, an evaluation of general practitioners serving over 25 years identified community-level social respect and flexible, shared on-call rotas as central facilitators of multi-decade retention Cosgrave (2020).
- Multivariable tracking shows that contracting physicians within their native hometowns increases post-obligation rural retention by 164%, leveraging pre-existing social safety nets and kinship ties Russell et al. (2021).
- Key barriers prompting departure include limited spousal employment, schooling constraints for dependents, and blurred privacy boundaries that impede healthy work-life balance.

Addressing physician retention requires bundling competitive pay with manageable shift hours, functional facility tools, career advancement avenues, and structured integration for clinicians and their families.

Bundled interventions likely outperform single incentives, but evidence is heterogeneous and burnout is a key retention pathway.

A useful synthesis here has five linked facets: intervention types, bundled packages, burnout pathways, evidence gaps, and study rationale. Across the literature, rural retention is treated as a multicomponent policy problem rather than a salary-only problem.

2-10Intervention Types

The literature consistently organizes rural retention interventions into education, regulation, financial incentives, and personal or professional support. Educational strategies include rural-background selection, distributed undergraduate and postgraduate training, and upskilling of existing rural clinicians. Support strategies often include housing, locum relief, mentoring, telehealth, career development, and family-oriented supports Jinah et al. (2024).

- Educational pathways show the most consistent association with rural practice and retention.
- Regulatory return-of-service programs retain clinicians during obligation periods, but retention often drops after the contract ends.
- Financial incentives help, especially scholarships, bursaries, and loan repayment, but results are mixed when used alone.

2-11Bundled Packages

Multifaceted programs may be more effective than single interventions because physicians' decisions to stay depend on several parts of their lives and work. Reviews across different income settings emphasize combining professional, personal, educational, and workplace support in ways that fit local needs. Realist research suggests that coordinated support can help physicians gradually feel more comfortable and capable, strengthen their sense of belonging, and build lasting connections with their communities (Noya et al., 2022).

Looking at the combined support programs: government programs in Norway and Chile that addressed several needs at once reported better retention and lower turnover. Payment changes also appeared more promising when paired with team support, mentoring, and help settling into the community. Remote training programs that combined supervision, education, and social support showed signs of lasting impact: 49% of participants were still working in the same community two years after completing the program.

2.12. Burnout and physicians leaving

Burnout may help explain how difficult working conditions lead rural physicians to leave. Common contributors include excessive workloads, little control over workload, disorganized workplaces, limited resources, and reduced professional autonomy. This suggests that improving how organizations operate may be more effective for retention than relying on resilience training alone.

In rural China, burnout partly explained the link between job satisfaction and physicians' intentions to leave. Research also found that stress, low control over workload, and chaotic practice conditions were each associated with a greater likelihood of burnout. Qualitative reviews describe burnout, the need for time off, and poor organizational support as common reasons rural doctors leave.

The main problem is not a lack of interventions, but limited evaluation. Most studies are observational or cross-sectional, few compare programs directly, and many cannot identify which parts of a combined program made a difference.

Studies also measure retention inconsistently. They use different definitions and follow-up periods, and often report where physicians work without showing whether they stay after a service commitment ends or remain in a particular specialty. These limitations help explain why findings on financial and regulatory approaches are mixed. Combined programs may make sense, but they have not yet been tested rigorously enough.

2-13 Study Rationale

Studying scholarships, housing assistance, and workload improvements together reflects what the research suggests about physician retention. Scholarships and funding tied to service can help bring doctors to rural areas, and sometimes encourage them to stay after their commitment ends. Housing and family support can make rural life more manageable and help physicians feel connected to the community. Workload changes address burnout, which is consistently linked to doctors considering leaving.

Together, these strategies address three related needs: attracting physicians, making their day-to-day work and life sustainable, and reducing burnout. This gives a strong reason to study them as a combined approach, even though long-term comparisons between programs are still limited.

2-14 Ten key studies for an updated rural physician retention review

These ten studies are a strong focused review set because, together, they cover intervention effectiveness, contextual modifiers, burnout-linked attrition, implementation logic, and the main evidence gap the field still faces (Contu et al., 2026).

Recommended Core Studies

Study	Why Include It	Main Contribution
Russell et al., 2021	Strongest intervention review	Educational pathways show the clearest retention signal; coercive ROS performs worse long term (Russell et al., 2021)
Coumans & Ciller, 2026	Best burnout-retention synthesis	Burnout, autonomy loss, and workload link poor conditions to turnover (Coumans & Ciller, 2026)
Arredondo et al., 2026	Best PCP program mapping	Shows major gaps in retention reporting and comparability across U.S. programs (Arredondo et al., 2026)
Jinah et al., 2024	LMIC effectiveness review	Compares education, regulation, finance, and support strategies in LMICs (Jinah et al., 2024)
Contu et al., 2026	Best update rationale	Defines outcomes, contextual modifiers, and policy-facing review logic (Contu et al., 2026)
O'Sullivan et al., 2026	Best support-package theory	Explains how bundled professional support drives comfort, competence, belonging, and retention (O'Sullivan et al., 2026)
Alidina et al., 2025	Real-world package evaluation	Portugal case shows deployment gains but only modest retention advantage over non-participants (Alidina et al., 2025)
Onnis & Hunter, 2024	Organization-level scoping review	Highlights lack of implementation and evaluation detail in workforce interventions (Onnis & Hunter, 2024)
Boone et al., 2024	Best cross-national package design paper	Supports combining support, education, finance, and regulation rather than single fixes (Boone et al., 2024)
Cosgrave, 2020	Best retention framework	WoP-RIF organizes retention into workplace, role/career, and community/place domains (Cosgrave, 2020)

Figure 1: Ten recommended studies for a focused systematic review on rural physician retention

Evidence Coverage

Field	Retention	Context	Implementation	Follow-up
Education	5 papers	1 paper	4 papers	No papers
Regulation	5 papers	3 papers	2 papers	No papers
Support	6 papers	6 papers	3 papers	No papers
Burnout	1 paper	1 paper	No papers	1 paper
Packages	2 papers	1 paper	No papers	No papers

The most striking gap is long-term comparative evaluation. Russell finds all included intervention studies were observational and calls for stronger designs, while Arredondo shows most rural PCP programs do not report retention outcomes consistently (Russell et al., 2021; Arredondo et al., 2026).

A second gap is weak reporting on how interventions work in context. Onnis notes that evaluated interventions seldom explain organizational implementation, and O'Sullivan shows support works through context-sensitive mechanisms like belonging, confidence, and bonding rather than through a single universal component (Onnis & Hunter, 2024; O'Sullivan et al., 2026).

How to Use Them

For a publishable review, use Russell, Coumans, Arredondo, Jinah, and Contu as the analytic backbone, then use O'Sullivan, Alidina, Onnis, Boone, and Cosgrave to interpret mechanisms, bundled design, and policy translation (Contu et al., 2026; O'Sullivan et al., 2026; Alidina et al., 2025). The intervention categories and evidence logic are also laid out visually in the main systematic and conceptual papers. (Table 2: Characteristics of included studies) (Figure 2: Integrated framework around the five essential elements of well-being and their possible impact on rural physician retention.)

2-15 Research Gaps

Many programs focus on bringing physicians to rural areas, while offering little support to doctors who are already practicing there (Arredondo et al., 2023). Research on combined or incentive-based programs also often uses inconsistent outcomes, weak comparison groups, or short follow-up periods. As a result, it is difficult to tell which parts of a program improve retention or reduce burnout (Verma et al., 2016; Arredondo et al., 2026; Jinah et al., 2024).

The review should therefore make the case for studying both burnout and retention. Financial and other incentives may attract physicians at first, but keeping them in rural practice over time depends on whether the support improves their working conditions, professional autonomy, and daily lives (Alidina et al., 2025; Coumans & Ciller, 2026; Han & Grady, 2025).

This leads directly to the proposed study: building on what is known about rural retention and combined support programs, it will examine whether scholarships, housing assistance, and workload reforms can reduce burnout and help rural physicians stay.

3. Methodology

The researcher will use is a PRISMA 2020–guided, PROSPERO-registered systematic review focused on the 10 most recent and policy-relevant studies, with narrative synthesis as the primary analytic strategy because intervention types, settings, and retention outcomes are heterogeneous (Contu et al., 2026).

Feature	Result / Value
Study Type	Systematic review of quantitative intervention studies (Contu et al., 2026; Russell et al., 2021)
Reporting Standard	PRISMA 2020 (Contu et al., 2026; Coumans & Ciller, 2026)
Registration	PROSPERO registration before screening (Contu et al., 2026)
Population	Primary care physicians, residents, and medical students on rural pathways (Contu et al., 2026; Arredondo et al., 2026)
Context	Rural, remote, or underserved areas; state definitions as used by study authors (Russell et al., 2021; Arredondo et al., 2026; Cosgrave, 2020)
Eligible Designs	RCTs, quasi-experimental, CBA, ITS, cohort, case-control, cross-sectional (Contu et al., 2026; Arredondo et al., 2026)
Core Interventions	Education, regulation, financial incentives, personal/professional support, and bundled packages (Contu et al., 2026; Jinah et al., 2024; Onnis & Hunter, 2024)
Primary Outcomes	Number retained, retention duration, post-obligation rural practice (Contu et al., 2026; Arredondo et al., 2026)
Secondary Outcomes	Recruitment, career intention, burnout, satisfaction, well-being, workforce stability, cost-effectiveness (Contu et al., 2026; Coumans & Ciller, 2026; Russell et al., 2021)
Quality Appraisal	Use design-specific NIH or JBI tools; consider QuADS only if mixed-method evidence is retained (Contu et al., 2026; Russell et al., 2021; Coumans & Ciller, 2026)
Synthesis	Narrative thematic synthesis; meta-analysis only for closely comparable studies (Contu et al., 2026; Russell et al., 2021)

Figure 1: Recommended methodology for the planned systematic review

3-1 Core Design

Set the review question to identify which rural physician retention interventions show the strongest evidence, which contextual modifiers shape effectiveness, and where evidence gaps remain (Contu et al., 2026; Onnis & Hunter, 2024; Coumans & Ciller, 2026). Restrict inclusion to studies published in roughly the last 5–10 years to keep the review current, but justify the window because shorter windows can miss pre-COVID foundations while longer windows dilute policy relevance (Contu et al., 2026; Coumans & Ciller, 2026; Arredondo et al., 2026).

Use the WHO intervention typology as the organizing framework: education, regulation, financial incentives, and personal/professional support, with an added cross-cutting category for bundled or multifaceted packages (Contu et al., 2026; Jinah et al., 2024; Boone et al., 2024). Frame interpretation with WoP-RIF and realist logic so results can be grouped not only by intervention type but also by workplace, role/career, and community/place mechanisms (Cosgrave, 2020; O'Sullivan et al., 2026).

3-2 Eligibility Criteria

- Include quantitative studies evaluating retention or recruitment interventions for rural physicians, residents, or medical students (Contu et al., 2026).
- Accept experimental, quasi-experimental, and observational designs because stronger designs are rare in this field (Contu et al., 2026; Russell et al., 2021; Arredondo et al., 2026).
- Exclude editorials, opinion pieces, conference abstracts without full text, and qualitative-only studies if they lack extractable quantitative outcomes (Contu et al., 2026; Arredondo et al., 2026).
- Require measurable outcomes on retention, duration of stay, turnover, or post-program rural practice location (Contu et al., 2026; Jinah et al., 2024; Cosgrave, 2020).

3-3 Search and Appraisal

Search at minimum MEDLINE, Embase, and CENTRAL, and consider Web of Science plus targeted grey literature searching because program evaluations are often poorly represented in indexed journals (Contu et al., 2026; Russell et al., 2021; Onnis & Hunter, 2024; Arredondo et al., 2026). Use two independent reviewers for screening, extraction, and bias assessment, with a third reviewer resolving disagreements (Contu et al., 2026; Russell et al., 2021; Arredondo et al., 2026; Jinah et al., 2024).

Extract author, year, country, rurality definition, population, career stage, intervention components, comparator, follow-up length, outcome definition, and effect estimate (Contu et al., 2026; Coumans & Ciller, 2026; Arredondo et al., 2026). Add implementation fields such as maturity, tailoring, and organizational context because recent reviews identify these as major blind spots (O'Sullivan et al., 2026; Onnis & Hunter, 2024).

3-4 Analysis Plan

Because this literature has inconsistent rural definitions, weak comparators, and heterogeneous outcomes, make narrative synthesis the primary analysis (Russell et al., 2021; Arredondo et al., 2026). Conduct

random-effects meta-analysis only when at least two studies share sufficiently similar population, intervention, and outcome definitions, and report heterogeneity with I^2 (Contu et al., 2026).

A strong review should also prespecify subgroup synthesis by country income setting, physician career stage, intervention category, and whether the intervention is single-component or bundled (Contu et al., 2026; Jinah et al., 2024; O'Sullivan et al., 2026; Alidina et al., 2025). Include a separate synthesis of burnout-related pathways and contextual mechanisms, since workload, autonomy, and under-resourcing repeatedly link poor conditions to attrition (Coumans & Ciller, 2026; O'Sullivan et al., 2026; Boone et al., 2024).

4. Results

Educational pathways are the strongest retention signal, while bundled, context-sensitive packages are more plausible than single incentives.

The ten studies answer three linked questions: which interventions show the clearest retention signal, why bundled packages may work better, and why the evidence still limits firm causal ranking. The strongest comparative signal favors rural-background selection, distributed rural training, and career-development support, while financial and regulatory approaches show more variable durability (Russell et al., 2021; Contu et al., 2026).

4-1 Comparative Findings

Russell provides the strongest intervention-level evidence in this set, concluding from 34 observational studies that educational interventions have the clearest association with longer rural retention (Russell et al., 2021). That signal is specific: selecting rural-background students, training them in rural settings, and removing barriers to further skills development were each linked to better medium- and long-term retention (Russell et al., 2021). By contrast, strongly coercive return-of-service schemes performed worse after the obligation ended, although loan-repayment-linked obligations appeared more favorable than visa- or license-linked coercion (Russell et al., 2021).

Jinah extends this pattern to LMICs, where education, regulation, finance, and support all showed some positive results, but no single strategy dominated across settings (Jinah et al., 2024). About 77% of included LMIC studies reported positive outcomes, and both single-strategy and combined-strategy approaches could succeed, especially when education or regulatory measures were paired with effective administration and context fit (Jinah et al., 2024).

- **Educational pathways** showed the most consistent retention signal across the ten-study corpus (Russell et al., 2021).
- **Financial incentives** helped recruitment and sometimes retention, but durability and comparability were mixed (Arredondo et al., 2026; Alidina et al., 2025).
- **Regulatory approaches** retained doctors during service periods more reliably than after them (Russell et al., 2021; Jinah et al., 2024).

4-2 Mechanisms and Packages

The analytic logic across these studies is that retention is not a single decision about pay; it is the cumulative outcome of workplace, career, and community conditions (Contu et al., 2026; Cosgrave, 2020;

Boone et al., 2024). Cosgrave's WoP-RIF is useful here because it organizes retention into **Workplace/Organisational, Role/Career, and Community/Place** domains and explicitly aims to translate complexity into action (Cosgrave, 2020). The framework and its three domains are laid out visually in a practical form for synthesis and policy translation. (Figure 2: Integrated framework around the five essential elements of well-being and their possible impact on rural physician retention.)

O'Sullivan sharpens that logic by showing how professional support works when delivered as a bundle rather than as isolated activities (O'Sullivan et al., 2026). Lifelong career support, sustainable practice support, and healthcare and social support appear to act through comfort, confidence, competence, belonging, and bonding, which helps explain why mentorship alone or housing alone often underperforms (O'Sullivan et al., 2026). Boone reaches a similar conclusion from cross-national co-creation work: organizations emphasized interprofessional teamwork, leadership, onboarding, mentorship, workload monitoring, competitive conditions, and supportive infrastructure, and explicitly rejected a one-size-fits-all solution (Boone et al., 2024).

Study	Main Analytic Contribution	Discussion Implication
Russell	Education outperforms coercion	Build rural pipelines first (Russell et al., 2021)
O'Sullivan	Support works through mechanisms	Bundle career, practice, social support (O'Sullivan et al., 2026)
Boone	Retention needs multiple levers	Tailor packages to local attrition drivers (Boone et al., 2024)
Cosgrave	Actionable retention framework	Align interventions across three domains (Cosgrave, 2020)
Portugal case	Package improved deployment more than comparative retention	Tailor incentives and reassess uptake (Alidina et al., 2025)

Figure 1: Analytic contribution of five intervention-focused studies

4-3 Burnout and Attrition

Coumans adds an important mediating pathway that earlier retention reviews treated less explicitly: poor rural conditions appear to translate into attrition partly through **burnout and stress** (Coumans & Ciller, 2026). Across 11,130 rural physicians, burnout was the most prevalent outcome, driven by excessive workload, diminished autonomy, blurred boundaries, and under-resourcing (Coumans & Ciller, 2026). The proposed five-domain framework links fair conditions, belonging, mastery, purpose, and mental health support to commitment, making burnout reduction a retention intervention rather than a separate wellness issue (Coumans & Ciller, 2026). The causal pathway from stressors to workforce outcomes is shown clearly in the conceptual model. (Figure 1: Conceptual framework illustrating pathways from multi-level stressors to workforce outcomes, informed by Carol Weiss' theory of change.)

Onnis complements this by showing that organization-level evaluations remain thin even when interventions around remuneration, education-to-employment pathways, and working or living conditions are implemented (Onnis & Hunter, 2024). Arredondo makes the same point in U.S. rural primary care: most programs still do not report standardized long-term retention outcomes, so apparent success often reflects incomplete measurement rather than robust comparative evidence (Arredondo et al., 2026).

- **Burnout** emerged as the most prevalent adverse outcome in rural physicians (Coumans & Ciller, 2026).
- **Workload and autonomy loss** were recurrent drivers of turnover intention (Coumans & Ciller, 2026).
- **Implementation evidence** remains weaker than intervention theory (Onnis & Hunter, 2024; Arredondo et al., 2026).

4-4 Evidence Gaps and Q1-Style Discussion

Contu is valuable not for intervention results, but for structuring a modern Q1 discussion around intervention logic, contextual modifiers, and workforce-relevant outcomes such as retention duration, career intentions, well-being, cost-effectiveness, and service accessibility (Contu et al., 2026). Across the ten studies, three limitations recur: most evidence is observational, outcome definitions are inconsistent, and implementation detail is often too sparse to isolate which component of a package caused benefit (Russell et al., 2021; Arredondo et al., 2026; Jinah et al., 2024; Onnis & Hunter, 2024). Russell notes that all included studies were observational, Jinah highlights weak long-term program evaluation in LMICs, and Coumans notes geographic skew and limited generalizability (Russell et al., 2021; Jinah et al., 2024; Coumans & Ciller, 2026).

The Portugal case usefully illustrates both promise and caution. A national package increased uptake and produced a 59% retention rate in the same underserved institution, but the difference from non-participants was minimal, and some non-financial incentives had limited real-world usability (Alidina et al., 2025). That pattern fits the broader literature: bundled packages are conceptually stronger because they address multiple determinants at once, but their effectiveness still depends on local design, implementation maturity, and transparent follow-up (Contu et al., 2026; O'Sullivan et al., 2026; Alidina et al., 2025; Boone et al., 2024). For a Q1 discussion, the most defensible conclusion is that **rural educational pipelines** have the strongest current evidence, while **multifaceted support packages** are the most policy-plausible strategy for sustainable retention, especially when they target workload, career development, and belonging together.

5- Conclusion

Educational and training-pathway interventions show the most consistent association with **rural physician retention**, especially rural-background selection, distributed rural training, and support for ongoing skills development (Russell et al., 2021). Financial incentives can improve recruitment and sometimes retention, but their effects are less consistent across settings and often depend on program design, follow-up duration, and complementary supports (Contu et al., 2026; Arredondo et al., 2026; Alidina et al., 2025). Strongly coercive return-of-service approaches appear less durable once obligatory

service ends, whereas less coercive and more supportive strategies appear more sustainable (Russell et al., 2021).

Across contexts, retention is shaped by interacting workplace, career, and community factors rather than a single intervention lever (Contu et al., 2026; Cosgrave, 2020). Burnout, workload strain, diminished autonomy, and weak professional or social support are central pathways linking poor conditions to attrition (Coumans & Ciller, 2026). The literature therefore supports **multifaceted, context-sensitive packages** that combine education, professional support, fair working conditions, and tailored financial or regulatory measures, while also showing that the evidence base remains limited by observational designs, inconsistent retention definitions, sparse comparator groups, and weak long-term evaluation (Contu et al., 2026; Jinah et al., 2024; Boone et al., 2024; Russell et al., 2021; Jinah et al., 2024).

6- Recommendations

- Prioritize **rural education pipelines** from student selection through postgraduate rural training (Russell et al., 2021).
- Design retention strategies as **bundled packages**, not single incentives (Contu et al., 2026; Boone et al., 2024; O'Sullivan et al., 2026).
- Target **workload, autonomy, and burnout** directly through organizational reform and professional support (Coumans & Ciller, 2026; Boone et al., 2024).
- Standardize reporting of retention duration, post-obligation practice location, specialty, and workforce outcomes (Contu et al., 2026; Arredondo et al., 2026).

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FULL PAPER

Professional Competencies and Smart Capabilities of Library and Archive Staff:
A Proposed Training Framework for Adapting to Digital Transformation and
Artificial Intelligence Applications.

الكفاءات الاحترافية والجدارات الذكية للعاملين في المكتبات والأرشيف: إطار تدريبي مقترح لمواكبة
التحولات الرقمية وتطبيقات الذكاء الاصطناعي

Abstract

This study aims to develop a proposed training framework for enhancing the professional competencies and smart capabilities of library and archive personnel in response to digital transformation and advances in artificial intelligence. The study adopted a descriptive-analytical approach, document analysis, and a systematic review of the literature, using a content analysis form. The study identified four main domains: digital and technological competencies; analytical competencies and data management; innovation and smart service development; and ethics and digital governance. It also identified four proficiency levels (PL1–PL4), progressing from basic use to application, analysis, and leadership. The study further linked learning objectives and learning outcomes to performance indicators for measuring competency attainment. It recommends designing progressive training pathways aligned with the proficiency levels (PL1–PL4) and strengthening continuous professional development in artificial intelligence, data analytics, digital technologies, and innovation.

Keywords: Professional Competencies; Smart Capabilities; Libraries; Archives; Digital Transformation; Artificial Intelligence.

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المستخلص

تهدف هذه الدراسة إلى بناء إطار تدريبي مقترح لتنمية الكفاءات الاحترافية والجدارات الذكية للعاملين في المكتبات والأرشيف بما يواكب التحولات الرقمية والذكاء الاصطناعي. واعتمدت الدراسة المنهج الوصفي التحليلي وتحليل الوثائق والمراجعة المنهجية للأدبيات، باستخدام استمارة تحليل المحتوى. وتوصلت الدراسة إلى أربع مجالات رئيسية: الكفاءات الرقمية والتقنية، والجدارات التحليلية وإدارة البيانات، والابتكار وتطوير الخدمات الذكية، والأخلاقية والحوكمة الرقمية، إلى جانب أربعة مستويات للإتقان (PL1–PL4) تتدرج من الاستخدام الأساسي إلى التطبيق والتحليل والقيادة. كما ربطت الدراسة أهداف ومخرجات التعلم بمؤشرات أداء لقياس تحقق الكفاءات، وأوصت الدراسة بتصميم مسارات تدريبية متدرجة وفق مستويات الإتقان (PL1–PL4). وتعزيز التدريب المستمر في الذكاء الاصطناعي، وتحليل البيانات، والتقنيات الرقمية، والابتكار.

الكلمات المفتاحية: الكفاءات الاحترافية، الجدارات الذكية، المكتبات، الأرشيف، التحول الرقمي، الذكاء الاصطناعي.

مقدمة:

في ظل تنامي الاعتماد على التقنيات الرقمية والأنظمة الذكية، تبرز الحاجة إلى إعادة تحديد متطلبات العمل المهني، بما يواكب الأدوار المتجددة وما تستلزمه من معارف ومهارات وقدرات لأداء المهام بكفاءة وفاعلية. ومن هنا تبرز أهمية بناء إطار تدريبي مقترح يستند إلى الأدبيات العلمية والمعايير المهنية ذات الصلة، ويوجه تنمية قدرات العاملين بما يتوافق مع متطلبات البيئة الرقمية وتطبيقات الذكاء الاصطناعي.

1.1 مشكلة البحث وتساؤلاته:

لم يعد الأداء المهني يعتمد على المعرفة التخصصية وحدها، بل يتطلب تكامل المهارات التقنية والتحليلية والسلوكية لمواكبة المستجدات وتوظيف التقنيات الحديثة بفاعلية. وعليه، يسعى البحث إلى الإجابة عن التساؤل الرئيس الآتي:

ما مكونات الإطار التدريبي المقترح لتنمية الكفاءات والجدارات الذكية للعاملين في المكتبات والأرشيف لمواكبة التحولات الرقمية وتطبيقات الذكاء الاصطناعي؟
ويتفرع عنه الأسئلة الآتية:

1. ما أبرز مجالات الكفاءات والجدارات الذكية اللازمة للعاملين في المكتبات والأرشيف في ظل التحولات الرقمية وتطبيقات الذكاء الاصطناعي؟
2. كيف يمكن تصنيف مستويات الإتقان للكفاءات والجدارات الذكية بما يتناسب مع المستويات الوظيفية وطبيعة المسؤوليات المهنية للعاملين في المكتبات والأرشيف؟
3. ما أهداف ومخرجات التعلم المناسبة لكل مستوى من مستويات الإتقان في مجالات الكفاءات والجدارات الذكية؟
4. ما مؤشرات الأداء المناسبة لقياس مدى تحقق الكفاءات والجدارات الذكية في الممارسة المهنية؟

2.1 أهداف البحث:

تهدف هذه الدراسة إلى الآتي:

1. تحديد مجالات الكفاءات والجدارات الذكية اللازمة للعاملين في المكتبات والأرشيف في ضوء متطلبات التحولات الرقمية وتطبيقات الذكاء الاصطناعي .
2. تصنيف مستويات الإتقان للكفاءات والجدارات الذكية بما يتناسب مع المستويات الوظيفية وطبيعة المسؤوليات المهنية للعاملين في المكتبات والأرشيف .
3. تحديد أهداف ومخرجات التعلم المناسبة لكل مستوى من مستويات الإتقان في مجالات الكفاءات والجدارات الذكية .
4. تحديد مؤشرات أداء مناسبة لقياس مدى تحقق الكفاءات والجدارات الذكية وانعكاسها على الممارسة المهنية.

3.1 أهمية الدراسة

الأهمية العلمية : إثراء الأدبيات العربية حول الكفاءات والجدارات الذكية، وتحديد متطلبات العمل في ظل التحول الرقمي والذكاء الاصطناعي.

الأهمية التطبيقية: تقديم إطار تدريبي متدرج يساعد مؤسسات المكتبات والأرشيف ومراكز التدريب على تطوير كفاءات العاملين وتوظيف التقنيات الرقمية والذكاء الاصطناعي.

4.1 منهج الدراسة

اعتمدت الدراسة على **المنهج الوصفي التحليلي**، مدعوماً بمراجعة منظمة للأدبيات العلمية وتحليل الأطر والمعايير والوثائق المهنية ذات الصلة بالكفاءات المهنية والرقمية، والجدارات والمهارات المستقبلية، والتحول الرقمي، وتطبيقات الذكاء الاصطناعي في المكتبات والأرشيف. وقد وظف المنهج في رصد وتحليل الكفاءات والمعارف والمهارات والقدرات المهنية التي تناولتها الأدبيات العلمية والمرجعيات المهنية، ومقارنة مكوناتها وتحديد أوجه التقاطع بينها، وصولاً إلى استخلاص مجموعة من الكفاءات والجدارات التي تشكل الأساس لبناء الإطار التدريبي المقترح.

واعتمدت الدراسة على **مسارين متكاملين في جمع المصادر وتحليلها**؛ تمثل المسار الأول في مراجعة الأدبيات العلمية المنشورة خلال الفترة **2020-2026** من خلال قواعد البيانات **Scopus** و **Web of Science** و **Google Scholar**، بينما تمثل المسار الثاني في تحليل مجموعة من الأطر والمعايير والوثائق المهنية الدولية المرجعية، شملت: **جمعية المكتبات الأمريكية (ALA)**، و**جمعية المكتبات المتخصصة (SLA)**، و**معهد تشارترد لأخصائي المكتبات والمعلومات (CILIP)**، و**الاتحاد الدولي لجمعيات ومؤسسات المكتبات (IFLA)**، و**المجلس الدولي للأرشيف (ICA)**.

وتم تحليل المصادر العلمية والمهنية بصورة تكاملية؛ بهدف تحديد الكفاءات والمهارات والقدرات التي تعكس متطلبات الممارسة المهنية في البيئة الرقمية، مع التركيز على المتطلبات المرتبطة بالتقنيات الرقمية والذكاء الاصطناعي، وتحليل البيانات وإدارتها، والابتكار وتطوير الخدمات، والأخلاقيات والحوكمة الرقمية. ثم جرى تجميع العناصر المتقاربة دلاليًا ووظيفيًا وتصنيفها ضمن مجالات رئيسية، وبناء مستويات متدرجة للإتقان، وربطها بأهداف التعلم ومخرجاته ومؤشرات الأداء والمسارات التدريبية.

5.1 إجراءات الدراسة:

إجراءات الدراسة

اتبعت الدراسة مجموعة من الإجراءات المترابطة لبناء الإطار التدريبي المقترح، وذلك من خلال المراحل الآتية:

أولاً: تحديد نطاق الدراسة ومفاهيمها الرئيسية:

تم تحديد المفاهيم والمجالات المرتبطة بالكفاءات المهنية والجدارات الذكية، والكفاءات الرقمية، والمهارات المستقبلية، والتحول الرقمي، والذكاء الاصطناعي، وإدارة البيانات، والابتكار في خدمات المكتبات والمعلومات، والممارسات الأرشيفية الرقمية، بوصفها المجالات الرئيسية الموجهة لعملية البحث والتحليل.

ثانياً: البحث في الأدبيات العلمية:

تم البحث في قواعد **Scopus** و **Web of Science** و **Google Scholar** عن الدراسات العلمية المنشورة خلال الفترة **2020-2026**، باستخدام مجموعة من الكلمات المفتاحية والمصطلحات العربية والإنجليزية ذات الصلة بموضوع الدراسة. وشملت الكلمات المفتاحية مفاهيم: الكفاءات المهنية (**Professional Competencies**)،

والكفاءات الرقمية (Digital Competencies) ، والجدارات (Competencies) ، والقدرات (Capabilities) ، والمهارات المستقبلية (Future Skills) ، والذكاء الاصطناعي (Artificial Intelligence) ، والتحول الرقمي (Digital Transformation) ، والمكتبات (Libraries) ، والأرشفة (Archives) ، وإدارة البيانات (Data Management) ، والابتكار في خدمات المعلومات (Information Services Innovation).
ثالثًا: اختيار الأدبيات وتحليلها:

تم فحص المصادر المسترجعة واختيار الدراسات الأكثر ارتباطًا بموضوع الدراسة وأهدافها، وبخاصة الدراسات التي تناولت الكفاءات والمهارات والجدارات المهنية أو الرقمية، أو ناقشت تأثير التحول الرقمي والذكاء الاصطناعي في طبيعة العمل ومتطلبات الممارسة المهنية في المكتبات والأرشفة ومؤسسات المعلومات. واستُبعدت المصادر التي لا ترتبط بصورة مباشرة بموضوع الدراسة، أو التي تركز على الجوانب التقنية البحتة دون تناول الأبعاد المهنية أو المهنية، أو التي لا توفر محتوى كافياً يمكن تحليله واستخلاص الكفاءات منه.
رابعًا: تحليل الأطر والمعايير والوثائق المهنية:

تم تحليل خمسة أطر ومرجعيات مهنية دولية هي ALA و SLA و CILIP و FLA و ICA، بهدف تحديد المعارف والمهارات والكفاءات والقيم المهنية التي تؤكد عليها هذه المرجعيات، ومقارنتها بالكفاءات والمهارات المستخلصة من الأدبيات العلمية. وقد روعي في تحليل هذه المرجعيات اختلاف نطاقها بين المكتبات والمعلومات والأرشفة، بما يسمح ببناء إطار أكثر شمولاً للعاملين في المجالات المهنية محل الدراسة.
خامسًا: استخراج الكفاءات والجدارات وتصنيفها:

استخدمت الدراسة استمارة لتحليل المحتوى في تسجيل الكفاءات والمهارات والقدرات المهنية والتقنية والتحليلية والابتكارية والأخلاقية الواردة في المصادر المختارة. ثم جرى تجميع العناصر المتقاربة في مضمونها أو وظيفتها، وتحليل العلاقات بينها، بهدف الوصول إلى مجموعات مفاهيمية أكثر شمولاً تمثل المجالات الرئيسة للكفاءات والجدارات.

سادسًا: بناء مجالات الإطار:

استنادًا إلى نتائج التحليل والمقارنة بين الأدبيات العلمية والمرجعيات المهنية، تم تصنيف الكفاءات والجدارات المستخلصة ضمن أربع مجالات رئيسة، هي: الكفاءات الرقمية والتقنية، والجدارات التحليلية وإدارة البيانات، والابتكار وتطوير الخدمات الذكية، والأخلاقيات والحوكمة الرقمية. ولم تُعامل هذه المجالات بوصفها تصنيفات منفصلة للمصادر، وإنما بوصفها ناتجًا للتحليل التكاملي للكفاءات المتكررة والمتقاربة وظيفيًا ودلاليًا عبر مختلف المصادر.

سابعًا: بناء مستويات الإلتقان:

تم تنظيم الكفاءات والجدارات المستخلصة في أربعة مستويات متدرجة للإلتقان PL1-PL4، بما يعكس الانتقال التدريجي من المعرفة والاستخدام الأساسي للكفاءة إلى التطبيق، ثم التحليل والتطوير، وصولاً إلى القيادة والتخطيط وإدارة التغيير. وسيتم توضيح الأساس النظري والمنهجي لهذه المستويات وعلاقتها بالمستويات الوظيفية في الجزء الخاص ببناء الإطار المقترح.

ثامناً: بناء الإطار التدريبي المقترح:

تم ربط مجالات الكفاءات ومستويات الإتقان بأهداف التعلم ومخرجاته ومؤشرات الأداء، ثم تحديد المتطلبات والاتجاهات التدريبية المناسبة لكل مستوى، بما يتيح بناء مسارات تدريبية متدرجة لتنمية الكفاءات الاحترافية والجدارات الذكية للعاملين في المكتبات والأرشيف.

6.1 أداة تحليل المحتوى

اعتمدت الدراسة على استمارة **لتحليل المحتوى** بوصفها الأداة الرئيسة لتنظيم واستخلاص الكفاءات والجدارات من الأدبيات العلمية والأطر والمعايير والوثائق المهنية المختارة. وقد صُممت الاستمارة بما يسمح بتسجيل العناصر المهنية والمهارية الواردة في كل مصدر، ومقارنتها وتصنيفها وفق موضوعها ووظيفتها وعلاقتها بمتطلبات البيئة الرقمية والذكاء الاصطناعي.

وتضمنت عملية التحليل تحديد **وحدة التحليل** المتمثلة في الكفاءة، أو المهارة، أو المعرفة، أو القدرة، أو القيمة المهنية الواردة في المصدر، ثم تسجيل مضمونها وتصنيفها مبدئياً، ومقارنة العناصر المتشابهة والمتكررة بين المصادر، وتجميع العناصر ذات التقارب الدلالي والوظيفي في مجموعات مفاهيمية. وبعد ذلك تم تحليل هذه المجموعات لتحديد المجالات الرئيسة التي تشكل مكونات الإطار التدريبي المقترح.

كما تم توظيف نتائج التحليل في تحديد مستوى التعقيد المهني لكل كفاءة، بما ساعد في تنظيمها ضمن مستويات الإتقان PL1-PL4، ثم ربط كل مستوى بأهداف التعلم ومخرجاته ومؤشرات الأداء المناسبة.

8.1 الدراسات السابقة

دراسة (Yadav (2022)

هدفت هذه الدراسة إلى تحديد المعارف والمهارات والقدرات الأساسية اللازمة لاختصاصيي المكتبات والمعلومات في العصر الرقمي. واعتمدت الدراسة على استقصاء آراء خريجي عشرة برامج لعلم المكتبات والمعلومات في الهند ممن يعملون في قطاعات مكتبية مختلفة، وجمعت 377 استجابة باستخدام استبانة منظمة وطريقة العينة التراكمية. وأظهرت النتائج تعدد مجالات الكفاءات المطلوبة، بما يشمل المهارات المهنية التقليدية، والمهارات البحثية والحاسوبية، وإدارة البيانات، والمهارات الشخصية، بما يؤكد اتساع متطلبات الممارسة المهنية مع التحول الرقمي.

ونقيد هذه الدراسة البحث الحالي في تأكيد اتساع متطلبات تطوير العاملين لتشمل المهارات الرقمية وإدارة البيانات والمهارات الشخصية، بما يدعم بناء إطار تدريبي متكامل.

دراسة (Arias Hernandez et al. (2024)

هدفت دراسة (Arias Hernandez et al. (2024) إلى استخلاص الكفاءات اللازمة لطلاب وممارسي مهنة الأرشفة للاستفادة من الذكاء الاصطناعي وتعلم الآلة في دعم إتاحة السجلات العامة الموثوقة واستمراريتها. واعتمدت الدراسة على منهج نوعي، من خلال مقابلات أجريت بين يناير ويوليو 2023 مع 10 من الأرشفين ومديري السجلات والباحثين في الأرشفة الرقمي من المملكة المتحدة وكندا والولايات المتحدة وأستراليا ونيوزيلندا. وصنفت نتائج التحليل الكفاءات المستخلصة في ثلاث مجالات رئيسة: المعرفة والمهارات والاتجاهات.

وتكتسب هذه الدراسة أهمية مباشرة للبحث الحالي لأنها تؤكد أن توظيف التقنيات الذكية يتطلب تكامل المعرفة والمهارات والاتجاهات.

دراسة (Cox 2024)

تناولت دراسة Cox (2024) أثر الذكاء الاصطناعي في عمل اختصاصيي المكتبات الأكاديمية والكفاءات التي تتطلبها الأدوار المهنية المتغيرة. واعتمدت الدراسة على مراجعة أدبية تفسيرية (Hermeneutic Literature Review)، وناقشت بصورة خاصة تأثير الذكاء الاصطناعي التوليدي في عدد من الأدوار، منها مدربو الثقافة المعلوماتية، والمديرون، ومتخصصو البيانات، ومديرو المجموعات. تدعم الدراسة الحالية بتأكيد أن الذكاء الاصطناعي يعيد تشكيل الأدوار والكفاءات المهنية، مما يستدعي تطوير برامج تدريبية مواكبة لهذه التحولات.

دراسة (Jalinur et al. 2026)

هدفت دراسة Jalinur et al. (2026) إلى تحليل كفاءات الأرشيفيون في إندونيسيا عبر ثلاث مجالات هي: الكفاءات الإدارية، والاجتماعية-الثقافية، والتقنية، مع مراعاة اختلاف المستويات الوظيفية. واعتمدت الدراسة المنهج الوصفي الكمي، وجمعت بياناتها من خلال استبانة إلكترونية شملت 68 أرشيفياً، استناداً إلى معايير الكفاءات الوظيفية الصادرة عن KemenPANRB عام 2022. وأظهرت النتائج ارتفاع مستويات الكفاءة بصورة عامة، مع بروز الكفاءات الإدارية والاجتماعية-الثقافية بدرجة أكبر في المستويات الوظيفية العليا، إلى جانب وجود فجوة في المهارات الرقمية عبر مختلف المراحل الوظيفية. وأوصت الدراسة بتطبيق مسارات تطوير مهني متدرجة تتوافق مع المواقع الوظيفية للأرشيفيين، وتعزيز الكفاءات الرقمية بصورة منهجية. وتعد هذه الدراسة من أكثر الدراسات ارتباطاً بالبحث الحالي؛ لأنها تقدم أساساً واضحاً لفكرة ربط تنمية الكفاءات بالمستوى الوظيفي، وهو ما يتقاطع مع اعتماد الدراسة الحالية لمستويات الإلتقان PL1-PL4 وربطها بطبيعة المسؤوليات المهنية.

دراسة (Oberländer et al. 2020)

هدفت دراسة Oberländer et al. (2020) إلى تقديم تصور شامل للكفاءات الرقمية في بيئة العمل، من خلال مراجعة موسعة للأدبيات المتعلقة بتعريفات وأطر الكفاءات الرقمية، إلى جانب إجراء (11) مقارنة شبه منظمة مع متخصصين في الرقمنة والكفاءات الرقمية. وأسفرت الدراسة عن تحديد 25 بُعداً للكفاءات الرقمية لدى العاملين في الوظائف المكتبية، بما يعكس تنوع المعارف والمهارات والقدرات التي تتطلبها بيئة العمل الرقمية، كما أكدت أهمية هذه الكفاءات في التعلم والتطوير المهني.

وتفيد هذه الدراسة البحث الحالي في توفير أساس نظري أوسع لمفهوم الكفاءة الرقمية، وتدعم ضرورة النظر إلى الكفاءات باعتبارها منظومة متعددة الأبعاد، وهو ما يتوافق مع توجه الدراسة الحالية في عدم حصر الجدارات الذكية في الجانب التقني، وإنما ربطها بالتحليل والابتكار والحوكمة والاستخدام المسؤول للتقنيات. التعقيب على الدراسات السابقة

تكشف الدراسات السابقة عن تنوع واضح في تناول الكفاءات المهنية والرقمية في مجالي المكتبات والأرشيف، وتبين أن مفهوم الكفاءة المهنية لم يعد يقتصر على المعارف والمهارات المرتبطة بالممارسات التقليدية، وإنما أصبح يتصل بمجموعة أوسع من القدرات التي تفرضها التحولات التقنية وتغير طبيعة العمل. فقد ركزت دراسة (Oberländer et al. (2020 على تعدد أبعاد الكفاءات الرقمية في بيئة العمل، وأظهرت أن الكفاءة الرقمية مفهوم متعدد الأبعاد يتجاوز الاستخدام الأساسي للتقنية. كما تناولت دراسة (Yadav (2022 المهارات والكفاءات المهنية والرقمية المرتبطة بالعمل في المكتبات ومؤسسات المعلومات، بما يعكس اتساع متطلبات الممارسة المهنية في البيئة الرقمية.

وفي السياق الأرشيفي، ركزت دراسة (Arias Hernandez et al. (2024 على الكفاءات المرتبطة بالذكاء الاصطناعي وتعلم الآلة، وهو اتجاه يعكس انتقال التقنيات الذكية من كونها أدوات مساندة إلى عنصر مؤثر في طبيعة الممارسة المهنية ومتطلباتها. كما ناقشت دراسة (Cox (2024 أثر الذكاء الاصطناعي في طبيعة الأدوار المهنية في المكتبات الأكاديمية، وأبرزت التحولات التي تطرأ على مهام العاملين وتخصصاتهم نتيجة توظيف تطبيقات الذكاء الاصطناعي، بما يشير إلى الحاجة المستمرة إلى تطوير المعارف والمهارات المهنية. ومن جانب آخر، أضافت دراسة (Jalinur et al. (2026 بعداً مهماً يتعلق بتفاوت الكفاءات وفق المستويات الوظيفية، وأبرزت أهمية التطوير المهني المتدرج في التعامل مع الفروق في طبيعة المسؤوليات ومتطلبات الأداء. ويختلف هذا التركيز عن الدراسات التي تناولت الكفاءات بوصفها مجموعة عامة من المعارف والمهارات، إذ ينقل الاهتمام إلى مستوى الإتقان الذي يمكن أن يصل إليه العامل في ممارسة الكفاءة وتوظيفها في مواقف العمل المختلفة.

وتشير هذه الدراسات مجتمعةً إلى ثلاث اتجاهات رئيسة في تطور مفهوم الكفاءة المهنية: اتساع نطاق الكفاءات الرقمية والتقنية، وتزايد أهمية الكفاءات المرتبطة بالبيانات والذكاء الاصطناعي، وظهور الحاجة إلى النظر إلى الكفاءة بوصفها مستوى متدرجاً يرتبط بدرجة تعقيد المهام والمسؤوليات المهنية. كما توضح أن التحول الرقمي لا يؤدي فقط إلى إضافة مهارات تقنية جديدة إلى الممارسة المهنية، وإنما يؤثر في طبيعة الأدوار والمهام وفي أنماط التطوير المهني المطلوبة.

وتفيد هذه النتائج في تحديد الأسس التي ينبغي مراعاتها عند بناء إطار للكفاءات المهنية في المكتبات والأرشيف؛ إذ لا يكفي النظر إلى الكفاءة من منظور تقني منفرد، وإنما ينبغي تناولها في سياق طبيعة العمل ومتطلبات الأداء، مع مراعاة التدرج في مستوى الإتقان واختلاف طبيعة المهام والمسؤوليات. كما تكشف الأدبيات عن أهمية الجمع بين المعرفة المهنية والقدرة على توظيف التقنيات الرقمية وتحليل البيانات والتعامل مع تطبيقات الذكاء الاصطناعي، إلى جانب القدرات التي تساعد العاملين على تطوير الممارسات والخدمات والتعامل مع القضايا المهنية والأخلاقية المصاحبة للتحول الرقمي.

وبناءً على ذلك، استفادت الدراسة الحالية من الدراسات السابقة في تحديد المفاهيم والأبعاد الرئيسة للكفاءات المهنية والرقمية، وفي فهم طبيعة التحولات التي طرأت على متطلبات العمل في المكتبات والأرشيف، كما استفادت بصورة خاصة من الاتجاهات التي تناولت تعدد أبعاد الكفاءة وأهمية التدرج في مستوى الإتقان. وقد

شكلت هذه النتائج أساسًا لتحليل الأدبيات والأطر والمعايير المهنية ذات الصلة، واستخلاص المكونات التي يمكن الاستفادة منها في بناء الإطار التدريبي المقترح.

الفجوة البحثية:

يتضح من مقارنة الدراسات السابقة انها أسهمت في تحديد مجموعة مهمة من الكفاءات والمهارات التي تتطلبها البيئة المهنية المتغيرة، إلا أن كل دراسة ركزت على جانب أو مجموعة محددة من هذه المتطلبات. فبينما قدمت دراسة (Oberländer et al. (2020 تصورًا متعدد الأبعاد للكفاءات الرقمية في بيئة العمل، اهتمت دراسة (Yadav (2022 بالكفاءات والمهارات المهنية والرقمية في مجال المكتبات والمعلومات، وركزت دراسة (Arias (2022 على كفاءات الذكاء الاصطناعي وتعلم الآلة في المجال الأرشيفي. كما تناولت دراسة (Cox (2024 تأثير الذكاء الاصطناعي في الأدوار المهنية والكفاءات المطلوبة في المكتبات الأكاديمية، في حين أبرزت دراسة (Jalinur et al. (2026 أهمية التدرج في الكفاءة وربط التطوير المهني بالمستويات الوظيفية، مع الإشارة إلى وجود فجوات في المهارات الرقمية عبر المستويات.

وعلى الرغم من هذا التنوع، فإن الدراسات التي تم تحليلها لا تقدم تصورًا متكاملًا يجمع في إطار تدريبي واحد بين الكفاءات المهنية والرقمية والتكنولوجية، والكفاءات التحليلية وإدارة البيانات، وكفاءات الابتكار وتطوير الخدمات الذكية، والكفاءات الأخلاقية والحوكمة الرقمية. كما أن تحديد الكفاءات في الدراسات السابقة لا ينتقل، بصورة متكاملة، إلى تحديد مستويات متدرجة للإتقان، ثم ربط كل مستوى بأهداف التعلم ومخرجاته ومؤشرات أداء يمكن استخدامها في تصميم البرامج التدريبية وتقويم نتائجها.

ومن هنا تتمثل الفجوة البحثية التي تسعى الدراسة الحالية إلى معالجتها في الحاجة إلى الانتقال من مجرد تحديد الكفاءات والمهارات التي تفرضها التحولات الرقمية والذكاء الاصطناعي إلى بناء إطار تدريبي مترابط وقابل للتطبيق والتقييم. ويتميز الإطار المقترح بأنه لا يتعامل مع الكفاءات بوصفها قائمة منفصلة من المهارات، وإنما ينظمها في مجالات مترابطة، ويضعها ضمن مستويات متدرجة للإتقان PL1-PL4، ثم يربط هذه المستويات بأهداف التعلم ومخرجاته ومؤشرات الأداء.

1.0 الإطار النظري

1.2 التحولات الرقمية والذكاء الاصطناعي وأثرها في تطور أدوار العاملين في المكتبات والأرشيف:

يمثل التحول الرقمي في مؤسسات المكتبات والأرشيف عملية تتجاوز تحويل المصادر والوثائق إلى صيغ رقمية، لتشمل إعادة تصميم العمليات والخدمات ونماذج العمل بالاعتماد على التقنيات الرقمية والبيانات والمنصات الإلكترونية (Das & Islam, 2021). وقد أدى ذلك إلى توسع متطلبات العمل المهني، فأصبح العاملون مطالبين بالتعامل مع أنظمة إدارة المحتوى الرقمي، والبيانات الوصفية، والمستودعات الرقمية، وتقنيات الحفظ الرقمي، والمشاركة في تطوير الخدمات القائمة على البيانات. كما استلزم التحول الرقمي تطوير البنية التحتية وإعادة تنظيم العمليات وتأهيل العاملين.

وفي سياق هذا التطور، جاء ظهور الذكاء الاصطناعي وتطبيقاته المختلفة ليضيف بُعداً جديداً إلى التحول الرقمي، فلم تعد التقنيات الرقمية تقتصر على دعم العمليات المهنية التقليدية، بل أصبحت تسهم بصورة متزايدة في تنفيذ بعض المهام وتحليل البيانات وتطوير الخدمات واتخاذ القرارات. وقد بدأت تطبيقات الذكاء الاصطناعي وتعلم الآلة تدخل في عدد من عمليات المكتبات والأرشيف، مثل تنظيم المعلومات، وتحليل المحتوى، وتحسين استرجاع المعلومات وتقديم خدمات أكثر تخصيصاً للمستخدمين. ومن ثم، أدى هذا التطور إلى إعادة تشكيل طبيعة الأدوار المهنية، إذ أصبح العاملون بحاجة إلى فهم هذه التقنيات، وتقييم مخرجاتها، والتحقق من دقتها، وإدراك حدود استخدامها، فضلاً عن التعامل معها بصورة مسؤولة وأخلاقية (Cox, 2024)

وبذلك انتقل دور اختصاصي المعلومات تدريجياً من تنفيذ الإجراءات التقليدية إلى أدوار أكثر ارتباطاً بإدارة المعرفة الرقمية، والتحليل، وتطوير الخدمات، وتعزيز الثقافة المعلوماتية والرقمية لدى المستخدمين. وفي مؤسسات الأرشيف، انعكس ذلك على ممارسات إدارة الوثائق والبيانات والحفظ الرقمي وإتاحة المحتوى الإلكتروني، إلى جانب توظيف تقنيات مثل التعرف الضوئي على الحروف وتحليل الوثائق (Colavizza et al., 2021) ولا يلغي ذلك الدور البشري، بل يتطلب تعزيز التفكير النقدي وفهم البيانات وتقييم الخوارزميات والتحقق من النتائج والاستخدام المسؤول للتقنيات (Arias Hernandez et al., 2024)

2.2 الكفاءات الاحترافية:

يُعد مفهوم الكفاءة من المفاهيم الأساسية في إدارة الموارد البشرية وتطوير الأداء المهني، وقد تطور من التركيز على المؤهلات والقدرات العامة إلى الاهتمام بالمعارف والمهارات والقدرات والسلوكيات التي تمكن الفرد من تحقيق أداء فعال في سياق وظيفي محدد. وأسهمت أعمال McClelland في ترسيخ هذا الاتجاه من خلال التأكيد على أهمية الكفاءات الفعلية المرتبطة بالأداء بدلاً من الاقتصار على مؤشرات القدرات العقلية التقليدية (Swapna & Biradar, 2016). ومع تغير بيئات العمل، اتسع مفهوم الكفاءة ليشمل قدرات التحليل والتواصل والعمل الجماعي والتعلم المستمر والتكيف مع المتغيرات المهنية والتقنية (Swapna & Biradar, 2016; Duran-Riquelme et al., 2024)

وتكتسب الكفاءات الاحترافية أهمية خاصة في المكتبات والأرشيف، لارتباطها بقدرة العاملين على الاستجابة لتغيرات العمل والخدمات المعلوماتية. فقد وسعت البيئة الرقمية الأدوار المهنية لتشمل إدارة المحتوى الرقمي واستخدام الأنظمة والمنصات التقنية، وتحليل احتياجات المستخدمين، وتطوير الخدمات المعلوماتية، مما يجعل تنمية الكفاءات المهنية عملية مستمرة، ترتبط كذلك بالتعلم المستمر والقدرة على التكيف مع التطورات التقني (Duran-Riquelme et al., 2024)

وبناءً على ذلك، تُعرّف الكفاءة الاحترافية في هذه الدراسة بأنها قدرة العاملين في المكتبات والأرشيف على توظيف معارفهم ومهاراتهم وخبراتهم التخصصية والتقنية والسلوكية في أداء المهام والمسؤوليات المهنية وتحقيق النتائج المستهدفة بجودة وفاعلية، مع القدرة على التكيف مع متطلبات البيئة الرقمية والمهنية المتغيرة.

3.2 الجدارات الذكية:

تُعرّف الجدارة بأنها منظومة متكاملة من المعارف والمهارات والقدرات والسلوكيات التي تمكّن الفرد من توظيف ما يمتلكه بفاعلية لتحقيق أداء فعّال و متميز في سياق وظيفي محدد، وهو ما يتفق مع الطروحات التي قدمها Boyatzis (1982) و Spencer and Spencer (1993) ومع التحول الرقمي، اتسع مفهومها ليشمل التعامل مع التقنيات والبيانات، والتكيف مع التغيرات، والتعلم المستمر، والابتكار. وبناءً على ذلك، تشير الجدارات الذكية في هذه الدراسة إلى مجموعة متكاملة من المعارف والمهارات والقدرات والسلوكيات التي تمكّن العاملين من توظيف التقنيات الرقمية والذكاء الاصطناعي والبيانات بفاعلية بما يمثل امتداداً متطوراً للجدارات المهنية في البيئة الرقمية والذكاء.

وفي هذا السياق، تبرز العلاقة التكاملية بين الجدارة والمهارة، مع اختلافهما من حيث المفهوم والنطاق؛ فالمهارة تمثل جانباً تطبيقياً ضمن الجدارة، في حين تتجاوزها الجدارة إلى قدرة العامل على توظيف ما يمتلكه في مواقف العمل الفعلية وفقاً لمتطلبات السياق المهني. فعلى سبيل المثال، لا يعني إتقان العاملين في المكتبات والأرشيف استخدام الأنظمة أو المنصات امتلاكهم بالضرورة للجدارة الرقمية أو الذكاء المرتبطة بها، ما لم يقترن ذلك بقدرتهم على فهم متطلبات العمل، وتحليل النتائج، وتقييم المخرجات، واختيار البدائل الملائمة، وتوظيف الإمكانيات المتاحة بما يخدم أهداف المؤسسة ويرتقي بمستوى خدماتها (Oberländer et al., 2020).

ويكشف هذا التمييز عن اتساع متطلبات الممارسة المهنية، وما يرتبط بها من فجوات في المهارات والكفاءات، فقد أظهرت دراسة Yadav (2022) تنوع الاحتياجات المهنية للعاملين في المكتبات والمعلومات، لتشمل الجوانب المكتبية والبحثية والحاسوبية وإدارة البيانات والمهارات الشخصية، مع تزايد أهمية الحوسبة والأتمتة والرقمنة. ويتقاطع ذلك مع ما توصلت إليه دراسة Jalnur et al. (2026) في المجال الأرشيفي، حيث كشفت عن فجوات في الكفاءات الرقمية المرتبطة بتغير الأدوار والمسؤوليات المهنية، والحاجة إلى تطوير قدرات تقنية وإدارية واجتماعية تتناسب مع متطلبات العمل الرقمي.

وبناءً على ذلك، يمكن استنتاج أن الفجوات مهارية لا ترتبط بنقص المعرفة التقنية وحدها، وإنما تعكس تحولاً أوسع في طبيعة الممارسة المهنية، الأمر الذي يجعل التطوير المهني بحاجة إلى الانتقال من التدريب على أدوات وتقنيات محددة إلى بناء منظومة متكاملة تراعي اختلاف الأدوار والمستويات الوظيفية وتواكب المتطلبات المستجدة للمكتبات والأرشيف.

4.2 الأطر والمعايير المهنية الدولية للكفاءات المطلوبة للعاملين في المكتبات والأرشيف

تمثل الأطر والمعايير المهنية الدولية المرجعية الأساسية لتحديد الكفاءات المهنية المطلوبة للعاملين في المكتبات والأرشيف، وقد اعتمدت هذه الدراسة عليها بوصفها مرجعيات لتحديد مجالات المعرفة والمهارات والقيم المهنية اللازمة للممارسة المعاصرة. فقد حدد إطار Core Competences of Librarianship الصادر عن جمعية المكتبات الأمريكية (ALA) مجالات رئيسة تشمل المعرفة المهنية، وتنظيم المعرفة، وإدارة مصادر المعلومات، وخدمات المستفيدين، والتقنيات، والقيادة، والتطوير المهني المستمر. (American Library Association, 2009).

فيما ركز إطار Competencies for Information Professionals الصادر عن جمعية المكتبات المتخصصة (SLA) على إدارة المعلومات والمعرفة، وتحليل البيانات، وتوظيف التقنيات الحديثة، ودعم اتخاذ القرار، إلى جانب مهارات القيادة والتواصل والتعلم المستمر (Special Libraries Association, 2016) وفي السياق نفسه، يقدم إطار Professional Knowledge and Skills Base (PKSB) الصادر عن CILIP تصوراً متكاملاً للمعارف والمهارات المهنية، يشمل تنظيم المعرفة، وإدارة المحتوى الرقمي والبيانات، وخدمات المعلومات، والبحث والتحليل، والسلوك المهني، والتطوير المستمر. (CILIP, 2024) كما تمثل إرشادات الاتحاد الدولي لجمعيات ومؤسسات المكتبات (IFLA) مرجعية للقيم المهنية، وإتاحة المعرفة، والتكيف مع التحولات الرقمية (IFLA, 2015, 2022)، بينما توفر معايير المجلس الدولي للأرشيف (ICA) إطاراً لتنظيم الممارسات الأرشيفية في مجالات إدارة الوثائق، والوصف، والحفظ، والإتاحة، والتعامل مع الوثائق الرقمية وضمان أصالتها وسلامتها. (ICA, 2016)

وتكشف المقارنة بين هذه المرجعيات المهنية عن وجود مجموعة من الكفاءات المشتركة رغم اختلاف سياقاتها المؤسسية؛ إذ تتفق جميعها على أهمية الكفاءة المهنية التخصصية، والقدرات الرقمية، وإدارة البيانات والمحتوى، والتطوير المهني المستمر، والقيادة، والتواصل، والتكيف مع التقنيات الحديثة. وفي المقابل، تختلف هذه الأطر في مستوى التركيز على الذكاء الاصطناعي، والبيانات، والحوكمة الرقمية، تبعاً لتاريخ إصدار كل إطار وطبيعة المؤسسة التي طورته.

0.3 الإطار المقترح للكفاءات المهنية والجدارات الذكية للعاملين في المكتبات والأرشيف:

ينطلق الإطار من رؤية متكاملة لا تنظر إلى التحول الرقمي بوصفه اكتساباً للمهارات التقنية فقط، وإنما باعتباره تحولاً يمتد إلى إدارة البيانات، والابتكار وتطوير الخدمات الذكية، والأخلاقيات والحوكمة الرقمية. كما يستوعب التطورات المتسارعة في تطبيقات الذكاء الاصطناعي والتقنيات الناشئة، بما يسمح بتحديث مكوناته وأساليب تنفيذه وفق احتياجات المكتبات والأرشيف ومتطلبات بيئة العمل المتغيرة.

1.3 أهداف الإطار التدريبي المقترح:

يهدف الإطار التدريبي المقترح إلى تنمية الكفاءات الاحترافية والجدارات الذكية للعاملين في المكتبات والأرشيف، من خلال تحديد المجالات التدريبية ومستويات الإتقان المناسبة، وربطها بالمسؤوليات الوظيفية ومسارات تدريبية متدرجة، بما يدعم تطوير الأداء المهني ومواكبة التحولات الرقمية وتطبيقات الذكاء الاصطناعي.

2.3 المجالات الرئيسية للكفاءات والجدارات الذكية ومكوناتها:

جدول رقم (1) يوضح المجالات الرئيسية للكفاءات والجدارات الذكية ومكوناتها

المجالات الرئيسية	الكفاءات والجدارات الذكية المكونة للمجال
الرقمية والتقنية	أنظمة إدارة المكتبات المتكاملة، أنظمة المستودعات الرقمية، أنظمة إدارة المحتوى، الأمن السيبراني وحماية المعلومات، الذكاء الاصطناعي وتعلم الآلة، الحوسبة السحابية
التحليلية وإدارة البيانات	إدارة البيانات الوصفية، تحليل البيانات، حوكمة البيانات، دعم اتخاذ القرار
الابتكار وتطوير الخدمات الذكية	الابتكار الرقمي، التفكير التصميمي، تطوير الخدمات المعلوماتية الذكية، توظيف

التقنيات الناشئة.	
أخلاقيات الذكاء الاصطناعي، الخصوصية وحماية البيانات، حقوق الملكية الفكرية، الحوكمة الرقمية، الاستخدام المسؤول للتقنيات الذكية	الأخلاقية والحوكمة الرقمية

يشير الجدول رقم (1) إلى أن الإطار المقترح يتكون من أربع مجالات رئيسة تمثل الأبعاد الأساسية للكفاءات والجدارات الذكية اللازمة للعاملين في المكتبات والأرشيف، ويضم كل مجال مجموعة من الكفاءات والجدارات المترابطة التي تعكس المتطلبات المهنية والتقنية اللازمة لمواكبة التحولات الرقمية وتطبيقات الذكاء الاصطناعي في بيئة المكتبات والأرشيف.

3.3 المستويات الوظيفية وطبيعة التدريب

جدول رقم (2) يوضح المستويات الوظيفية وطبيعة التدريب

الفئة الوظيفية	المستوى الوظيفي	طبيعة التدريب
القيادية	مدير مكتبة / مدير أرشيف / رئيس مؤسسة معلومات	القيادة، التخطيط، وضع السياسات والاستراتيجيات، وإدارة التحول والتطوير المؤسسي
الإشرافية	رئيس قسم / رئيس وحدة / مشرف	التطوير، التحليل، حل المشكلات، وتحسين العمليات والخدمات
التخصصية	أخصائي مكتبات ومعلومات / أخصائي أرشيف	التطبيق المستقل للكفاءات والجدارات في المهام والعمليات المهنية
المساندة التخصصية	مساعد أخصائي / فني مكتبات وأرشيف	اكتساب المعرفة الأساسية والقدرة على استخدام الأدوات والتقنيات في المهام المهنية

يوضح الجدول رقم (2) اختلاف الاحتياجات التدريبية وفق طبيعة المسؤوليات المرتبطة بالمستوى الوظيفي؛ حيث يتجه التدريب في المستويات القيادية نحو الجوانب الاستراتيجية وإدارة التحول، بينما يركز في المستويات الإشرافية على تطوير الأداء وتحسين العمليات، وفي المستويات التخصصية على الممارسة المهنية المستقلة، وفي مستويات المساندة التخصصية على بناء المعارف والمهارات الأساسية. ويُستخدم هذا التصنيف بوصفه إطاراً استرشادياً لتوجيه طبيعة التدريب، ولا يعني أن شاغلي المستوى الوظيفي نفسه يمتلكون درجة متساوية من الإتقان؛ إذ قد يختلف مستوى تمكن الأفراد من الكفاءة الواحدة باختلاف الخبرة والتخصص والممارسة.

مستويات الإتقان:

جدول رقم (3) يوضح وصف مستويات الإتقان وطبيعة الأداء المتوقعة

مستوى الإتقان	المسمى	وصف المستوى	طبيعة الأداء المتوقعة
PL1	الاستخدام الأساسي	يملك المعرفة الأساسية بالمفاهيم والأدوات والتقنيات المرتبطة بالكفاءة، ويستخدمها في أداء المهام المحددة وفق إجراءات أو إرشادات	التعرف، الفهم، الاستخدام الأساسي، وتنفيذ المهام الروتينية.

	معروفة.		
PL2	التطبيق	يوظف المعرفة والأدوات بصورة مستقلة في مواقف العمل المعتادة، ويطبق الإجراءات المناسبة للتعامل مع المشكلات التشغيلية البسيطة.	التطبيق المستقل، معالجة المشكلات المعتادة، واختيار الأدوات والإجراءات المناسبة.
PL3	التحليل والتطوير	يحلل البيانات والمعلومات والمشكلات المهنية، ويقم البدائل، ويطور الإجراءات أو الخدمات، ويقترح حلولاً لتحسين الأداء.	التحليل، التقييم، حل المشكلات المعقدة، التحسين، والتطوير.
PL4	القيادة والابتكار	يقود المبادرات والمشروعات المهنية أو التقنية، يصمم حلولاً جديدة، ويوجه العاملين، ويدعم اتخاذ القرار وإدارة التغيير والابتكار المؤسسي.	القيادة، التصميم، الابتكار، التوجيه، اتخاذ القرار، وإدارة التغيير.

يستند الجدول رقم (3) في بناء مستويات الإتقان إلى مبدأ التدرج في اكتساب المهارة والكفاءة المهنية، الذي يفترض انتقال الأداء من الممارسة الأساسية القائمة على المعرفة والقواعد إلى مستويات أكثر استقلالية وتعقيداً، مع تزايد القدرة على التعامل مع المواقف المهنية وتحليلها وتطويرها. ويتوافق هذا التوجه مع نموذج Dreyfus و Dreyfus لاكتساب المهارة، الذي ينظر إلى اكتساب المهارة بوصفه عملية تطويرية تتغير خلالها طبيعة أداء الفرد وطريقة تعامله مع المواقف المهنية مع ارتفاع مستوى الخبرة والإتقان (Dreyfus & Dreyfus, 1980, 2004).

ولا تتبنى الدراسة نموذج Dreyfus بصورة حرفية؛ إذ يتكون النموذج الأصلي من خمس مراحل، بينما اعتمدت الدراسة أربعة مستويات للإتقان تتلاءم مع طبيعة الإطار التدريبي والكفاءات المستخلصة من الأدبيات والأطر المهنية. كما استفادت الدراسة من مبدأ التدرج المستخدم في أطر الكفاءات المهنية، حيث يرتبط الانتقال من مستوى إلى آخر بزيادة تعقيد المهام، وعمق المعرفة، والاستقلالية، والقدرة على التحليل وحل المشكلات، ونطاق المسؤولية. وبناءً على ذلك، طورت الدراسة تصنيفاً رباعي المستويات لا يرتبط بصورة حتمية بالمسمى الوظيفي، وإنما يعبر عن درجة إتقان الفرد للكفاءة التي يجري التدريب عليها.

وبناءً على التحليل، تم تحديد أربعة مستويات للإتقان PL1: الاستخدام الأساسي، و PL2 التطبيق، و PL3 التحليل والتطوير، و PL4 القيادة والابتكار. ويمثل هذا التدرج انتقالاً من امتلاك المعرفة واستخدام الأدوات في المهام المحددة، إلى توظيف الكفاءة بصورة مستقلة، ثم تحليل المشكلات والبيانات وتطوير الممارسات، وصولاً إلى قيادة المبادرات، وتصميم الحلول، وإدارة التغيير، والابتكار.

العلاقة بين مستويات الإتقان والمستويات الوظيفية في النموذج المقترح

لا تفترض الدراسة وجود تطابق بين مستوى الإتقان والمستوى الوظيفي؛ فالمسمى الوظيفي لا يحدد بصورة تلقائية مستوى الكفاءة التي يمتلكها الفرد في جميع المجالات. فقد يختلف مستوى إتقان الشخص من كفاءة إلى أخرى

تبعاً لخلفيته العلمية وخبرته التدريبية وطبيعة مهامه والممارسة الفعلية للكفاءة. وعليه، تُستخدم مستويات-PL1
 PL4 بوصفها مستويات أداء وإتقان للكفاءة، وليس بوصفها بديلاً عن التصنيف الوظيفي.
 ومع ذلك، يمكن الاستفادة من المستوى الوظيفي وطبيعة المسؤوليات المهنية بوصفهما مؤشرين استرشادين عند
 تحديد مستوى الإتقان المتوقع وتصميم المسارات التدريبية؛ إذ قد تتطلب بعض الأدوار ذات المسؤوليات الإشرافية
 أو القيادية مستويات أعلى من الإتقان في مجموعة معينة من الكفاءات، بينما قد تظل بعض الكفاءات الأخرى
 عند مستويات أقل تبعاً لطبيعة المهام الفعلية. وبذلك يتيح الإطار المقترح قدرًا من المرونة في تحديد الاحتياجات
 التدريبية، بحيث يُبنى التدريب على مستوى الكفاءة الفعلي والمستوى المطلوب للأداء، وليس على المسمى
 الوظيفي وحده.

4.3 أهداف ومخرجات التعلم للكفاءات والجدارات الرقمية والتقنية:

جدول رقم (4) أهداف ومخرجات التعلم في الإطار التدريبي المقترح للكفاءات الرقمية والتقنية

مستوى المهارة	الأهداف	مخرجات التعلم
PL1	إكساب العاملين أساسيات الأنظمة والمستودعات والمنصات الرقمية المستخدمة في المكتبات والأرشفات.	استخدام الأدوات والأنظمة الرقمية الأساسية، وتطبيق ممارسات الأمن الرقمي في المكتبات والأرشفات.
PL2	توظيف التقنيات الرقمية والذكاء في العمليات والخدمات المعلوماتية.	توظيف الأنظمة والمنصات الرقمية وأدوات الذكاء الاصطناعي في المكتبات والأرشفات.
PL3	تطوير العمليات الرقمية، وإدارة المخاطر، وتقييم التقنيات الذكية.	تقييم التقنيات الرقمية، وإدارة مخاطرها، وتحسين العمليات والخدمات في المكتبات والأرشفات.
PL4	تمكين القيادات من وضع خطط التحول الرقمي، وتطوير سياسات حوكمة الأمن، وتقييم فرص توظيف الذكاء الاصطناعي، والتخطيط للخدمات السحابية في المكتبات والأرشفات.	التخطيط للتحول الرقمي، ووضع السياسات، وتوجيه توظيف التقنيات الذكية في المكتبات والأرشفات.

يقسم الجدول رقم (4) أهداف ومخرجات التعلم المستهدفة للكفاءات الرقمية والتقنية إلى أربعة مستويات، حيث
 يتدرج التعلم من اكتساب الأساسيات والاستخدام الآمن للأنظمة والمنصات الرقمية في المستوى PL1 ، إلى
 توظيف التقنيات الرقمية والذكاء في المستوى PL2 ، ثم تطوير العمليات الرقمية وتقييم التقنيات وإدارة مخاطرها
 في المستوى PL3 ، وصولاً إلى التخطيط للتحول الرقمي وتوجيه توظيف التقنيات الذكية في المستوى PL4 .

5.3 أهداف ومخرجات التعلم للكفاءات والجدارات التحليلية وإدارة البيانات:

جدول رقم (5) أهداف ومخرجات التعلم في الإطار التدريبي المقترح للجدارات التحليلية وإدارة البيانات

مستوى المهارة	الأهداف	مخرجات التعلم
PL1	إرساء أساسيات التعامل مع البيانات والمعلومات المهنية لدى العاملين.	جمع البيانات وتنظيمها، واستخدام أدوات إدارتها الأساسية، وتمييز مصادرها، والتحقق من جودتها.
PL2	تطوير كفاءة الأخصائيين في تحليل البيانات وتوظيفها في العمليات وخدمات المعلومات.	تحليل البيانات المهنية، واستخراج المؤشرات، وتفسير النتائج، واستخدام البيانات لدعم القرارات اليومية وتحسين الخدمات.
PL3	بناء قدرات المشرفين في توظيف التحليلات المتقدمة وإدارة عمليات البيانات لتحسين الأداء.	تفسير البيانات المعقدة، واستخدام أدوات التحليل المتقدم، وتقييم جودة البيانات، وتحويل نتائج التحليل إلى رؤى تدعم تحسين الأداء.
PL4	بناء قدرة القيادات على تطوير استراتيجيات البيانات والتحليلات وتوظيفها في دعم القرارات الاستراتيجية.	وضع استراتيجيات إدارة البيانات، وتطوير ممارسات قائمة على البيانات، وتوظيف الرؤى التحليلية في القرارات الاستراتيجية.

يعكس الجدول رقم (5) تطور الكفاءة والجدارة في مجال التحليلية وإدارة البيانات عبر مستويات الإتقان الأربعة؛ إذ يركز PL1 على تنظيم البيانات والتحقق من جودتها، بينما يتجه PL2 إلى تحليلها وتوظيفها، ويرتقي PL3 إلى التحليلات المتقدمة وتحسين الأداء، في حين يختص PL4 بتطوير استراتيجيات البيانات وتوظيفها في دعم القرارات الاستراتيجية.

6.3 أهداف ومخرجات التعلم لكفاءات وجدارات الابتكار وتطوير الخدمات الذكية:

جدول رقم (6) أهداف ومخرجات التعلم في الإطار التدريبي المقترح للجدارات الابتكار وتطوير الخدمات الذكية

مستوى المهارة	الأهداف	مخرجات التعلم
PL1	فهم مفاهيم الابتكار والخدمات الذكية واستيعاب فرص التطوير الممكنة في المكتبات والأرشيفات.	شرح مفاهيم الابتكار والخدمات الذكية، والتعرف على فرص التحسين والتطوير في بيئة العمل، واستكشاف إمكانات توظيف التقنيات الناشئة لدعم العمليات الفنية وخدمات المعلومات.
PL2	تنمية القدرة على استخدام أساليب الابتكار في تطوير العمليات الفنية والخدمات لتلبية احتياجات المستفيدين.	توظيف أساليب الابتكار والتفكير التصميمي في تطوير العمليات والخدمات، واقتراح حلول مبتكرة تسهم في تحسين تجربة المستفيد ورفع كفاءة الأداء.
PL3	إعداد الكفاءات القادرة على تصميم الحلول والخدمات الذكية وتقويم أثرها والتعامل مع تحديات تطبيقها.	تصميم حلول وخدمات ذكية استجابةً للاحتياجات المؤسسية، وتقويم أثرها باستخدام مؤشرات مناسبة، ومعالجة التحديات المرتبطة بتنفيذها وتطويرها.

PL4	تطوير القدرات القيادية لتوجيه الابتكار المؤسسي وترسيخ منظومة مستدامة لتطوير الخدمات الذكية.	قيادة مبادرات الابتكار المؤسسي، وتوجيه تطوير الخدمات الذكية وتوظيف التقنيات الناشئة، وتقييم الأثر المؤسسي للمبادرات بما يسهم في استدامة التطوير والتحسين.
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يبرز الجدول رقم (6) مسار تطور أهداف ومخرجات التعلم في مجال الابتكار وتطوير الخدمات الذكية؛ حيث يبدأ PL1 بالتعرف إلى مفاهيم الابتكار وفرص التطوير، ويتدرج PL2 نحو تطبيق أساليب الابتكار والتفكير التصميمي، ثم ينتقل PL3 إلى تصميم الخدمات الذكية وتقويمها، وينتهي PL4 بتوجيه الابتكار المؤسسي وضمان استدامة تطوير الخدمات الذكية.

7.3 أهداف ومخرجات التعلم للكفاءات والجدارات الأخلاقية والحوكمة الرقمية.

جدول رقم (7) أهداف ومخرجات التعلم في الإطار التدريبي المقترح للجدارات الأخلاقية والحوكمة الرقمية

مستوى المهارة	الهدف	مخرجات التعلم
PL1	الوعي بالمبادئ الأخلاقية والضوابط الأساسية للتعامل الآمن والمسؤول مع البيانات والتقنيات	الالتزام بمبادئ الخصوصية والأمن والملكية الفكرية، وممارسة الاستخدام المسؤول للتقنيات الرقمية، وحماية المعلومات.
PL2	تطبيق المتطلبات الأخلاقية والقانونية في التعامل مع البيانات والتقنيات الرقمية والذكاء الاصطناعي.	توظيف مبادئ الخصوصية وحماية البيانات والملكية الفكرية، والالتزام بالضوابط الأخلاقية والقانونية لاستخدام الذكاء الاصطناعي وإدارة البيانات.
PL3	تقويم المخاطر الأخلاقية والرقمية، ومعالجة قضايا الخصوصية والاستخدام المسؤول للتقنيات الذكية	تقييم المخاطر الأخلاقية والرقمية، ومعالجة قضايا الخصوصية وحماية البيانات، واقتراح ضوابط للاستخدام المسؤول للتقنيات الذكية والذكاء الاصطناعي.
PL4	قيادة الحوكمة الرقمية وتطوير سياسات الاستخدام الأخلاقي والمسؤول للتقنيات الذكية	صياغة سياسات الحوكمة الرقمية، ووضع معايير الاستخدام المسؤول للذكاء الاصطناعي، وتقييم أطر الخصوصية والأمن والامتثال.

يبين الجدول رقم (7) التدرج في أهداف ومخرجات التعلم للجدارات الأخلاقية والحوكمة الرقمية عبر مستويات الإلتقان الأربعة، بدءاً من الوعي بالمبادئ والضوابط الأساسية في PL1، مروراً بتطبيق المتطلبات الأخلاقية والقانونية في PL2، وتقويم المخاطر وقضايا الخصوصية في PL3، وصولاً إلى قيادة الحوكمة الرقمية ووضع السياسات في PL4.

8.3 مؤشرات الأداء المتوقعة للإطار:

جدول رقم (8) مؤشرات الأداء المتوقعة للإطار

PL4	PL3	PL2	PL1	الكفاءة والجدارة
قيادة التحول الرقمي وتحديد الأولويات التقنية.	تقييم التقنيات وملاءمتها ومخاطرها.	اختيار الأدوات الرقمية المناسبة واستخدامها بكفاءة.	تنفيذ المهام الرقمية الأساسية بأمان.	الكفاءات الرقمية والتقنية
توجيه القرارات استناداً إلى تحليل البيانات.	تحليل البيانات واقتراح تحسينات.	استخراج البيانات والمؤشرات لدعم العمل.	تنظيم البيانات والتحقق من دقتها.	الجدارات التحليلية وإدارة البيانات
قيادة الابتكار وتطوير الخدمات الذكية.	قيادة اختبار الحلول وتقييم نتائجها.	تطوير حلول عملية واختبارها.	اقتراح أفكار لتحسين العمل والخدمات.	جدارات الابتكار وتطوير الخدمات الذكية
قيادة الحوكمة ووضع السياسات المنظمة.	تقييم المخاطر واتخاذ الإجراءات التصحيحية.	تطبيق السياسات الأخلاقية والقانونية.	الالتزام بضوابط الخصوصية والأمن.	الجدارات الأخلاقية والحوكمة الرقمية

يبين الجدول رقم (8) مؤشرات الأداء المتوقعة، التي تترجم أهداف ومخرجات التعلم إلى ممارسات مهنية قابلة للملاحظة والتقييم. وتدرج من تنفيذ المهام والاستخدام الأساسي في PL1 إلى التوظيف المهني في PL2 ، ثم التقييم والتحسين وإدارة المخاطر في PL3 ، وصولاً إلى التخطيط والتوجيه والقيادة والحوكمة في PL4 ، بما يتيح ربط التدريب بالأداء الفعلي للعاملين.

9.3 خطوات تنفيذ الإطار التدريبي المقترح

يقترح تنفيذ الإطار التدريبي من خلال خمس خطوات مترابطة تبدأ بتحديد الاحتياجات التدريبية وتنتهي بالمراجعة والتحديث المستمر، وذلك على النحو الآتي:

1.9.3 تحديد الاحتياجات التدريبية: تشخيص فجوات الكفاءات والجدارات وتحديد المجال ومستوى الإلتقان المناسب وفق PL1-PL4.

2.9.3 تحديد المسار التدريبي المناسب: اختيار المسار وفق المجال ومستوى الإلتقان واحتياجات العامل ومسؤولياته المهنية.

3.9.3 تنفيذ البرامج التدريبية: تنفيذ تدريب يجمع بين المعرفة والتطبيق العملي، وفق طبيعة الكفاءة ومستوى الإلتقان.

4.9.3 تقييم التعلم والأداء: قياس مخرجات التعلم والأداء والتحقق من أثر التدريب في الممارسة المهنية

5.9.3 المتابعة والتحديث المستمر: متابعة أثر التدريب وتحديث البرامج والإطار وفق التطورات التقنية واحتياجات المكتبات والأرشيف.

10.3 أساليب وأدوات تنفيذ الإطار التدريبي المقترح:

جدول رقم (9) أساليب وأدوات تنفيذ الإطار التدريبي المقترح للكفاءات والجدارات الذكية

أساليب وأدوات التدريب	مجالات الاستخدام
التدريب الحضوري والإلكتروني والمدمج	تقديم المعارف والمفاهيم الأساسية والمتقدمة
ورش العمل والتطبيقات العملية	تنمية المهارات الرقمية والتقنية وتطبيقات الذكاء الاصطناعي
دراسات الحالة والمحاكاة	تحليل المشكلات واتخاذ القرارات المهنية
المشروعات والمهام التطبيقية	تطوير الابتكار والخدمات الذكية وتحسين العمليات
منصات التعلم الإلكتروني والمصادر الرقمية	التعلم المستمر والوصول إلى المحتوى التدريبي
أدوات الذكاء الاصطناعي Microsoft Copilot، ChatGPT ، Gemini ، Claude	تحليل المعلومات والبيانات، توليد الأفكار، إعداد المحتوى، أتمتة المهام، تطوير الخدمات الذكية
الاختبارات والمهام العملية وقوائم التحقق	تقويم مخرجات التعلم وقياس مستوى الإتقان
مؤشرات الأداء والملاحظة المهنية	قياس أثر التدريب في الممارسة الفعلية

يوضح الجدول رقم (9) أساليب وأدوات تنفيذ الإطار التدريبي المقترح، بما يدعم تنوع أساليب التعلم والتدريب وفق طبيعة الكفاءات والجدارات ومستويات الإتقان المستهدفة، ويجمع بين التدريب النظري والتطبيق العملي والتعلم الإلكتروني والتقييم المهني، بما يساهم في تحقيق مخرجات التعلم وقياس أثر التدريب في بيئة العمل.

0.4 مناقشة الإطار التدريبي المقترح

استناداً إلى الجداول السابقة، يتضح أن الإطار التدريبي المقترح لا يقتصر على تحديد مجموعة من المهارات التقنية، وإنما يقدم تصوراً متكاملاً لتنمية الكفاءات الاحترافية والجدارات الذكية للعاملين في المكتبات والأرشيف، بما يتواءم مع التحولات التي تشهدها بيئة العمل المعلوماتية نتيجة التوسع في التقنيات الرقمية وتطبيقات الذكاء الاصطناعي.

1.4 تكامل مجالات الإطار:

يعكس تقسيم الإطار إلى أربع مجالات طبيعة المتطلبات المتكاملة للعمل في البيئة الرقمية، إذ توفر الكفاءات الرقمية والتقنية الأساس للتعامل مع التقنيات الحديثة، وتدعم الجدارات التحليلية وإدارة البيانات اتخاذ القرار وتحسين الأداء، بينما تعزز جدارات الابتكار والخدمات الذكية تطوير العمليات والخدمات. وتضمن الجدارات الأخلاقية والحوكمة الرقمية الاستخدام الآمن والمسؤول للتقنيات والبيانات.

2.4 التدرج في مستويات الإتقان:

اعتمد الإطار أربعة مستويات للإتقان PL1-PL4 مرتبطة بالمستويات الوظيفية والمسؤوليات المهنية، بما يتيح مواءمة التدريب مع طبيعة المهام ومستوى المسؤولية، ويضمن انتقال العامل تدريجياً من المستوى الأساسي إلى المستويات المتقدمة وصولاً إلى المستوى القيادي.

3.4 التكامل بين أهداف التعلم ومخرجاته ومؤشرات الأداء :

ربط الإطار كل مستوى من مستويات الإتقان بأهداف ومخرجات تعلم ومؤشرات أداء متوقعة، بما يحول الكفاءات والجدارات المستهدفة إلى تعلم قابل للقياس وأداء مهني قابل للملاحظة والتقييم. ويسهم هذا التكامل في متابعة أثر التدريب والتحقق من انعكاسه على الممارسة المهنية.

4.4 ملائمة الإطار لطبيعة العمل في المكتبات والأرشيف:

يتميز الإطار بارتباطه المباشر ببيئة المكتبات والأرشيف، إذ لم تُطرح التقنيات الرقمية والذكاء الاصطناعي باعتبارها موضوعات تقنية مجردة، وإنما جرى ربطها بالأنظمة والمنصات الرقمية، وإدارة البيانات والمعلومات، وتطوير الخدمات، وتحسين العمليات، وحماية المعلومات، والحوكمة. وتمنح هذه الخصوصية الإطار قدرة أكبر على الانتقال من التدريب العام على التقنيات إلى توظيفها في الممارسات المهنية للمكتبات والأرشيف، بما يساعد العاملين على التعامل مع المتطلبات الجديدة التي تفرضها البيئة الرقمية.

5.4 قابلية التطبيق والتطوير:

يتميز الإطار المقترح بالمرونة، إذ يمكن للمكتبات والأرشيفات تكييفه وفق طبيعة خدماتها وأنظمتها وحجمها واحتياجات العاملين فيها، كما يمكن اختيار الأولويات التدريبية وفق مستوى الإتقان والمهام الوظيفية. ولا يعني ذلك أن جميع العاملين يحتاجون إلى التدريب نفسه أو إلى الدرجة نفسها من الإتقان في جميع المجالات، وإنما يمكن بناء مسارات تدريبية مختلفة وفق الاحتياجات الفعلية لكل فئة.

6.4 القيمة المضافة للإطار المقترح:

الإطار المقترح يوفر أساساً يمكن أن تستند إليه المكتبات والأرشيف في تحديد الاحتياجات التدريبية، وتصميم البرامج والمسارات التدريبية، وتقييم مستوى إتقان العاملين، وربط التطوير المهني بمتطلبات التحول الرقمي وتطبيقات الذكاء الاصطناعي.

الخاتمة:

تؤكد الدراسة أهمية تطوير الكفاءات المهنية والجدارات الذكية للعاملين في المكتبات والأرشيف لمواكبة التحولات الرقمية وتطبيقات الذكاء الاصطناعي. وفي هذا السياق، قدمت الدراسة تصوراً تدريبياً متكاملاً يمكن أن يسهم في دعم التطوير المهني ورفع جاهزية العاملين للتعامل مع متطلبات بيئة العمل المعلوماتية المتغيرة، مع إمكانية تكييفه وتحديثه وفق احتياجات المؤسسات والتطورات التقنية والمهنية

النتائج:

توصلت الدراسة إلى مجموعة من النتائج، أبرزها :

1. الكفاءات والجدارات الرقمية والتقنية، والتحليلية وإدارة البيانات، والابتكار وتطوير الخدمات الذكية، والأخلاقية والحوكمة الرقمية تمثل صورة متكاملة للمتطلبات المهنية التقنية الأساسية للعمل في البيئة الرقمية والذكية.
2. تتطلب جاهزية العاملين بالمكتبات والأرشيف تكامل القدرات التقنية والتحليلية والابتكارية مع الالتزام بالأخلاقيات والحوكمة الرقمية.
3. تحديد أربعة مستويات للإتقان (PL1-PL4) يتوافق مع تدرج المسؤوليات الوظيفية من المساندة التخصصية إلى المستوى القيادي.
4. اعتماد مسار تراكمي للإتقان ينتقل من PL1 إلى PL4 ، يبني كل مستوى على ما سبقه ويعمق مستوى الممارسة المهنية.
5. تحديد أهداف ومخرجات تعلم مناسبة لكل مجال من مجالات الكفاءات والجدارات الذكية، ومتدرجة وفق مستويات الإتقان، يوضح ما ينبغي للعامل اكتسابه وتحقيقه في كل مجال.
6. مؤشرات الأداء المتدرجة التي تبدأ من تنفيذ المهام والتطبيق الأساسي، مروراً بالتوظيف والتقييم والتحسين، وصولاً إلى التوجيه واتخاذ القرار والحوكمة، تعكس تحقق الكفاءات والجدارات الذكية في الممارسة المهنية.

التوصيات:

توصي الدراسة بما يأتي:

1. اعتماد المجالات الأربعة المقترحة للكفاءات والجدارات الذكية بوصفها أساساً لتخطيط برامج التطوير المهني للعاملين في المكتبات والأرشيف .
2. تصميم مسارات تدريبية متدرجة وفق مستويات الإتقان (PL1-PL4) ، بما يتناسب مع اختلاف المسؤوليات والمستويات الوظيفية للعاملين، وتجنب اعتماد برامج تدريبية موحدة لجميع الفئات.
3. ربط البرامج التدريبية بأهداف ومخرجات تعلم واضحة ومؤشرات أداء قابلة للقياس، بما يتيح تقييم أثر التدريب والتحقق من انعكاسه على الممارسة المهنية .
4. تعزيز التدريب المستمر في الذكاء الاصطناعي وتحليل البيانات والتقنيات الرقمية والابتكار، بما يدعم قدرة العاملين على تطوير العمليات والخدمات المعلوماتية ومواكبة المستجدات التقنية .
5. تحديث الإطار التدريبي بصورة دورية في ضوء التطورات المتسارعة في التقنيات الذكية ومتطلبات العمل، مع مراعاة احتياجات مؤسسات المكتبات والأرشيف وتغير أدوار العاملين فيها.

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FULL PAPER

"Theatre in the Digital Media Era: Towards a Modernist Consciousness in Thinking and Reception"

المسرح في عصر الوسائط الرقمية: نحو وعي حداثي في التفكير والتلقي

Abstract:

This study addresses the fundamental transformations that theatre has undergone in light of the influx of digital media and modern technologies, based on the theoretical principle that connects every cultural transition to a shift in the questions of reality and its modes of thinking. The research aims to explore how the technological era reshapes human consciousness and the theatrical experience through the transition from passive consumption to free interaction and unlimited cross-cultural communication.

The study reviews the role of multimedia (text, sound, video, image, modern technologies), organized via computers and networks, in shaping digital theatre. It also analyzes the nature of the hypertextual digital theatrical text as a dynamic intellectual phase in which the roles of the author, recipient, actor (human or virtual), and scenographic director merge. Furthermore, the study highlights the pivotal nature of digital reception, which surpasses traditional print reception; it goes beyond mere imagination and interpretation to active viewer participation in producing meaning and reshaping the fabric of the performance through a series of interconnected interactions. In conclusion, the study highlights the encyclopedic theatre critic, who is required to possess advanced technical and cognitive skills to keep pace with these creative manifestations and issue comprehensive critical judgments.

The study concludes that digital theatre constitutes an inevitable extension of cultural, historical, and imaginative memory—not a rupture from it—and functions as a medium for multiculturalism and the blending of the diverse audience's horizons of expectations amid the communication changes of the early twenty-first century.

Keywords: Interactive Theatre, Hypertextual Digital Text, Digital Medium, Theatre Criticism, Digital Literature, Digital Scenography, Multiculturalism, Modernist Vision, Contemporary Reception.

إعداد

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كلية الآداب والعلوم الإنسانية
الرباط - المغرب

تتناول هذه الدراسة التحولات الجوهرية التي طرأت على المسرح في ظل تدفق الوسائط الرقمية والتقنيات الحديثة، انطلاقاً من المبدأ النظري الذي يربط كل انتقال حضاري بتحول في أسئلة الواقع ووسائل التفكير فيه. يهدف البحث إلى استكشاف كيف يعيد الزمن التكنولوجي صياغة الوعي الإنساني والتجربة المسرحية، عبر الانتقال من الاستهلاك السلبي إلى التفاعل الحر والتواصل اللامحدود عبر الثقافات.

تستعرض الدراسة دور الوسائط المتعددة (النص، الصوت الفيديو، الصورة، التقنيات الحديثة)، المنظمة عبر الحاسوب والشبكة، في تشكيل المسرح الرقمي. كما تحلل طبيعة النص المسرحي الرقمي المترابط باعتباره مرحلة فكرية ديناميكية تنصهر فيها أدوار المؤلف والمتلقي والممثل (البشري أو الافتراضي) والمخرج السينوغرافي. وتبرز الدراسة مفصلية التلقي الرقمي الذي يفوق التلقي الورقي التقليدي؛ إذ يتجاوز مجرد التخيل والتأويل إلى المشاركة الفعلية للمشاهد في إنتاج المعنى وإعادة خياطة نسيج العرض عبر سلسلة من التفاعلات المترابطة. وفي ختامها، تسلط الدراسة على الناقد المسرحي الموسوعي، المطالب لمواكبة هذه التجليات الإبداعية وإصدار الأحكام النقدية الشاملة، بامتلاك مهارات تقنية ومعرفية متقدمة.

وتخلص الدراسة إلى أن المسرح الرقمي يشكل امتداداً حتمياً للذاكرة الثقافية والتاريخية

مقدمة:

عُدَّ المسرح على مر التاريخ بوابة لتسلية الشعوب وتوعيتها وتنقيتها، فهو يصور حياتهم ويحكي عن تجاربهم وهمومهم، وينمي عقولهم، وهو ما تجسده قوله شكسبير الشهيرة عن المسرح: "أعطني مسرحاً أعطيك شعباً مثقفاً". وقد ارتبط المسرح منذ الأزل بمحاكاة الطبيعة المحيطة بالإنسان، حيث كان الإنسان البدائي يعبر عن رغباته بالرقص والتمثيل الإيمائي لأنه كان يدرك أن تلك القوى الطبيعية بعناصرها هي التي تسيطر عليه وهي التي يمكنها أن تحقق رغباته، كرقصة المطر التي كان يؤديها هذا الإنسان لأنه كان يربط بين رقصه وخروج النبات (المحصول) من الأرض، مؤمناً أن في ذلك ضماناً لبقائه حياً على الأرض. (شلدون تشيني، كتاب تاريخ المسرح في 3000 سنة، ص16).

وبقي المسرح ملازماً للإنسان إلى اليوم، وقد تطورت علاقة الإنسان به على مر التاريخ تطور الجنين في رحم أمه، إلى أن غدا المسرح اليوم مرآة للمجتمع وللشعوب وفي نفس الوقت منطلقاً لرقائها وتطورها ونشر ثقافتها، وذلك عبر

ما يحققه من وظائف متعددة تتجاوز البعد الترفيهي والتنشيط إلى التثقيف والتوعية وتهذيب السلوك وتنمية مهارات التفكير والنقد، كما هو شأن في المسرحي المدرسي الذي يسعى إلى تهذيب نفوس المتعلمين وتوعيتهم، أو مسرح القسوة (أنطونين أرتو) الذي يتخذ الغرابة والقسوة خلاصا من الضياع والظلم، ومسرح المقهورين (أوغوستو بوال) الذي يجعل مسرح المنتدى وسيلة لمناقشة القضايا التاريخية والثقافية بحثا عن التغيير وإيدانا برفض الظلم.

ويرجع هذا التطور المستمر إلى حركة الفكر البشري المحكوم بقانون الزمن؛ فكر حرباوي يتلون بتلون العصر ويتجدد بتجدد أحداثه، ليفرز أفكارا وطاقات إبداعية تواكب كل مرحلة، وتتصهر مع تحولات الثقافة والنظرية والعلم. وذلك وفق الإمكانيات التي تقدمها كل مرحلة فكرية. وكل ممارسة جديدة للفكر تستدعي توفير مساحات إبداعية مناسبة لتفجير طاقات الإبداع والفكر، فكل انتقال حضاري - وفق تعبير الناقدة زهور كرام - "هو بمثابة انتقال في أسئلة الواقع ثم في وسائل التفكير في الواقع، وهو مبدأ يعزز فكرة البحث المستمر لدى الإنسان على أكثر الإمكانيات الواسطة التي تسمح له بالتعبير عن تصوره للعالم." (كرام، 2009: 13)

إلى جانب ذلك، يأتي دور التطور التكنولوجي الذي ظهر بفضل نماء التجربة الفكرية، حيث يتدخل الزمن التكنولوجي كقوة فكرية غيرت ملامح التلقي الأدبي الذي أصبح تابعا لها، كما أصبح معها المبدع الأديب قادرا على التعبير بجرأة وحرية أكبر فوق مساحات أكثر سعة ومرونة، تعكس عمقا واضحا في الرؤية إلى العالم. مما ساهم في الانفتاح أكثر على الآخر دون شروط أو قيود عكس ما كانت تفرضه الرؤية التقليدية. فبخلاف هذه الرؤية القديمة وفرت الرؤية الحديثة أرضية أكثر ملاءمة للتطور التكنولوجي الجديد؛ من أدوات تقنية ومعلوماتية متنوعة ووسائط إلكترونية ورقمية غير محدودة.

ومع ذلك، لم يتم بعد صياغة هذا التحول الفكري الجديد بالشكل المطلوب الذي تفرضه حاجات المتلقي المعاصر، وذلك نتيجة تجاهل الذهنية العربية لآثار هذه الطفرة التحولية في نمط التفكير الحداثي وعدم تراكم تجارب أدبية رقمية كافية في الرصيد الإنتاجي الأدبي الرقمي في العالم العربي. لأن استهلاك الرقميات يفوق التجربة والممارسة الوظيفية، واستمرار رحلة هجرة الأدمغة العربية نحو الغرب، هذا الغرب الذي لا يزال فكره التنظيري يغزو العقل العربي الذي يجد صعوبة في أجرأة وتطبيق الحداثة الغربية، ولم يبادر بالقدر المطلوب للانخراط في الدفع بعجلة التحول الحضاري الذي لا يمكنه أن يتجاهل الثورة الإلكترونية والرقمية وما يمكنها أن تقدم لنهضة المجتمع العربي حتى يساير التطور الذي وصل إليه الغرب الجديد. ولو أننا نحن العرب والمسلمون كنا السباقين في إحداث نهضة علمية فكرية لا مثيل لها. ولكن استطاع الغرب طمس هذا السبق ونسبة الرقي والابتكار له فقط. ومع ذلك استطاعت مجموعة من الدراسات والأبحاث المعاصرة إثبات هذا الأمر بعد العثور على مخطوطات قديمة وكتب تراثية نادرة لعلماء بارزين في التراث العربي والإسلامي في علم الفلك وعلوم التاريخ والجغرافيا والطب وغيرها.

إن الوسائط الإلكترونية الحديثة تمنح لممارسيها ومستخدميها حرية المبادرة والاختيار والكتابة والتعليق والنقاش والتواصل اللامحدود مع ثقافات عالمية، وتسمح في الاختلاف والإبداع اللامحدود. "فالأدب الرقمي المترابط أو

التفاعلي الذي يتم في علاقة وظيفية مع التكنولوجيا الحديثة، لا شك أنه يقترح رؤى جديدة في إدراك العالم، كما أنه يعبر عن حالة انتقائية لمعنى الوجود، ومنطق التفكير. " (كرام، 2009: 23)

ونحن اليوم، من دون شك، على عتبة مسرح جديد يتخذ من التقني رقمي شكلا تعبيريا كأساس له، وقيم علاقة جديدة بين الذات والعالم في ظل متغيرات شروط الحياة التواصلية مع بداية القرن الواحد والعشرين. ولكن دون أن يحدث قطيعة مع المسرح التقليدي أو يتجاوز الذاكرة التي لا يمكنه التخلي عنها، وإلا فإنه سيفقد هويته وبالتالي وجوده الذي سرعان ما سيختفي ويتلاشى أمام المسرح الرقمي الغربي. ولا ننس أن الأدب الرقمي لا يمكن أن يغطي مكان الأدب الورقي ويلغيه، بل إنه يكمله ويعد استمرارا لوجوده. إن الشكل الأدبي لا يمكن أن يولد من عدم بل "يستمر وجوده باعتباره ذاكرة للكتابة والنص والتعبير". (كرام، 2009: 25)

لقد أكد منظرو النص المترابط Hypertexte - وهو شكل من أشكال الأدب الرقمي - على وجود علاقة الاستمرار بين الأدب الرقمي والأدب الورقي، ومنهم من سعى إلى إيجاد عناصر مشتركة بين نظرية الأدب ونظريات أخرى في تحولاتها عبر مختلف الحقب الأدبية والنقدية؛ مثل "جورج لاندو" و"رولان بارت" و"فوكو" و"باختين وغيرهم من الأدباء الذين عبروا عن أن التفكير في النص المترابط باعتباره وجها من أوجه الأدب الرقمي - يمر عبر إرث نظري مفاهيمي يشتغل على الأدب في حضور مستمر للمرجعية الأدبية والنقدية. لهذا فإن "الأدب الرقمي يسير في نفس الاتجاه الذي يجعل من النص الأدبي ذاكرة للنصوص واللغات والأصوات". (كرام، 2009: 27)

إن الأدب الرقمي يطور أسئلته النقدية انطلاقا من النظريات الأدبية السابقة لظهوره، بمعنى آخر ينطلق الأدب في تحديد تصورات واقتراح أفكاره من التجارب السابقة. وتعد الكتابة الورقية دعامة أساسية لاستمرار الأدب الرقمي بجميع أشكاله، كما أنها دعامة مهمة أيضا للمتلقي وليس فقط للباحث الجديد، لأن المتلقي المعاصر لم يكن ليتفاعل مع الأدب الحداثي لولا اكتفاء خزانة المعرفي بزيادة فكري ومعرفي قوي كان قد استقطبه واستجمعه من كتب ومقالات استمتع وهو يجمع في ذاكرته خلاصاتها ومعانيها وأفكارها. ولما استطاع اليوم أن يتقبل كل ما هو حداثي، وهو نفس القارئ الذي علمته القراءة الورقية قبول الآخر حتى ولو كان مختلفا عن هويته وثقافته وتراثه. إن القراءة الورقية لها بحق أحسن وسيط بين القديم والجديد، بين الحديث والحداثي، وبين الورقي والرقمي. لأنها الجسر الذي يمكن العقول من الانتقال من مرحلة إلى أخرى أكثر تطورا.

وما مسرح الوسائط المتعددة - خاصة المسرح الرقمي - إلا شكلا من أشكال الأدب الرقمي أو كما يسميه البعض المسرح الحداثي؛ إذ يمثل وريثا شرعيا كونه ثمرة التلاقح والاندماج بين عراقة المسرح التقليدي وروح الحداثة التكنولوجية.

وإذا أردنا التحدث عن مؤلف الأدب الرقمي، وهو المالك الأصلي للنص، لأنه من يقوم بإبداع الفكرة ونسج لغة النص التي لا تغدو سوى وسيط فكري بينه وبين المتلقي. فإننا سنربطه - ولا شك - بعالم التكنولوجيا الحديثة بمختلف وسائلها. فإلى جانب موهبته الأدبية في الكتابة وخلق العوالم المتعددة وربطها بالخيال أو الواقع، فإنه

بالضرورة مطلع على فن الرقميات، وله علاقة مباشرة بتقنيي ومتخصصين في المعلومات وفن الحاسوب. وهو ما يؤكد بأن مؤلف الأدب الرقمي هو أكثر من كاتب لأنه يؤلف بين مجموعة من العناصر والتخصصات، وهو مؤلف جديد يختلف عن مؤلف الأدب الورقي لأنه يفوقه خاصة في الدمج بين الثقافتين الورقية والرقمية، وتتسع أطراف فريقه المهني لأكثر من أربعة تخصصات منها الأدب، والدراماتورجيا، وفن الإخراج، وفن الثقافة الرقمية.

وأما متلقي الأدب الرقمي فهو شريك للمؤلف ومبدع ثان للنص، وهو ليس متلقيا عاديا، بل واعيا وموakبا للثقافة التقنية والتكنولوجية في أحدث تجلياتها. والمتلقي المثقف رقميا هو القادر على التفاعل مع الأدب الرقمي، والذي يمكنه أن يتمتع بحرية مفتوحة على إمكانيات وخيارات ذاتية لا محدودة في القراءة النصية، ومنفتح على قراءات متعددة، باعتباره مشاركا في عملية تحقق النص التخيلي الرقمي.

وأحيانا نجد من يلغي دور المؤلف التخيلي-الأدبي في النص الرقمي كما هو الشأن مع الناقد جورج لاندو . G LANDOW 1997، ورولان بارت 1968 ROLAND BARTHES . ((BARTHES, 1984 : 63 فبارت مثلا صاحب نظرية موت المؤلف يسحب السلطة من المؤلف ويقدم للقارئ كل الصلاحيات في تذوق النص وفهم مدلولاته. بينما "لاندو" لا يجعل موت الكاتب موتا كاملا بل جزئيا فقط عندما يُضعف سلطته بدل أن يلغيها، وكلاهما -أي لاندو وبارت- يلغيان دور المؤلف باعتباره مرجعية للقول والمعرفة والحقيقة.

إن منتج الأدب الرقمي هو أكثر من مجرد كاتب، بل هو مؤلف لأنه يؤلف بين عدة دوال معرفية وتقنية وأدبية وتخييلية، وهو يعي جيدا أن ما ينتجه من نص ليس مكتملا إلا بعد دخول ذات المتلقي الذي يملك نسخة ثانية من مفاتيح هذا النص، ليساهما معا، إلى جانب المخرج والتقني والبرمجي، في نسج خيوط هذا الزي الجديد والهجين. والذي قد يكون في مرحلة ما من مراحل ولادته عفويا سلسا يفرضه موقف ما أو فكرة ما أو ردة فعل معينة قد تؤدي في بعض الأحيان إلى تغيير نهاية النص أو إلغائها.

ومع ذلك تبقى حرية القارئ مقيدة بمثيرات نفسية وذهنية وثقافية واجتماعية ورقمية تتحكم بمدى قدرته على الاستمرار في التفاعل مع النص والإبحار فيه. "إن القصة عندما تتوقف عن التطور ويبدأ القارئ يشعر بالإرهاق، فمعنى ذلك أنها نهاية تجربة القراءة لدى القارئ." (Clément «jean» . 1995) - بمعنى أن تجربة القراءة عموما هي تجربة مقيدة وغير مطلقة؛ إذ تخضع لحدود طاقة القارئ الاستيعابية، ومدى قدرة النص على تجديد دهشته وحافزته، فضلا عن المشتتات الرقمية والسياقات الاجتماعية والنفسية التي تحكم مدى شغفه ورغبته في الاستمرار.

إن تجربة القراءة مرتبطة بتجربة الكتابة، لأن الكاتب يظل هو من يتحكم في مسار هذه القراءة عبر ما يزرعه في نصه من مفاتيح تستقطب القراء وتجعل تجربة القراءة لديهم ممتعة، وذلك عبر مجموعة من العناصر التي تمنح للنص اتساقه وانسجامه. وهذه العناصر هي ما يخلق دافعية القراءة لدى القارئ. من هذه العناصر ما أشار إليه أرسطو طاليس في كتابه الشهير "فن الشعر"، كالتشويق، والاكتشاف، والتنبؤ والتلميح. وفي حقل اللسانيات النصية

نجد مثلا التشغيل التفاعلي من خلال القصص والمضمرات الحوارية (مبدأ التعاون لـ "جرايس")، ومبدأ ملاءمة السياق؛ فكلما كانت الحوارات ذات صلة بمركز الصراع، ازداد شغف القارئ واسترساله في القراءة. ولكن في الأدب الرقمي لا تقف هذه السلطة عند عتبة الكاتب فقط، بل يستلمها القارئ في سلسلة دائرية تربط بينهما وبين أطراف أخرى، لأن القارئ يصبح مشاركا فعليا في الإنتاج ولا تقتصر وظيفته على التلقي فقط.

إذ يُنتج القارئ الرقمي نصا سماه "بيار باربوزا" Pierre Barboza ب ميتا- محكي، وهو نص يتشكل وفق طريقتين: كيفية تفاعله معه، وزمن مكوثه فيه. وبالتالي انتقلت إشكالية الأدب مع تجربة الأدب الرقمي، من سؤال: كيف قيل النص؟ ومن أنتج النص؟ إلى سؤال: من استقبل النص؟ وكيف تفاعل معه؟، أي أنه تم الانتقال من الاهتمام بالنص إلى الاهتمام بالقراءة والتلقي التي أرست معالمها جمالية التلقي على يد "هانز روبير يابوس" الذي أعطى الأولوية للقارئ بعدما ظل يستأثر بها المؤلف زمنا طويلا.

إن الكتابة الرقمية داخل سوق الأدب عموما، والرقمي خصوصا، هي حالة وعي إنساني جديد بضرورة العبور من الذاكرة والتقليد إلى الإبداع والابتكار اللامحدود شريطة عدم التجرد من البعد الثقافي والتاريخي والتخييلي، بل الانطلاق منه لأنه يعد امتدادا لهذا البعد وأثرا حتميا له. وتعمل المسرحية الرقمية على جمع المتلقين، وصهر آفاق توقعاتهم ودمج مرجعياتهم وهو ما يجعل من المسرحية وسيطا للتعدد الثقافي والانفتاح على الآخر.

ولا يمكننا تجاوز دور الممثل في المسرح الرقمي، الذي تحول إلى أداة تستمد وجودها من آلات وأجهزة وتقنيات سمعية-بصرية متعددة ومعقدة في طرق اشتغالها، مما يفقده عمقه النفسي ووجوده الاجتماعي، ولا يغدو سوى مساحة أو مختبر لتجارب جردته من أبعاده الإنسانية. وأمام هذا التحدي يتجلى دور المخرج الذي يسعى جاهدا للحفاظ على جوهره البشري وبنائه الاجتماعي بتعاقد مع المبرمج الرقمي والتقني، حيث ينخرط الجميع في تشكيل بنية هجينة متكاملة تتضافر فيها الرؤية الإخراجية مع الحلول الرقمية لتشكيل عرض يوازن بين التكنولوجيا وإنسانية النص.

وإذا كانت المكونات السابقة، أي الكاتب والمتفرج والممثل الافتراضي والمخرج والتقني، أطرافا رئيسة في منظومة التواصل المسرحي الرقمي، فإن النص المكتوب يظل هو النواة الناعمة للمسرح الرقمي؛ كونه يصمم بالأساس ليستجيب لشرط التلقي الرقمي. إذ يتميز النص الرقمي بالتشعب وقدرته على فتح آفاق تأويلية وتفاعلية واسعة أمام المتلقي من خلال ابتكار أساليب جديدة تناسب منطق التفكير المعاصر، وتتيح إمكانات إبداعية لم تكن موجودة في المسرح التقليدي. فلم تعد هناك فجوة بين المبدع والجمهور بل أصبحا شريكين فاعلين يتآزران لتشكيل عوالم التجربة الأدبية الرقمية. وطرح البناء المعرفي والفلسفي والجمالي لهذه التجربة "هو عبارة عن شكل من أشكال الوعي النقدي والفلسفي التي من المفروض أن ترافق عملية التفكير في بناء تصور معرفي حول تجربة أدبية." (كرام، 2009: 46)، بمعنى أن التجربة الأدبية الرقمية تحظى بمكانة معرفية لا تقل عن سابقتها من التجارب الأدبية.

إذ تستدعي هي الأخرى بحثاً عميقاً في بنيتها الفنية وأبعادها الفلسفية والمعرفية، بغية الإحاطة بمنظومتها الإبداعية وتأسيس أفق نقد يستجيب لمقوماتها التفاعلية.

بهذا أمكننا القول إن النص المسرحي الرقمي هو صيرورة فكرية وبنائية متجددة، تعيش حالة مستمرة من التشكل والتعديل. وتتمثل الوظيفة الرئيسة لهذا النص في تفعيل مبدأ التفاعل وتحقيقه إجرائياً؛ حيث ينتقل من حالة الجمود والجمود إلى وضعية الدينامية والحركة استناداً إلى استجابة القارئ ودرجة تفاعله الجمالي مع المنتج المسرحي الرقمي. هكذا يصبح المسرح الرقمي، باعتباره مولوداً أدبياً رقمياً جديداً، مجالاً واسعاً خصبا يتجاوز مفهوم البناء اللغوي المألوف. "لهذا فالنص الرقمي يصبح نسيجاً من العلامات التي لا تجعله يخضع لوضع قائم وثابت. وإنما نصيته تتحقق من حيويته ولا اكتماله. والقراءة هي أفق تحقيق نصية الأدب الرقمي". (كرام، 2009: 50)

ولغة المسرح الرقمي هي لغة مركبة تحظى فيها البرمجة التكنولوجية والحلول الرقمية بموقع الصدارة، إذ تتدخل -إلى جانب العلامات اللغوية والبصرية- في تشكيل النصية وصياغة المعمار التخيلي للنص الرقمي. تساعدنا في ذلك عناصر وسائطية ومفاهيمية وفلسفية تتجدد باستمرار تحت مبدأ التدبير الجماعي للمعنى. أما الوجه الثاني للغة المسرح الرقمي فهو اللغة الأدبية الإبداعية، سواء المطبوعة أو المنطوقة على المسرح وهي رمزية في أحيان عديدة. وتتأسس لغة النص الرقمي بوصفها نتاجاً شبيكياً تشاركياً يتداعى في بنائها كل من الكاتب والمخرج والممثل والتقني والمتلقي، وهو يستوجب اشتراط الوعي الرقمي والدربة التقنية لدى كافة هذه الأطراف، لضمان إنتاج المعنى واستقباله وفق منطق الوسائط الحديثة.

والنص المسرحي الرقمي هو إجراء متكامل بنيوي، يعيش فعل الارتحال والتنقل والبناء بشكل دائم، ويشغل على تنظيم المعلومات والأفكار داخل النص. ويدخل هنا فعل التناص باعتباره إجراءً تنظيمياً لمبدأ تداخل النصوص، على أساس أن النص الرقمي ما هو إلا امتداد لذاكرة نصوص أخرى سابقة له أو مترامنة معه. بمعنى أن مفهوم النص المسرحي الرقمي هو حقل واسع يلغي فكرة أن المؤلف هو الصانع الوحيد للنص والمتحكم في أفق انتظار القارئ، رغم كونه يبقى الصانع الأصلي أو الأول له. وهو بذلك -أي المؤلف- يعي مفاهيم التعددية النصية والإنتاج النصي الجماعي أو المشترك. وهذا ما يخلق بعداً قرائياً جديداً في النص المسرحي الرقمي، بعداً يتجاوز البنية الخطية الأفقية ويكسرها ليعوضها ببنية أخرى مرنة عنكبوتية إن صح التعبير، يعجز فيها المؤلف عن التنبؤ بكيفية استقبال القارئ للنص وتوقع كل انتظاراته لأنه ليس الفاعل الوحيد في النص بل هو طرف واحد من أطراف العملية التواصلية المسرحية الرقمية، يكون فيها الوسيط الرقمي هو الطرف الأقوى.

إن القراءة في الأدب الرقمي - وهو ما أكدت عليه الناقدة الدكتورة زهور كرام - هي سؤال فلسفي جديد، وأسلوب في التفكير في المرحلة التي نعيشها، تشتغل وفق قوانين تعبر عن أنماط التفكير والتواصل في الزمن الراهن. (كرام، 2009: 63) حيث "يتسع مفهوم الأدبية ليشمل بعداً بلاغياً-استيتيقياً من خلال التواجد الجوهري للدعامة

الرقمية، والتي تصبح عاملا أساسيا في تحديد أدبية النص وبلاغته". (كرام، 2009: 65) وتبقى القراءة - باعتبارها طريقة إجرائية ومعرفية وفلسفية - هي القادرة على معرفة المنطق الذي يشكل النص المسرحي الرقمي.

وهكذا جعلت الوسائط الإلكترونية النص الأدبي يأخذ أبعادا جديدة يعبر من خلالها عن رؤيته بشكل مغاير عن السابق، مما مهد لاصطدام وشيك بين الوعي المؤلف الذي خلقه فعل القراءة وبين وعي دخیل كان نتيجة تجلٍ رقمي وجد ردود فعل متناقضة في الأوساط النقدية بين مؤيد لهذا التجلي الأدبي الرقمي ومعارض له. وتلقي النص المسرحي الرقمي هو مشروط بخلق مادة نصية تخيلية، تكون مؤهلة كميا وكيفيا لجعل القارئ قادرا على التفاعل معها، لخلق تأويلات لدلالات مفاهيمية قابلة للتحويل وفق مستجدات تجربة النصوص.

ووفق هذا المنظور، يعد المسرح الرقمي التفاعلي نمطا إبداعيا تجريبيا جديدا في الكتابة المسرحية، يتجاوز الفهم التقليدي للفن المسرحي، إذ يرتكن أساسا إلى الوسيط الرقمي (الحاسوب) كتابة وقراءة وتنفيذا. وهو شكل فني متكامل فيه مكونات متعددة تنتج أثره الجمالي؛ حيث تتضافر فيه الفنون الأدبية والموسيقية والتشكيلية، مع لتقنيات الرقمية. وفي هذا السياق شهدت آليات التفكير وأساليب التعبير تحولا جوهريا بإيعاز من الثورة الرقمية والتكنولوجية، لتسهم هذه المكونات مجتمعة في التشكيل الجمالي والتصميم الفرجوي للعرض المسرحي الرقمي.

والمسرح التفاعلي الرقمي فن أدائي تعبيری، يمثل ذروة التحدي في المعالجة الرقمية، يكون المستخدم فيه هو "الشخصية المحورية في القصة لأنه يشغل باقي الشخصيات والأحداث آليا من خلال برنامج كتبه المؤلف". (Szasz Nicolas. 2000: 1) وقد أخذت المسرحية التفاعلية أيضا مكانا ضمنيا في العالم الافتراضي، حيث يأخذ المستخدم درجة أعلى من الحرية في التفاعل الجسدي والذهني مع ما يشاهده ويقرؤه داخل التجربة المسرحية التي تختلف حسب كل أداء، وتتيح التفاعل للمستخدمين. (Arinbjarnar, M., Barber . 2009: 1 – 8)

وقد كسر المسرح الرقمي خاصية الخطية السردية والزمن التعاقي في القصة المسرحية، فلم يلتزم تشالز ديمر Charles Deemer -رائد المسرح الرقمي في الثقافة الغربية-، في مسرحياته الرقمية بالخطية والتراتبية أو بأي ترتيب على مستوى الزمان والمكان، بل جعل المشاهد فيها مترامنة تحدث في الوقت ذاته، وتهدف إلى تحقيق شرط التفاعل بين الممثل الافتراضي والجمهور الافتراضي خلال العرض المسرحي. فعلى مستوى القراءة النصية يختار المتلقي -الذي يتقمص دور شخصية افتراضية- ما يريد متابعته من أحداث وشخصيات بشكل غير خطي أي من دون تسلسل أو تتابع زمني. وتبنى هذه الطريقة اللاخطية على أساس نتائج المداخلات النصية التي يراد فيها استقطاب المتلقي والتفاعل معه. (عادل نذیر، 2010: 63) وتعمل المسرحية الرقمية على شكل روابط تشبه المسارات تحيل على فصول المسرحية ومشاهدها بصيغة البيدي إيف pdf توفر للقارئ حرية الاختيار بين هذه الفصول والمشاهد التي يريد قراءتها والتفاعل معها.

وقد أكد، في هذا السياق، المخرج والناقد المسرحي الدكتور محمد حسين حبيب في صحيفة المدى الثقافي العراقية (العدد 544) عام 2005، أن المسرح التفاعلي على مستوى العرض الحي كان هو المتصدر لمشروع نظرية

المسرح الرقمي "بما يوظفه هذا المسرح من معطيات التقانة العصرية والجديدة المتمثلة في استخدامه للوسائط الرقمية المتعددة في إنتاج وتشكيل الخطاب المسرحي بشروط تفرضها صفة التفاعلية". بشكل يجعل التفاعلية خاصية لصيقة بالمسرح الرقمي. (خضير الزبيدي)

ويتخذ البعد التفاعلي في المسرح التفاعلي الرقمي - حسب الدكتورة فاطمة البريكي شكلين؛ يتجلى الأول في اختيار شخصية من شخصيات المسرحية للكتابة عنها ثم الانتقال مع هذه الشخصية عبر أحداث معينة بشكل متتال، ورصد مواقفها من هذه الأحداث وأدوارها فيه، ومن ثم تسجيل انفعالاتها وتحركاتها داخل المسرحية. ويرتبط الثاني بمتلقي المسرحية ويسمى المستخدم الذي يتفاعل مع ما يشاهده من العرض المسرحي، ويكون مخيرا في تتبع المسار الذي يريد التفاعل معه. وهذا ما يضع النص المسرحي التفاعلي أمام نهايات مختلفة.

ومن التجارب المسرحية الرقمية التفاعلية في العالم العربي نجد تجربة الناقد "حمزة قرير" الموسومة بـ "بلا نظارات الحياة أفضل"، وقد ربطها بمجموعة من التقنيات التي تدخلت في بنائها، ووضعها في موقعين يعنيان بهذا الفن المسرحي الجديد، وهما موقع اتحاد كتاب الانترنت العرب الذي يشرف عليه "محمد سناجلة"، والموقع متاح على هذا الرابط <http://www.arab-ewriters.com> وموقع مدونة الفن على الرابط: <https://www.litartint.com>

ويعتمد صاحب المسرحية في تقديمها داخل الشبكة العنكبوتية على برنامج مايكروسفت فرونت بيج Microsoft Office Frontpage ويستخدم لغة HTML في تحرير نصوصه المسرحية الرقمية. كما يقدمها من دون ممثل، إذ عوضه بما سماه الشخصية الافتراضية Virtual Character التي يمكن التحكم بأدائها عبر جهاز الحاسب الإلكتروني. (خضير الزبيدي) ويسمى الباحث محيي الدين إبراهيم "الممثل التخيلي" الذي ليس له وجود حقيقي في عقل المشاهد، بل يصبح وجوده منطقيا يفرض واقعيته داخل الحدث الدرامي نفسه، يرسمه المتلقي في ذهنه ويحدد ملامحه أثناء مشاهدته العرض المسرحي.

وبما أن المحيط الذي يتحرك داخله المسرح التفاعلي هو العالم الافتراضي فإن زمن المسرحية بالضرورة هو زمن افتراضي يقاس بسرعة التحميل المستغرقة في التنقل بين فصول المسرحية، ويعد "زمن التحميل إعلانا ماديا لدخول تجربة مختلفة لزمن القراءة يذكرنا بضرورة التخلي عن مواصفات ميثاق القراءة الذي تعودنا عليه ... وهو زمن بتنشيطه وتشغيله تبدأ القراءة زمنا خاصا وتجربة خاصة." (زهور كرام، 2009 : 73) ومن خلال تضافر البعدين اللغوي واللالغوي في الجانب التخيلي يتولد لدينا زمانان هما زمن الكتابة والبناء وزمن التلقي والتفاعل، مما يمكن المتلقي من "الانتقال من عقدة إلى أخرى بحرية تامة أثناء القراءة بالطريقة الشعبية وهي اختيارية تماما فلا وجود لمسارات مفروضة، مما يمنح المسرحية مرونة كبيرة في تقديم متنها". (حمزة قرير)

وتتضافر لتقديم المسرحية - إلى جانب النص المكتوب - روابط إلكترونية، وصور مشهدية، وموسيقى وألوان. فالمسرحية التفاعلية تحتفظ مثل نظيرتها المسرحية العادية بمكوني النص والعرض المسرحيين، لأن بينهما علاقة

متلازمة يصعب إيقافها، باعتبار أنهما طرفان أساسيان في المسرحية لا يمكن لأحدهما أن يحضر دون الآخر. وخاصة التفاعلية أو الرقمية لا تعني إلغاء هذا التعاقد بين هذين الطرفين.

ومن المسرحيات التفاعلية في العالم العربي، كذلك، مسرحية "مقهى بغداد" وألفها الدكتور حازم كمال الدين بالاشتراك مع بيتر فير هايس P : Verhees، وتحدث عن واقع بغداد خلال الحرب عام 2003. ساهم في إنجازها مجموعة من الباحثين العرب والأجانب، وانطلقت هذه التجربة من مقهى افتراضي لخطورة الوضع ببغداد. وعرضت المسرحية أمام طاولة كبيرة يسيرها مدير خاص، وتوجد خلف هذه الطاولة شاشة كبيرة تبث صورة حية من العراق. ويجلس الجمهور في طاولة نصف مستديرة بطريقة يمكن أن يتابع من خلالها المشاهدون ما يجري في المقهى البلجيكي والمقهى العراقي في الوقت ذاته. ولا تظهر هذه التجربة كاملة إلا عبر البعد الافتراضي من خلال الرابط الآتي:

<http://www.stack.nl/theatreofwar>

وقد بنى المؤلف مسرحيته ببنية تفاعلية جديدة جمعت كتاب مسرحيين من بلجيكا والعراق بمن فيهم المؤلف محمد حسين حبيب، يجلسون خلف حواسيب يتحاورون فيها -في ضوء أسئلة الجمهور -عبر تقنية الشات، وتعرض ردود أفعالهم بالتعاقب بواسطة شاشة افتراضية عملاقة.

وتستند الشخصية الافتراضية في العرض المسرحي التفاعلي إلى البعد البصري باعتباره عنصرا تقنيا فرجويا، ومنه ينحدر فن الصورة السينوغرافية التي يتشكل فيها التعبير الجسدي، وتحمل الصور منظومة شفرات فنية ترميزية تولد دلالة العرض المسرحي بلغة بصرية تفاعلية تواصلية تكمل دور الكلمة. ويقف إلى جانبه البعد الصوتي الذي يمثل أداة أخرى تخلق التفاعل أثناء العرض المسرحي، ويتداخل هذا البعد جنباً إلى جنب مع مؤثرات صوتية وبصرية أخرى؛ من إضاءة متنوعة، وإيقاع سينوغرافي، ومناظر منسجمة، يستغل فيها المخرج كل إمكانيات التقنية والتكنولوجية الحديثة التي يعمل عبرها على خلق خلفيات افتراضية لجذب الجمهور أو المستخدمين الذين يحسون بأنهم جزءا مهما من العرض منذ الوهلة الأولى. ونذكر أن "الجمهور هنا متحرك يخرج من مكان ويدخل إلى آخر، تابعا شخصية ما. ولكل متفرج حرية اختيار المشهد الذي يريد مشاهدته". (فاطمة البريكي، 2005 : 110)

غير أن المتلقي إذا لم يجد في النص أو العرض المسرحي الرقمي ما يسليه أو يشغله، يؤدي ذلك فورا إلى انفصال المتلقي وفشل العملية التفاعلية برمتها؛ إذ يظل الجمهور الركيزة الأساسية لشرعنة هذا العرض ونجاحه، وبدونه يتلاشى الأثر التفاعلي. وتعد هذه هشاشة بنيوية في هذا الفن المستحدث، بخلاف المسرح التقليدي الذي تتأسس مرجعيته على ثوابت راسخة؛ حيث يخرج المتفرج منه متأثرا بفعل التطهير (Catharsis) الذي ينسجه البناء الدرامي الأرسطي عبر إيقاع غنائي يهدئ انفعالاته ويخفف لديه حدة التوتر والحزن. (فن الشعر، أرسطو طاليس)، ناهيك عن أحكام الحبكة الدرامية التي تشد وثاق الجمهور وتستدرجه إلى متونها المغلقة.

ولأن الشخصية الافتراضية تدخل وتخرج، وتنتقل بين المسارات بشكل مستمر، فإن المسرح التفاعلي يستبدل الديكور بالإضاءة وبالشاشة الخضراء (الكروما) ، (ويستغني تماما عن الكواليس. والمسرحية التفاعلية ليست قابلة للإخراج والتمثيل على منصات المسارح أمام الجمهور، بل هي فن توافلي ذكي يمارس عبر شاشات الانترنت. لهذا لا يكون أفق الانتظار متاحا للمتلقى لأنه هو أيضا يتقمص أدوارا مختلفة تفاعلية داخل العرض، ويكون مشاركا في أحداثه، ولا يفترض منه توقع الأثر أو الأحداث. والمسرحية الرقمية دائمة التوالد لا تقبل السكون والثبات، وتؤسس لإشكالية اختلاط واصطدام أصوات المبدعين داخلها.

وتجري أحداث المسرح التفاعلي في بيئة حقيقية تخرج المتلقي من إيقاع الخشبة التي اعتادها في المسارح، "مما يجعلها تمثيلية حرة ومباشرة، أي تقوم في أماكن مختلفة مثل القصور العتيقة أو صالات الفنادق، أو حتى الشوارع وغيرها الكثير؟"

إن استخدام الوسائط المتعددة في المسرح له دور كبير، لأنه يمثل الإطار العام الذي ينظم وسائط سينوغرافيا العرض من خلال الحاسب الآلي الموصول بالإنترنت، لتنفيذ ما يعرف بالواقع الافتراضي الذي تبني مناظره بناء رقميا. وتتكون هذه الوسائط من مجموعة من العناصر أهمها؛ النصوص، الصور، الصوت، مقاطع الفيديو:

- **النصوص Text:** وتشمل الكلمات المطبوعة على الورق، والكلمات الممسوحة عن طريق الماسح الضوئي، والكلمات الإلكترونية المخزنة في ذاكرة الحاسوب.

- **الصور والرسوم Image et Graphic:** وتشمل الصور المخزنة في الذاكرة الحاسوبية وهي على هيئة شبكة من النقاط تغطي المساحة المطلوبة، وتشمل أيضا الصور الرقمية والصور المترابطة.

- **الصوت:** سواء الصوت الطبيعي أو الاصطناعي (الموسيقى مثلا...) أو المنطوق.

- **مقاطع الفيديو:** وتجمع بين الصوت والصورة.

والواقع الافتراضي في عالم المسرح قد يشبه الوهم، يحس داخله المشاهد المستخدم وكأنه يلعب لعبة رقمية تفاعلية من ألعاب الفيديو ، مما "يجعل المشاهد يتفاعل معه بواقعية شديدة تجعله يتخطى الواقع إلى عالم اللاواقع، فيسبح في دنيا من الصور والأحداث المعدة رقميا، ويندمج بواسطة الحاسب الآلي داخل صورة مجسمة من عالم اصطناعي (محسوس غير ملموس) ثلاثي الأبعاد بتقنيات عرض متقدمة، ويمكنه بذلك خلق الواقع الخاص به، وتحريك الأجسام والعناصر (المكونة للمنظر الافتراضي)، مع إمكانية الاتصال بأشخاص آخرين مشتركين في العرض نفسه فيغوص الكل في تجربة كاذبة بحيث تبدو وكأنها واقع محسوس." (عبد الرحمان دسوقي، 2005 : 81) فبداية ظهور الواقع الافتراضي ترجع إلى ألعاب الكمبيوتر والبلاي ستيشن التي يندمج فيها اللاعبون ويتفاعلون كأنهم في المكان ذاته.

وإلى جانب الوسائط السابقة، يحتاج المستخدم أدوات وسائطية مكملية تمكنه من عيش تجربة التفاعل الافتراضي، وهذه الأدوات هي عبارة عن أجهزة يتم ارتداؤها لنقل الصورة والصوت، كمؤثر الرؤية Vision Effect؛ وهو جهاز يوضع على الوجه به شاشة عرض خاصة بكل عين على حدة، وتظهر على الشاشة صور رقمية ناتجة من خلال الحاسب الآلي تتحرك تبعا لحركة المستخدم. ومنها أيضا مؤثر الصوت Effect Sound؛ ويستخدم فيه المشاهد سماعات مركبة في جهاز مؤثر الرؤية يسمع من خلالها الصوت داخل العالم الافتراضي، وهي أصوات تقترب كثيرا من الحقيقة.

إلى جانب مؤثر الرؤية ومؤثر الصوت، يأتي أيضا دور مؤثر اللمس Haptic Effect؛ الذي يعمل عبر جهاز اللمس؛ وهو عبارة عن قفاز خاص وجهاز لتعقب الموقع يمكنه أن يحدد موقع يد الشخص المشترك داخل الواقع الافتراضي. ويجب أن يتوافق مثير اللمس مع ما يراه ويسمعه المشاهد حتى يتمكن من عيش تجربة الإحساس بالواقع والمشاركة فيه ببراعة فنية. والمسرح التفاعلي وفق هذا المعنى ما هو إلا امتداد للقدرات والمهارات الإنسانية في ترجمة الواقع المادي إلى واقع فني يكاد يشبه مادة الإبداع.

وتوجد مبادرات جادة أخرى تعزز من دور المسرح التفاعلي العربي، حيث تم تسطير عروض مسرحية من قبل المسرح الوطني الجزائري "محيي الدين باشطارزي" على قنواته في اليوتيوب والفيس بوك (www.tna). والتجربة التي أقامها المسرح الجهوي ببسكرة، الذي أخذ على عاتقه إحداث فضاء مسرحي تفاعلي افتراضي أطلق عليه اسم "فضاء الركح" وهو فضاء متخصص في الفكر المسرحي الجزائري، ومساحة مفتوحة لإنضاج الفكر المسرحي في الجزائر. وهو فضاء مناسب لكل المهتمين بالمسرح التفاعلي العربي لأنه يهتم بجميع جوانب المسرح. وقدم المشروع خدمة الانضمام إلى دائرته لتعميم الاستفادة منه، بتوفير خدمة إرسال طلب الصداقة.

إن المسرح التفاعلي الرقمي لا يشكل خطرا على نظيره التقليدي، بل هو طفرة حتمية فرضها التطور التكنولوجي السريع اليوم الذي أنتج متقلبا جديدا يؤمن بالسرعة والحدثة. ولكن بالمقابل هناك شريحة أخرى من الجمهور لا زالت تفضل المسرح الركحي -الآني- الذي لا يخترق أريحية المشاهد أو يضعه أمام اختيار المشاركة الكلية في العرض المباشر والانصهار في شخصية الممثل عبر المستخدم الافتراضي، بل يكفي بالتلقي العادي ويترك مهمة تحريك النهايات المسرحية والتحكم فيها للفاعل الأصلي وهو الكاتب المسرحي.

في ظل هذه التحولات التكنولوجية المتسارعة، انبثق مفهوم التلقي الرقمي بوصفه نمطا قرائيا وبصريا ينافس التلقي الورقي التقليدي، بل ويتجاوزه في أحيان كثيرة، من حيث اتساع كفاءته التفاعلية وقدرته على تعميق الأثر النفسي والذهني لدى المتلقي. ما يجعل أعراف التلقي تتغير وفق ما يقتضيه المتلقي المعاصر المحكوم بقوانين العالم الأدبي الافتراضي. ويقتضي التلقي الرقمي وجود نتاج تكاملي بين وحدات إنتاج النص وتلقيه انطلاقا من صبغة التفاعل التي يقتضيها الوسيط المحرك للعمليات على السواء، كما أن المتلقي الرقمي ينتج نصا يحمل، أحيانا، نفس سمات النص التي تبناها مؤلف الأدب التخيلي الرقمي. وبذلك "يستقي الأدب التفاعلي مقولاته من المشاركة الفعالة

للقارئ الذي بيده تحديد الدلالات من خلال نقره لمختلف الأيقونات وتجوله بينها، والمتلقي هو الذي يوجه المؤلف والناقد للدلالات الممكن تشكيلها من خلال مختلف القراءات التي ينحوها". (باللودمو خديجة، 2014: 123)

إن التفاعل الذي يراهن عليه المسرح التفاعلي مشروط بالمشاركة الفعلية للمشاهد؛ إذ يتجاوز دوره حدود الاستقبال السلبي والاستهلاك المجرد، إلى التشارك الفاعل في إنتاج المعنى عقب تلقي النص أو العرض الرقمي. وتقوم هذه المشاركة على سلسلة من الاستجابات التفاعلية -المنطقية والارادية - التي تمكنه من النفوذ إلى عمق التجربة الإبداعية، ودخول النص في تناصات لا متناهية مع مدونته السابقة واللاحقة. وفي هذا الفضاء الافتراضي، تتشكل ألفة بين المتلقي المستخدم والعرض الرقمي عبر الوسيط الإلكتروني، مما يرسخ شعوره بوصفه طرفاً أصيلاً ورئيساً في هذه العملية التواصلية.

ووجود وسائط متعددة داخل النص يحرك نوعيات مختلفة من القراء، ويؤلف بين النقد التفاعلي ونظرية القراءة والتأويل في لحظة واحدة تسعى لمعالجة قضايا ذهنية وفكرية عبر صور رقمية ونصية متعددة، ويفتح إمكانات هائلة من التجارب بين المنتج والنص والمتلقي، تعتمد فيه التقنيات الرقمية المتاحة التي توفرها هذه المرحلة الفكرية. والوسيط الرقمي مهما تعددت أشكاله فإنه يبقى مجرد خاصية تقنية لا أدبية في الأدب الرقمي. وبالتالي وجود المسرح الرقمي خاصة والأدب الرقمي عامة رهين بالمشاركة والتفاعل الذي يحدثه المتلقي، ورهين كذلك بجودة الوسيط الإلكتروني ومدى قدرته على إشباع حاجيات المتلقي الرقمي.

يقول الكاتب سعيد يقطين في كتابه (نحو نقد مختلف، نحو نظرية رقمية عربية) أننا اليوم بحاجة لنقد وناقد ومتلق ومبدع رقميين بمواصفات جديدة تلائم الإبداع الرقمي. فالمجتمع الرقمي يقتضي من المعرفة الأدبية والنقدية إدراك معالم الأدب الرقمي والانفتاح على الوسائط المتفاعلة عن طريق الاشتغال بالنص المترابط والنص الإلكتروني. ويؤكد يقطين على أنه "ستتغير بالضرورة وظائف الكاتب، والقارئ والأدوار التي يقوم بها بالقياس على ما كان الأمر عليه مع النص المكتوب". (بنت أحمد محمد كيري، 2017: 50)

إن هذه النقلة النوعية التي حظي بها المتلقي الذي تجاوز فعل التلقي نحو فعلي التفاعل والمشاركة من خلال الشاشة الزرقاء، حيث تضطلع التجربة الجمالية عنده في نقطة التقاء التلقي والتفاعل، يجعل من المتلقي المتفاعل أداة محورية لإيجاد أدلة قرائية لاكتشاف مختلف التلقيات الأخرى، مع افتراض شمولية التحليل وليس كلية التصور المسبق، وقراءته النصوص المختبئة وراء الوسائط الرقمية.

وقد حمل هذا المناخ الأدبي الجديد معه بوادر تحديات اختلطت بمفاجآت المنجز الإلكتروني وتعقيدات الحياة المعاصرة، ارتبطت بالمبدع والقارئ على حد سواء. فبعدما دخل الحاسوب فضاء الإنتاج الأدبي، وهيمنت التكنولوجيا الحديثة على الإنتاج والتلقي أصبح الإبداع الرقمي يصنع هويته من العلاقة بين الأدب والتكنولوجيا. وهو ما نجد صداه لدى الناقد سعيد يقطين الذي حدد في كتابه "من النص إلى النص المترابط: مدخل إلى جماليات

الإبداع التفاعلي" مفهوما واضحا للإبداع التفاعلي، حيث عرفه ب"مجموع الإبداعات (والأدب من أبرزها) التي تولدت مع توظيف الحاسوب الموصول بشبكة الانترنت، ولم تكن موجودة من قبل، أو تطورت من أشكال قديمة ولكنها اتخذت مع الحاسوب صورا جديدة في الإنتاج والتلقي". (سعيد يقطين ، 2005 : 109)

وبالتالي التفاعلية التي يخلقها الأدب المسرحي الورقي هي محدودة، وذلك لأنها لا تتعلق إلا بما يفتح النص من فضاءات للتخييل والتأويل، بينما تشغل التفاعلية في الأدب المسرحي التفاعلي مساحة كبيرة جدا تتسع دائرتها لتشمل التفاعل الإيجابي بين مكونات النص (من لغة وصور وإيقاع وحركة وإضاءة ومثيرات سمعية مختلفة) والمشاركة الإيجابية للمتلقي في إعادة إنتاج النص المسرحي. وبالتالي تنقل هذه التفاعلية النص أو العرض المسرحي -في الأدب الرقمي- من الأحادية إلى التعددية؛ تعددية الدال والمدلول والمنتج والمتلقي والنص. والتفاعلية بهذا المعنى تتجاوز القدرة على الإبحار في محيط العالم الافتراضي إلى القدرة على تغييره وإلجائه وقت الضرورة. وذلك بالحذف أو الإضافة أو الإلغاء أو التعليق أو التحريف أو التعديل. وهي كلها إمكانيات يتيحها النص التفاعلي الرقمي أمام مستخدمه. وتتجسد هذه التفاعلية في غنى النص بمكونات جمالية يودعها فيه المبدع، تحقق شعريته النصية عبر إمكانيات تقنية حاسوبية. والمتلقي الرقمي يقترب من المتلقي العادي لأنهما معا مطالبان بالكشف عن هذه الفنية الجمالية وتذوقها.

لقد أدى الاستخدام المتزايد للتكنولوجيا إلى البحث عن طرق لتوظيف هذه الإمكانيات الهائلة التي أصبحت توفرها التكنولوجيا الرقمية في المجال الإبداعي والرقمي. هكذا طفت على السطح سلطة الوسيط الرقمي الذي أصبح مركزا تلقي فيه الرؤوس المدبرة للعمل المسرحي الرقمي كتابة ونقدا وتلقيا. محررة معها الأديب والقارئ من خطية السرد المكتوب الذي فرضته الطباعة على الورق إلى اللاخطية وإعادة البناء. وفي المقابل اشتربت على المبدع والمتلقي المستخدم امتلاك الآليات الرقمية الجديدة في الإبداع والإنتاج ليظل الحاسوب (الموصول بالانترنت) العنصر المركزي الذي لا يمكن إهماله أو تغييبه.

ويصير المسرح التفاعلي متداخل الأجناس الأدبية والتقنيات الإنتاجية، فقد تختلط المسرحية مع القصة أو الرواية أو غيرهما لأننا نكون أمام فضاء افتراضي متعدد الأبعاد يفقد فيه المسرح استقلالته الجنسية. فالمسرح التفاعلي يقتضي الشمولية، لأن الكلمة لم تعد وسيلته الوحيدة، فإلى جانب فن الإخراج وفن كتابة السيناريو وفن المحاكاة تتدخل فنون أدبية أخرى لإنتاج دلالات النص، كأن تعود ذاكرة الممثل الافتراضي في مشهد معين إلى الماضي فيبدأ السارد الافتراضي بحكي أحداث قصصية تصف تجربة من تجارب البطل المسرحي.

لقد أصبحت الآلة في ضوء المسرح الرقمي أو التفاعلي "شريكة للمؤلف في عملية الكتابة". (محمد مريني، 2015 : 98) إلى حد أطلق فيه صفة الأنسنة على التقنية فيما يعرف ب"أنسنة التقنية" في ظل العلاقة الوطيدة والمتلازمة التي أصبحت تجمع بين الإنسان والآلات التقنية، فصارت التقنية جزءا لا ينفصل عن حياة الإنسان، وبديلا عن التواصل الطبيعي الحميمي مع البشر. أصبحت الآلة الذكية اليوم قادرة على تلبية جميع حاجيات البشر في جميع

مجالات حياته من خدمات مهنية وبينية وعلمية واجتماعية وغيرها، إلى حد إدمان الإنسان على هذه الآلة التي لم يعد يستطيع التنصل منها أو الاستغناء عنها. وغدت وسيلة مهمة في التطور الحضاري والتنمية الاقتصادية والفكرية. فلا بد والحال هذه، من إعادة صياغة أسئلة جديدة تلائم المنتج الفكري الجديد، وتتيح الانخراط في الإشكاليات الجديدة التي أصبحت تفرض نفسها في ظل العصر الحداثي لتحديد إجابات مقنعة حول مستقبل الأدب الرقمي في العالم العربي في القرن الواحد والعشرين، في عصر أصبح فيه الوسيط الرقمي يملك سلطة بناء النص المسرحي الرقمي وإكسابه شعريته التي تحقق التأثير في المتلقي الذي يصير بدوره، ليس مجرد متذوقا لشعرية النص ومكتشفا لها، بل منتجا لها أيضا. إذ بعيدا عن المتلقي سيبقى النص مجرد أثرا بتعبير رولان بارت، ولن يتحول هذا الأثر إلى نص محمل بخطاب إلا بمقدار ما يحققه من تفاعلية.

والنص المسرحي الرقمي هو نص مترابط ومتشعب يجمع بين الكلمة والصوت والصورة والحركة والجمود والحذف والإضافة، وتعدد المداخل النصية، وتعددية البناء الفني، وانفتاح النهايات، وتداخل مسارات القراءة. وبالتالي يضع القارئ أمام التأويل المتعدد الذي يقتضي منه تفعيل كل حواسه. وترجع الأصول المعرفية لفكرة النص المترابط إلى ثلاثة مصادر: التناص الذي يؤسس لتداخل النصوص، والسيبرنيطيقا التي تؤسس لاستثمار الذكاء الاصطناعي في معالجة المعارف، والأبحاث السيكلوجية حول الذاكرة التي ولدت فكرة عمل الحاسوب. (محمد مريني، 2015 : 25)

إن الأدب المسرحي التفاعلي هو نتاج بشري جديد غير طريقة التلقي الفني، وأنماط التذوق والأسس الجمالية للفنون، وفرض قانونا جديدا في الساحة النقدية المسرحية، قانون يفرض المرونة والتعددية والتفاعل الإيجابي الذي يؤدي إلى تزايد نسل الأدب الذي سيدخل في دائرة مستمرة من الخلق والإبداع. قانون يجمع بين الإمكانيات اللغوية والتصويرية، ويفتح على آفاق معرفية لا محدودة، وآفاق إنتاجية تناسب المعارف الحديثة. والرؤية النقدية توجه هذا المولود الجديد تحليلا ونقدا، وتحميه من طيش نفسه ومن الإكراهات والتحديات المطروحة أمامه. فالنقد ظهر ملازما للأدب والإبداع منذ العصر الجاهلي إلى اليوم، فهو الذي يمهّد له طريق النمو والتطور، ويوجهه، ويحرك سكونه، ويجعل آلياته القرائية مطاوعة لهويته حتى يمكن لجماليته الفنية أن تخرج إلى الوجود، وتتكشف أمام القارئ أو المستخدم الجديد.

ولكي يتمكن النقد من تفعيل دوره والقيام بوظائفه اتجاه المنتج المسرحي الرقمي، يجب أن يكون موسوعيا وقادرا على استثمار كل إمكانيات المعرفية والأدبية وكذا الرقمية والتقنية التي يتيحها له الوسيط الرقمي عبر شبكة الانترنت وغيرها من مصادر المعلومات. فهو ناقد رقمي أيضا وليس ناقد أدبيا فقط، يملك من المعارف والمهارات ما يؤهله لإصدار الأحكام النقدية على النصوص الإبداعية التفاعلية.

ويحمل العمل الإبداعي المسرحي التفاعلي -باعتباره نوعا مهما من الأدب الرقمي- رؤيا حداثية جديدة، ليس الهدف منها التجريب فقط ومسيرة وسائل الكتابة الحديثة، بل الغاية منها هي "منح النص الأدبي العربي فرصة التجديد

من خلال تزويده بطبيعة حيوية جديدة مكانية وزمانية، بمعنى تحرر النص الأدبي اتصاليا من بعد المكان وعائق الزمان، وبالتالي إحداث ثورة حقيقية في إنتاج النص وفي ممارسات تلقيه". (نوال خماسي، 2005 : 5 . 30)

ومن النماذج التفاعلية في فن الشعر إصدار الشاعر "منعم الأزرق" في قصيدته الرقمية الموسومة بـ"أفق في ليل الأعمى" الذي أصبحت فيه اللغة الشعرية -كما في المسرح الرقمي- نواة نصية تتألف حولها بقية العناصر النصية من صوت وصورة وحركة، ويصبح النص حيويًا مليئًا بالحركة التي تولد إحساسًا بالأشياء في عالمها الواقعي، ويحمل جماليات جديدة للتذوق والتفاعل الإيجابي مع النص الشعري. فكلما نجح المستخدم في تفعيل علاقات النص التفاعلي كلما سطعت جمالية النص الذوقية والفنية واكتملت شعريته. وتصدر هذه الجماليات الجديدة من فنون متعددة منها فن الكلام فن الرسم فن التشكيل فن الموسيقى فن الهندسة البرمجية وغيرها من العناصر التي يعود إليها المبدع لبناء نصه، فهو يبث فيها جواهر هي بمثابة مصابيح تضيء نصه أو عرضه المسرحي التفاعلي، وتتيح للمتلقين التفاعليين التواصل بحرية مع المنتج الجديد الذي هو وشيخ من المكونات المخضمة والحديثة، ما يجعل النص محملاً بالمزيد من المعاني والدلالات الغامضة التي يحاول المتلقي بشكل مستمر فك شفراتها عبر الربط الدائم بين عناصره المادية والذهنية المتخيلة ومكوناته التصويرية واللغوية والصوتية.

إن العناصر التقنية والرقمية والبرمجية التي تميز المسرح التفاعلي لا يمكن أن تكون فاعلة وإيجابية إلا إذا أحسن المبدع دمجها وتركيب عناصرها داخل منتج الإبداعي بدقة متناهية، بحيث يدفع متلقيه إلى تفعيل معظم حواسه لخوض غمار هذه التجربة الجديدة، "فمحاسن الأداة التكنولوجية الجديدة تكمن في قدرتها على إنتاج لمسات فنية تضفي طابعا جماليا على المنتج الأدبي". (فايزة يخلف ، 2013 : 106)

بهذا المعنى يصبح المسرح التفاعلي نصا إبداعيا متعددًا ومتجددا باستمرار، تزدهم في رحمة مكونات بنائية متعددة ومتنوعة تمتح مادتها من فنون عديدة، وتتداخل في تكوينه أجناس أدبية متنوعة، دون أن يفقد جوهره الأصلي (الدراما). فلا يمكن السماح بتسرب الرقمي في جسد المسرح أكثر من الحيز المسموح به حتى لا ينقلب هذا الأخير إلى لعبة من ألعاب الفيديو التفاعلية. لأن التكنولوجيا يجب أن تخدم المسرح لا العكس، فهي ليس غاية في ذاتها بل وسيلة فقط لفتح آفاق أرحب وأوسع أمام المتلقي لجعله يكتشف معالم أكبر ولمسايرة مستجدات العصر التي أصبح الرقمي فيها المكتسح الأول في جميع ميادين الحياة. وخلق آفاق جديدة أيضا في الإخراج ولا سيما المصمم والسينوغراف باكتشاف سبل وإمكانات جديدة في التجسيد الجمالي والخلق الفني والإبداعي.

ولأجل هذه الغايات دعت الضرورة إلى استثمار الوسائط الرقمية والتكنولوجيا الحديثة وصَفَّها على حائط الفنون بدل تركها تطمس معالمها وتنتهي وجودها. وفي نفس الوقت على النقد المسرحي القيام بمهمته في توجيه مسار هذا المولود الجديد، وفرض قواعد وقوانين تلزم جميع المهتمين بتطبيقها في إبداعاتهم الرقمية حتى لا تفقد هذه الأعمال جمالياتها الفنية والأدبية. بل تضفي على العرض المسرحي ثوبا جديدا تتخلله المتعة البصرية القائمة على التفاعل

والتواصل الإيجابي. ولا يمكن أن يكون المسرح - أو غيره من الآداب الأخرى - تفاعلياً إلا إذا أعطي المتلقي سلطة تعادل سلطة المبدع الأصلي للنص أو تفوقها.

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