PROJECT
(Professional Journal of English Education)
Volume 9, No. 2, March 2026
p–ISSN 2614-6320
e–ISSN 2614-6258

A Systematic Review of Technology-Integrated Focus on Form Instruction in Language Education

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Abstract

This study aims to examine the implementation of digitalized focus-form instruction (FFI) in second language learning and identify the types of technologies supporting its pedagogical functions. Using a systematic literature review (SLR) based on PRISMA guidelines, data were collected from major academic databases for publications from 2021 to 2025: Scopus, ERIC, Taylor & Francis, EBSCO, Wiley Online, Sage, and ScienceDirect. Of the 2,426 identified records, 13 articles met the inclusion criteria and were analyzed. The review results indicate that digital FFI is implemented through three main approaches: explicit, implicit, and hybrid. Besides, this research shows a variety of technologies, including ChatGPT and other large language models, auditory feedback systems in digital literacy games, the Meta AI chatbot via WhatsApp, Grammarly, AI-based diagnostic platforms, Siri as speech recognition, the PRAAT acoustic analysis tool, LLM in the DynaWrite platform, multimedia captioning tools (Nawmal), web-based multimodal teaching platforms, Machina Callida as a corpus-based CALL tool, and ASR-based speech-to-text tools. Thus, these findings highlight the potential of digital FFI to improve linguistic accuracy, noticing, and metalinguistic awareness.

Keywords: Artificial Intelligence; Corrective Feedback; Digitalization; Focus-Form Instruction; Second Language Learning

INTRODUCTION

The incorporation of digitalized focus-form instruction (FFI) into second language learning (L2) education has become increasingly important in recent years, in line with global educational changes aimed at improving language acquisition through technology. As online platforms and artificial intelligence (AI) have proliferated, educators have increasingly utilized these resources to enhance learner engagement and outcomes. Moreover, Aswad et al. (2022) indicate that online language instruction markedly improves vocabulary learning among Indonesian EFL learners, underscoring the efficacy of technology in language education. Besides, AI-driven applications have enhanced individualized learning experiences, rendering FFI more accessible and tailored to specific educational requirements (Suzuki et al., 2025). This technical improvement is especially critical given global trends favoring digital pedagogies, as highlighted in documents that stress the importance of integrating educational technology (Karhut et al., 2023). Therefore, comprehending the functionality of these digital resources within FFI frameworks is essential for modern language education. Research on FFI in language acquisition has been conducted through a comprehensive review of published studies. For example, Tkacikova & Tokowicz (2025) examined the effectiveness of SLA instructional

methods through the lens of the Knowledge-Learning-Instruction (KLI) cognitive framework, focusing on how FFI, processing instruction, and corrective feedback aligned with principles such as spacing, testing, feature focusing, worked examples, and accountable talk. Similarly, Oliver & Azkarai (2017) provided a review of child second-language acquisition (SLA), with a particular focus on pedagogy. Moreover, Larsen-Freeman (2015) selected several papers on SLA and applied linguistics and categorized them into three categories: research with little impact, modest impact (FFI), and significant impact. Besides, Truscott (1998) critiqued the noticing hypothesis by showing that its cognitive and linguistic foundations were weak, its predictions were unclear, and its empirical support was inconsistent, ultimately proposing that noticing was necessary only for metalinguistic knowledge rather than for actual linguistic competence. However, those review studies did not integrate digitalization tools in FFI.

On the other hand, several researchers have also conducted review articles on the integration of digital tools into language learning. First, Nurfazri et al. (2026) conducted a systematic literature review (SLR) with bibliometric analysis on integrating digitalized Islamic learning materials (IDLM) into English language teaching (ELT). Their study obtained data from Scopus, ERIC, ScienceDirect, and DOAJ, published between 2021 and 2025. The findings indicate that platforms such as LMS, Powtoon, e-books, and YouTube positively contributed to learning outcomes. IDLM not only successfully improved English language skills but also effectively fostered motivation, strengthened Islamic identity, and embedded character values. Second, Gong et al. (2025) synthesized 20 studies on the integration of blended learning and task-based language teaching (TBLT) in English as a foreign language (EFL) contexts, showing that blended TBLT enhanced language proficiency and learner engagement while highlighting that its success depends on the alignment of digital tools with instructional goals, the authenticity of tasks, and effective teacher facilitation. Third, similar research was also conducted to examine teachers' difficulties in implementing digital tools in the classroom (Shaniga & Ilankumaran, 2024), digital competence in teaching EFL (Yalçin & Bozyiğit, 2023), using clips in language classrooms (Mei et al., 2022), digital tools to enrich vocabulary (Kanellopoulou et al., 2019), and many more.

To complete of our comprehensive, none of the studies integrated digital technology into FFI. Based on the requirement, this systematic review aims to consolidate empirical evidence regarding the implementation of digitalized FFI in L2. By following Spada's FFI framework, this study posits that directing learners' attention to linguistic forms, whether explicitly or implicitly, and in isolation or integrated within communication, enhances L2 development beyond just meaning-focused exposure (Spada, 1997). It explores how modern digital tools implement FFI in technology-enhanced settings. The review examines two inquiries: What digital technologies and artificial intelligence have been used to support the implementation of FFI in L2? And what FFI approaches have been digitized and applied in L2? Therefore, this review's findings provide a guide for educators, researchers, and developers in the strategic design and integration of digital tools to improve learners' focus on linguistic forms in contemporary L2 classrooms.

METHOD

This study conducted an SLR to analyze the incorporation of digitalized FFI in L2. The literature search was conducted on November 24, 2025, and was limited to open-access journal papers published from 2021 to 2025. The search approach used two keyword categories: main terms and database-specific terminology. The principal keyword set ("form-focused instruction" OR "grammar instruction" OR "vocabulary instruction" OR "pronunciation instruction" OR "meaning-focused instruction") AND ("corrective feedback" OR "digital feedback") AND ("digital" OR "online" OR "application" OR "artificial intelligence" OR

"website") AND ("L2" OR "second language learning") was employed to query Taylor & Francis, ERIC, EBSCO, Wiley Online, and SAGE. Simultaneously, alternative keyword combinations such as ("form-focused instruction" OR "grammar") AND ("digital" OR "artificial intelligence" OR "application" OR "online platform" OR "LMS") AND ("corrective feedback" OR "digital feedback") AND ("second language" OR "L2 learning") were utilized in Scopus. In contrast, the search string ("form-focused instruction") AND ("corrective feedback" OR "digital feedback") AND ("digital" OR "online" OR "application" OR "artificial intelligence") AND ("L2" OR "second language learning") were employed in ScienceDirect.
The review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) principles to guarantee methodological transparency and procedural rigour (Page et al., 2021). Article selection was determined by various screening criteria, including publication year (2021–2025), document type (research articles exclusively), access status (open-access), source type (journal), language (English), subject area (education; language and linguistics in Taylor & Francis), and relevance to the research focus. The inclusion criteria comprised (1) studies addressing the application of digitalized form-focused education in second language acquisition, and (2) peer-reviewed, full-text research papers. The exclusion criteria comprised (1) studies irrelevant to the research issue, (2) FFI research lacking digital integration, and (3) review articles, opinion pieces, or non-empirical publications.

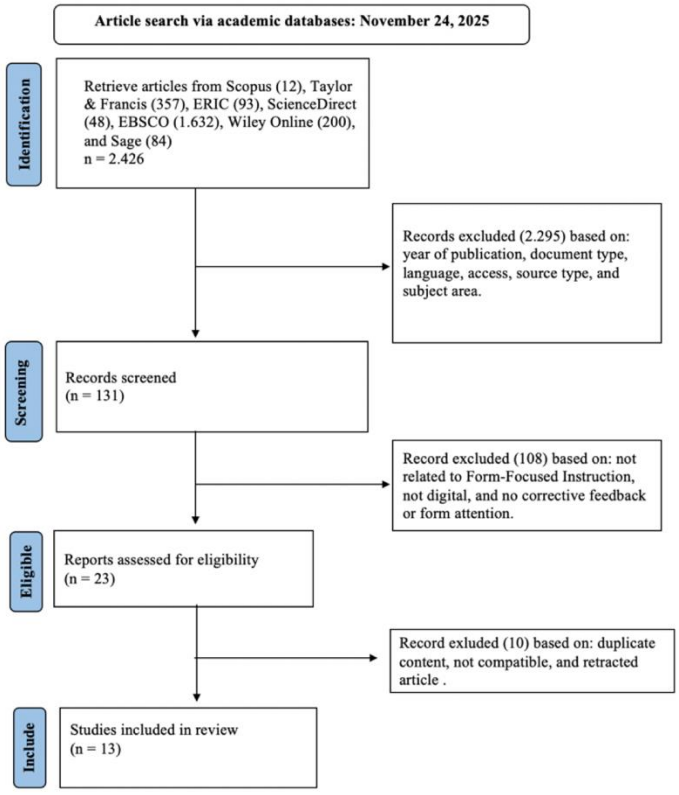

Figure 1. PRISMA flow diagram

The preliminary search produced 2,426 records. Upon applying the screening criteria, encompassing publication year, document type, access status, language, source type, subject area, and relevance, 131 articles were retained. The further review of titles, abstracts, and conclusions for relevance to form-focused instruction, digital integration, and corrective feedback reduced the dataset to 23 papers for comprehensive examination. An additional eligibility evaluation led to the elimination of 10 publications that failed to satisfy the fundamental research criteria. In conclusion, the final review encompassed 13 research studies.

RESULTS AND DISCUSSION

Results

This section presents a synthesis of 13 peer-reviewed studies published between 2021 and 2025 that investigate the application of digital FFI in L2. Following Spada's (1997) FFI theoretical framework, the study explains how FFI encompasses any pedagogical effort that directs learners' attention to language form, either explicitly through the presentation of grammatical rules and direct correction, or implicitly through indirect feedback. Furthermore, the studies in this review implement this approach using a variety of technologies, including Large Language Models (LLMs) such as ChatGPT, automated writing feedback platforms (Grammarly), speech recognition systems (Siri) and ASR-based speech-to-text conversion tools, visual-acoustic tools such as PRAAT, game-based learning platforms such as Perilous Paths, diagnostic and assessment tools within WhatsApp (Meta AI), and the DynaWrite system. The findings can be seen in Table 1.

Table 1. Technology and Approach Used

No	Author – Year	Technology / AI Used	Approach
1	Tran (2024)	ChatGPT (LLM)	Explicit
2	Lin & Crosthwaite (2024)	ChatGPT (GPT-4)	Explicit
3	Pattemore & Gilabert (2023)	Auditory elaborative feedback system in a digital literacy game	Explicit
4	Jamshed et al. (2025)	Meta AI + WhatsApp chatbot	Explicit
5	Murtisari et al. (2025)	Grammarly (AWCF)	Explicit
6	Suzuki et al. (2025)	AI-based diagnostic assessment platform	Explicit
7	Alharthi (2024)	Siri (Speech Recognition AI)	Implicit
8	Baagbah & Ganapathy (2025)	PRAAT (acoustic analysis software)	Explicit
9	Jaganov et al. (2025)	Large Language Models (LLMs) via DynaWrite	Hybrid: Explicit and Implicit
10	Cintrón-Valentín & García-Amaya 2021)	Multimedia captioning tools (Nawmal)	Explicit
11	Roehr-Brackin et al. (2025)	Web-based multimodal instructional platform	Implicit
12	Kuehnast et al. (2024)	Machina Callida (CALL tool)	Explicit
13	Leis (2025)	Speech-to-text ASR software	Explicit

Discussion

This part critically interprets the study's principal findings in relation to the stated research objectives and the existing literature. The discussion elucidates the extent to which the findings extend, corroborate, or challenge prior research, while also considering their implications for both practical application and theoretical advancement within the scope of the present study.

Types of Technology are employed in FFI

ChatGPT

ChatGPT is an artificial intelligence language model that understands and generates text in context, making it suitable for a wide range of purposes. Of the 13 selected articles, Tran (2024), Lin & Crosthwaite (2024), and Jaganov et al. (2025) utilize this AI to support FFI in L2. For example, Tran (2024) uses ChatGPT to generate consciousness-raising tasks by providing step-by-step instructions—from requesting a list of tasks that highlight grammatical forms to instructing these LLMs to create comprehensive podcast teaching materials full of examples of irregular past tense verbs tailored to proficiency levels according to the Common European Framework of Reference for Languages. Besides, Lin & Crosthwaite (2024) also employ ChatGPT as an automated written corrective feedback tool and provide metalinguistic explanations to students' writing. They compare ChatGPT's feedback patterns with those of a human teacher. Moreover, Lin & Crosthwaite (2024) find that ChatGPT tend to provide more reformulations and metalinguistic explanations, and to focus heavily on local issues (grammar). However, the results are inconsistent across sessions, demonstrating how this LLM technology operates as a powerful automated FFI provider but remains unstable in pedagogical practice. More than that, Jaganov et al. (2025) operate GPT-4o within the DynaWrite platform to provide dynamic assessment via graded prompts. By providing consistent, graded, and responsive feedback, this technology serves as a scalable form-focused feedback system for large classes. The findings of these three studies align with some researchers who consistently demonstrate that ChatGPT is beneficial in increasing learning engagement, providing personalized conversational practice, providing immediate feedback, facilitating self-directed learning, and supporting language skill development (Al-Hoorie & Alshakhori, 2025; Al-Obaydi et al., 2025; Nazeer et al., 2024).

Auditory elaborative feedback system in a digital literacy game

In Pattemore & Gilabert (2023), a game is understood as interactive digital environments that function as automated learning spaces, replacing the role of teachers by providing tasks, challenges, and feedback directly, while digital literacy refers to students' ability to process information, instructions, and text in digital formats while interacting with the game. In this context, researchers utilized a digital literacy game equipped with an auditory automated feedback system to provide metalinguistic and informational feedback whenever participants made errors, and used eye-tracking technology (Tobii TX-1200) to track students' visual focus, gaze duration, and cognitive processing, so they could analyze how this automated feedback technology functions as a form of form-focused feedback in learning.

Meta AI in WhatsApp

Jamshed et al. (2025) utilize Meta AI integrated into the WhatsApp application as an AI-driven corrective feedback system that automatically detects grammatical errors, generates improvement suggestions, and provides metalinguistic explanations when requested by students. The researchers implement this technology by asking participants to submit their texts to Meta AI via WhatsApp for immediate feedback and then revise their writing based on that feedback over a 20-week period. Hence, WhatsApp combined with Meta AI functions as a form-focused feedback platform that delivers real-time corrections and individualized, iterative grammar scaffolding.

Grammarly

Grammarly is an AI-based Automated Written Corrective Feedback (AWCF) system that provides real-time error detection and correction across grammar, vocabulary, and mechanics. Used by A2–B2 EFL learners as a self-revision tool, Grammarly primarily supports the correction of surface-level errors rather than deeper grammatical processing (Murtisari et al., 2025).

AI-based diagnostic assessment platform

The conversational AI agent in Suzuki et al. (2025) functions as an interviewer in an oral proficiency test, while a machine-learning scoring system automatically assesses speaking ability based on voice features and transcriptions. An explainable AI uses SHAP values to identify words or phrases that reduce speech quality, and GPT-4 generates higher-CEFR paraphrases to model improved lexical expression. In this system, the conversational AI conducts repeated interviews and a machine-learning model analyzes learners' speech to detect lexical weaknesses, which are then sent to GPT-4 to produce alternative paraphrases. As a result, learners receive personalized, form-focused diagnostic feedback that directly supports targeted remedial practice.

Siri

Siri is a speech-recognition–based intelligent assistant that provides real-time text and audio feedback on learners' pronunciation. Alharthi (2024) uses Siri as a pronunciation-training tool in which learners speak target words and identify phonological errors when the system produces incorrect transcriptions. Through repeated practice and teacher-supported feedback, Siri helps learners monitor phoneme accuracy, word stress, and consonant clusters.

PRAAT (acoustic analysis software)

PRAAT is an acoustic analysis tool that provides visual feedback on pitch, duration, and stress patterns in speech. In Baagbah and Ganapathy (2025), PRAAT supports a mirroring technique in which learners compare their speech with a model to identify segmental and suprasegmental differences, thereby enhancing phonological awareness and pronunciation accuracy.

Multimedia captioning tools (Nawmal)

Nawmal is an animated video authoring tool that allows researchers to manipulate captions and multimodal input. Cintrón-Valentín and García-Amaya (2021) use Nawmal to create caption-enhanced videos that vary the visual salience of target vocabulary and grammar, enabling controlled examination of how textual enhancement influences noticing and language acquisition.

Web-based multimodal instructional platform

Roehr-Brackin et al. (2025) develop a computer-based platform that integrates text, audio, images, and controlled practice to deliver form-focused instruction on Polish morphology. Through multimodal lessons with accuracy-based feedback, the system guides learners' attention to word-ending patterns and supports the noticing and acquisition of morphological forms.

Machina Callida

Machina Callida is a corpus-based CALL tool that generates form-focused reading and vocabulary exercises from annotated Latin corpora. By providing noticing, cloze, and matching tasks with learning analytics, the system supports learners' recognition of morphological patterns and the development of reading fluency and lexical knowledge (Kuehnast et al., 2024).

Speech-to-text ASR software

Speech-to-text technology provides real-time written feedback on learners' spoken output, enabling them to monitor pronunciation accuracy. Leis (2025) uses this tool within a flipped learning model in which students analyze automatic transcriptions to identify phonological errors and refine their phonemes, rhythm, and intonation through guided practice and peer-supported reflection.

FFI approaches have been digitized and applied in L2

Digital FFI in L2 refers to a set of teaching strategies that use technology to direct learners' attention to specific linguistic structures. Based on the 13 papers analyzed, digital FFI can be categorized into three main approaches: explicit, implicit, or hybrid that combines explicit and implicit elements (Spada, 1997). These forms reflect how technologies such as LLMs, speech recognition software, visual-acoustic devices, AI chatbots, and automated evaluation systems

are used to deliver grammar instruction, provide corrective feedback, enhance attention, and shape form awareness during language interaction and production. Besides, this diversity of approaches demonstrates that digitalized FFI not only expands the boundaries of traditional teaching but also creates new pathways for learners to engage independently and reflectively.

Explicit Digital FFI in L2

Explicit FFI describes to direct correction of language form (grammar, phonology, word structure, and lexical) to help students understand not only meaning but also accurate language form (Spada, 1997). Through this strategy, learners are guided to pay attention to form in a conscious, directed, and structured manner, thereby making the language acquisition process more systematic (Loewen, 2018). By combining explicit FFI with technology, language learners receive additional support in the form of visualizations of language form, consistent automatic feedback, and broader, more personalized practice opportunities (Karimpour et al., 2024). In addition, this integration enables students to process errors more quickly, understand rules more clearly, and continuously monitor their progress (Lyddon, 2011). In addition, the use of digital platforms creates a flexible, adaptive, and resource-rich learning environment, making explicit FFI more effective and engaging in modern learning (Yousefi & Nassaji, 2019). The majority of previous studies (10 papers) utilize technology to support the explicit implementation of FFI. These findings indicate that technology integration in FFI has been used to enhance direct explanations, provide more consistent automated feedback, and target students' attention to language forms. Thus, technology serves not only as a tool but also as a pedagogical medium that expands the scope of explicit FFI, enabling learners to process language rules more quickly and in a data-driven manner. For example, Tran (2024) positioned ChatGPT as a consciousness-raising task generator to foster grammatical awareness in writing, especially in the complexities of irregular past tense verbs. The goal was to test whether the model-generated content could highlight grammatical forms, thus encouraging noticing. The mechanism combined explicit tasks with enriched input to make the target form salient. Consequently, generative agents can be a scalable source of explicit material for training form awareness. In addition, Lin & Crosthwaite (2024) compared teacher-generated and GPT-generated written feedback for writing accuracy. Digital FFI was operationalized as explicit corrections (direct/indirect, metalinguistic, reformulation) provided automatically by the model. Their study demonstrated the potential for AI's consistency and speed. At the same time, their interpretation emphasized the need to evaluate the quality of automated feedback against the pedagogical nuances typically provided by teachers.

Furthermore, Pattemore & Gilabert (2023) used eye-tracking to investigate corrective feedback processing in a digital literacy game and found that elaborative auditory feedback facilitates comprehension. Besides, digital FFI was realized through automated auditory feedback that provided metalinguistic and informational explanations. This pattern suggests that multimodal feedback, especially audio, combined with games, could make explicit feedback easier for students to process. Besides, Jamshed et al. (2025) also found explicit FFI digitalization, evaluating AI-based correction via WhatsApp (Meta AI) on students' writing skills. They focused on personalized, real-time corrective feedback. In the process, Meta AI was operationalized as the detection and correction of syntactic/grammatical errors, complete with scaffolding in the zone of proximal development. They also revealed that this platform can be an effective channel for contextual, sustainable, explicit FFI, provided that detection accuracy, prompt optimization, and explanation quality are adequate.

On the other hand, Murtisari et al. (2025) examined EFL learners' engagement with Grammarly as Automated Writing Corrective Feedback (AWCF). Their study examined how automated feedback influenced revision by highlighting errors and providing immediate improvement suggestions. Although Grammarly demonstrated advantages in consistency and speed, the interpretation cautioned that the depth of students' explanations and understanding of

improvements depended on their metalinguistic abilities. In contrast to Murtisari et al. (2025), Suzuki et al. (2025) developed an AI-based diagnostic assessment to provide contextual feedback on speaking ability. They identified two groups (control and experiment) of 59 Japanese English learners. By combining task repetition with AI-based diagnostic feedback that identifies lexical weaknesses and paraphrases utterances, the system helped learners improve their form awareness and transfer learning outcomes more effectively than task repetition alone. Similarly, Baagbah & Ganapathy (2025) examined the effects of visual feedback on pronunciation ability using PRAAT software. By combining mirroring with visual feedback, the system helped learners improve pronunciation by increasing intrinsic motivation and cognitive engagement, making technology a more effective trigger for phonological awareness and behavior change.

Not only in the context of English language learning, Cintrón-Valentín & García-Amaya (2021) tested the effect of captions on grammar and vocabulary in a Spanish context. They evaluated whether explicit grammatical instruction improved. Using captioning as a multimodal highlighting aid, it was found that learners processed specific grammatical structures more easily than others. At the same time, its effectiveness was influenced by factors such as prior knowledge and frequency of use. In addition to the Spanish-language learning context, Kuehnast et al. (2024) implemented computer-assisted reading fluency training in Latin, emphasizing morphological and lexical aspects relevant to both beginner and intermediate learners. By utilizing corpus-based technology that semi-automatically generates contextualized vocabulary exercises, students' attention was directed to language forms explicitly within the context of text processing. Although it did not provide corrective feedback, this mechanism still provided explicit FFI by facilitating learners' attention to and processing of lexical forms through a component-skills approach that targeted specific needs in Latin reading acquisition. Moreover, Leis (2025) examined the improvement of EFL learners' pronunciation skills through the use of technology in a flipped learning model. Their findings revealed that learners in the experimental group practiced pronunciation using speech-to-text, which provided automatic feedback, enabling them to assess phoneme accuracy directly.

Implicit Digital FFI in L2

Implicit FFI emphasizes attention to forms that emerge naturally during meaning-oriented activities, without direct rule explanation or explicit correction from the instructor (Spada, 1997). Through this approach, learners are guided to discover linguistic patterns through observation, input processing, and independent inference, allowing language awareness to develop gradually and become more internalized (Valeo & Spada, 2015). When implicit FFI is combined with digital technology, this process is further enhanced as learners gain access to multimodal input, automatic form-priming activities, and a context-rich language processing environment. This integration allows for more subtle yet consistent attention to form, while maintaining a primary focus on communication and understanding meaning in modern digital learning platforms (Spada & Lightbown, 1993).

From 13 articles analyzed, only two studies applied implicit digital FFI in L2. Roehr-Brackin et al. (2025) used a series of inductive online lessons designed to encourage beginning Polish learners to independently discover morphological rules by observing linguistic patterns in digital input. Besides, their findings demonstrated that technology-enhanced inductive instruction can improve learners' ability to recognize morphological patterns without explicit intervention, such as rule explanations or direct correction. In addition, research on speech recognition technology as an interactive pronunciation trainer shows that EFL learners' pronunciation skills improve when pronunciation practice was combined with speech recognition-based feedback (Alharthi, 2024). In the experimental group, learners practiced reading and recording speech using Siri, which provided automatic transcription and

recognition feedback when speech was inaccurate, allowing them to monitor and adjust their pronunciation in real time. Meanwhile, the control group received only classroom practice and manual feedback from teachers and peers, so their improvement relied entirely on human evaluation, without support from a speech recognition system. Therefore, these studies the main characteristics of implicit FFI as proposed by Spada (1997), in which attention to form emerges naturally within meaning-processing activities without direct guidance. However, the low number of implicit studies reflects a recent research trend that prioritizes explicit FFI when combined with technology. This is because most digital platforms, such as speech-to-text, automated feedback systems, captioning tools, and visual analytics, are inherently designed to provide explicit feedback, form prominence, or direct explanations. In other words, the design of language-learning technologies aligns with explicit consciousness-raising rather than implicit learning that relies on intuition and self-discovery. As a result, research on technology-based FFIs almost always shifts toward explicit learning, leaving only a few studies that truly adopt a purely implicit approach.

Hybrid Digital FFI (Explicit + Implicit)

The hybrid FFI approach, which combines explicit and implicit elements, has emerged as an alternative strategy when language learning demands a balance between conscious understanding of rules and natural processing of forms in meaningful contexts (Spada, 1997). Within this framework, digital technology acts as a facilitator, enabling both types of attention to form simultaneously, either through direct explanation and explicit feedback or through context-rich input that encourages independent inference. This hybrid model offers greater pedagogical flexibility, as it allows learners to obtain structural support when needed while still engaging in the meaning processing that stimulates implicit attention to language form. This integration of the two approaches reflects recent developments in digital FFI research that aim to optimize language acquisition by combining targeted instruction with input that encourages the more natural development of competencies.

From the findings, Jaganov et al. (2025) investigated how large language models (LLMs) improved English writing skills through a dynamic grammatical assessment that combined implicit and explicit attention to form. Using the DynaWrite platform, learners received adaptive support in the form of incremental prompts that began with implicit cues and progressed toward more explicit explanations as difficulties emerged, thereby enabling the gradual development of grammatical awareness. The system processed sentences in real time, accurately identified errors, and delivered progressive feedback loops that allowed learners to refine their language production in a guided yet autonomous manner, reflecting the core principles of AI-based dynamic assessment. The findings demonstrated that the technology effectively integrated implicit and explicit attention to form, aligning with the hybrid FFI framework. This framework conceptualized language development as an adaptive process in which implicit and explicit learning mechanisms interacted meaningfully during authentic language use, as Berry & Broadbent (1988) emphasized. They explained that complex learning tasks typically involve a combination of explicit and implicit processes, ultimately leading to a richer, more profound understanding of language acquisition.

In the context of language teaching, explicit FFI provides direct instruction regarding language forms and rules, while implicit FFI encourages the natural use of language in communicative contexts, allowing learning to occur through discovery. According to Ellis (2002), explicit knowledge of complex structures could support the development of implicit skills through naturalistic exposure and practice. By combining these two approaches, learners gained the opportunity to interact with language flexibly, leveraging both rule-based understanding and intuitive language experience. In addition, Norris and Ortega's meta-analysis demonstrated that hybrid FFI could produce better learning outcomes by supporting explicit retention while

strengthening implicit understanding of language structures (Norris & Ortega, 2001). They found that tasks intentionally designed to activate both forms of learning offer greater retention and transfer advantages than approaches that rely solely on one type of learning. Thus, the findings of Jaganov et al. (2025) and the theoretical framework related to hybrid FFI confirm the great potential of integrating explicit and implicit approaches in technology-based language learning.

CONCLUSION

This study shows that digitalized FFI has been implemented through various approaches: explicit, implicit, and hybrid. Various technologies are used, such as large language models, automated feedback tools, speech recognition systems, acoustic analysis tools, conversational AI applications, and multimodal learning platforms, to accelerate language form improvement. Meanwhile, explicit approaches still dominate, especially for writing and pronunciation skills, through the provision of direct, rule-based, and example-based feedback. However, implicit and hybrid approaches are also developing through technologies that encourage noticing, self-reflection, and self-correction, such as automatic transcription, visual mirroring, and adaptive task generation. Consequently, the findings indicate that technology in FFI functions not only as a correction tool but also as a pedagogical agent that mediates students' attention to language forms in a more personalized, multimodal, and contextual way. Furthermore, integrating digital FFI offers significant potential to improve linguistic accuracy, metalinguistic awareness, and learning autonomy. However, its effectiveness remains dependent on the technology's characteristics, the targeted skills, and the readiness of the infrastructure and learning context. Thus, this study provides an overview of the use of technology in FFI to support educators, researchers, and developers in designing a learning ecosystem that not only digitizes FFI pedagogically but also ensures that the technology truly strengthens noticing, engagement, and the development of language competencies in a sustainable manner.

ACKNOWLEDGMENTS

The authors wish to acknowledge the contributions of scholars whose works were reviewed in this study. Their research provided essential insights that informed the analysis and synthesis presented in this article.

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