# Krashen's Input Hypothesis in Technology-Enhanced and AI-Assisted Language Learning Environments: A Systematic Review

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## Abstract

This systematic review examines the integration of Krashen's Input Hypothesis within technology-enhanced and AI-assisted language learning environments over the past decade (2018–2025). As digital tools and artificial intelligence become increasingly central to English as a Foreign Language (EFL) instruction, understanding how theoretical constructs like "comprehensible input" (i+1) and the "affective filter" are operationalized is crucial. Following a systematic selection process from the Web of Science (WoS) database, 11 empirical studies were analyzed based on their research foci, participant demographics, technological tools, and methodological designs. The findings reveal a significant shift from static web-based platforms to dynamic, AI-driven, and immersive environments, such as virtual reality and generative AI agents. Results indicate that while technology effectively facilitates multimodal and personalized input, research remains heavily weighted toward quantitative and mixed methods designs, with a notable absence of qualitative inquiry. Furthermore, most studies focus on undergraduate populations in Asian and Middle Eastern contexts. This review identifies critical research gaps, including the need for longitudinal studies on input comprehension processes rather than just output gains.

**Keywords:** Input Hypothesis, Artificial Intelligence, Second Language Acquisition, Technology-Enhanced Learning, Systematic Review, EFL

The acquisition of a mother tongue is an ordinary yet essential process: it occurs naturally through exposure to the native language, and, initially, no verbal output is produced (Noor, 1994). Parents patiently await the day when their children will begin to speak (Thyab, 2016). Similarly, Krashen (1985) posits that the emergence of speaking ability is the ultimate result of continuous exposure to comprehensible input. Krashen (1985) further clarifies that speaking ability is not a "cause" but the "result" of this continuous exposure.

Krashen's Input Hypothesis identifies that learners acquire language when they are exposed to comprehensible input that should be slightly beyond learners' current level; "i + 1" (Krashen, 1985). In the digital era, this input can be implemented in an instructional setting using a wide variety of digital tools. Over the past decade, the rapid integration of digital technologies and artificial intelligence in educational contexts has created opportunities for learners (Aslan & Zhang, 2021). These technological tools, ranging from computer-mediated feedback systems to AI-powered chatbots, have the potential to provide learners with individualized, scaffolded input, aligning closely with Krashen's theoretical framework (Javahery & Alizadeh, 2025).

Previous research demonstrates that computer-mediated and digital interventions enhance several dimensions of L2 learning (Javahery & Alizadeh, 2025; Rassaei, 2019). For instance, Rassaei (2019) found that computer-mediated feedback and speech input positively influenced learners' comprehension skills, supporting the idea that structured input facilitates acquisition. Sujannah et al. (2025) suggest that ChatGPT, as an AI-assisted tool, can promote learner autonomy and motivation. Reality-enhanced tools are also used; Augmented Reality

(AR)-based tasks combining speech and visual hints supported learning through rich, multimodal input (Che Dalim et al., 2020). Beyond conventional computer-assisted approaches, virtual reality technologies have also been explored as innovative methods for providing contextually meaningful input (Chen et al., 2021). Recent developments in AI-driven platforms, such as chatbots and large language models, have further expanded opportunities for interactive, adaptive input, and these offer learners continuous engagement with personalized linguistic material (Dai & Wu, 2025; H. Yang et al., 2022; L. Yang & Li, 2024). To summarize, these studies emphasize the importance of technology and AI in the application of input principles in modern language learning contexts.

This present study aims to systematically review empirical studies conducted within the framework of Krashen's Input Hypothesis in technology-enhanced and AI-assisted language learning environments over the past decade. By analyzing how comprehensible input is operationalized and delivered through modern technological tools, what research trends have emerged, and what research gap exists in studies applying Krashen's input hypothesis in the EFL context. Finally, this systematic review seeks to provide teachers and researchers understanding of how technology and AI can be implemented effectively in second language acquisition.

## Background of the Input Hypothesis

Dulay, Burt, and Krashen (1982) state that learners acquire language by understanding comprehensible input. They also mention that comprehensible input is necessary for language acquisition, but it is not sufficient. At the same time, input needs to be slightly beyond the learner's current level. Krashen's Input Hypothesis also emphasises that the affective filter must also be low enough to allow the input. According to him, second language acquisition

can take place when EFL learners are exposed to comprehensible input that contains linguistic features that are higher than their language competence (Krashen, 1985).

While many theories regard input as the keystone of learning, others assign it a more minimal role. In fact, the core debate among researchers such as McLaughlin (1987), Zhang (2009), and Ellis (2008) is both about whether input matters and how it matters in the process of linguistic information through input. However, there are many studies that emphasize the importance of input in second language acquisition. Authors have emphasized that input is not just helpful, but also essential for learners to construct their second language competence (VanPatten & Williams, 2007; Shimanskaya, 2018). Ellis (2008) also mentions that input is central and it is echoed across various theoretical definitions, such as behaviorist, mentalist, and interactionist traditions.

As mentioned earlier, there are many debates about the role of input. Over the past decade, the rapid advancement of educational technology and Artificial (AI) has revitalized this input hypothesis. Therefore, it is crucial to examine how these emerging technologies and artificial intelligence have reshaped and implemented the concept of input within the context of EFL education.

## Technology-enhanced and AI-assisted Input Studies

In technology-mediated learning, various studies have operationalized this notion by embedding digital and AI-assisted tools into rich input environments (Dogan et al., 2023; L.Yang & Li, 2024; Lin et al., 2022). However, the adoption of AI and technology-enhanced tools in education requires a comprehensive understanding of its implications (Duin & Pedersen, 2023). Many studies mention the benefits of incorporating these technological tools into language teaching settings. For instance, computer-mediated feedback demonstrated that

it can substantially increase comprehension, accuracy, and learner retention when tasks are scaffolded through comprehensible input (Rassaei, 2019). Javahery and Alizadeh (2025) confirmed that multimodal feedback environments enhance awareness of linguistic forms without explicit grammar instruction, supporting Krashen's claim that acquisition results from understanding messages rather than memorizing rules.

Augmented Reality (AR) — a technology that overlays digital content onto the real physical environment — was examined with speech-input technology in primary-level English learning (Che Dalim et al., 2020). Che Dalim et al. (2020) found that learners' improved listening and production outcomes suggested that AR contexts simulate real-life exposure, satisfying the "i + 1" principle through contextualized digital immersion. Chen et al. (2021) extended this line of inquiry through Virtual Reality (VR)-based problem-based learning. Unlike AR, which enhances the real world with digital overlays, VR immerses learners entirely within a computer-generated environment, enabling interaction with authentic communicative tasks in simulated spaces. Their results indicate greater vocabulary retention and engagement, implying that virtual immersion supports input internalization by allowing repetitive, meaning-driven encounters.

Yu and Trainin (2022) provided further evidence through a meta-analysis of technology-assisted L2 vocabulary learning across journals. They concluded that tools such as captioned videos, mobile apps, and online reading platforms reliably improve vocabulary acquisition—particularly when input is multimodal and adjustable to proficiency. Zhu et al., (2024) corroborated this conclusion, identifying digital reading as a robust facilitator of vocabulary development via sustained exposure to level-appropriate input. The findings confirmed that technology can deliver the kind of gradual linguistic enrichment central to Krashen's model.

The emergence of artificial intelligence has transformed the delivery of comprehensible input. H. Yang et al. (2022) implemented an AI chatbot as an English conversation partner in EFL classrooms and found that continuous interaction with the chatbot increased learners' willingness to communicate and improved fluency. Dai and Wu (2025) reached parallel conclusions in their study of an AI-powered conversational platform for undergraduate students: frequent, personalized exchanges produced measurable gains in vocabulary and oral accuracy, while also reducing learner anxiety.

Guan et al. (2024) examined AI-mediated informal digital learning, finding that learners engaged with AI tools like ChatGPT outside formal instruction to obtain instant language feedback and exposure to authentic discourse. These interactions mirrored naturalistic input encounters but lacked systematic pedagogical design, highlighting the need to integrate AI use more purposefully within instructional frameworks.

AI and multimodal technologies represent the natural evolution of the Input Hypothesis, which extends comprehensible input into a multimodal, adaptive, and emotionally responsive construct (Javahery & Alizadeh, 2025). Yang and Li (2024) analyzed ChatGPT-based learning practices and noted that the tool's adaptive scaffolding allows learners to negotiate meaning dynamically. Their study supports the idea that AI-driven dialogue systems can replicate human input conditions while adjusting complexity in real time. However, excessive reliance on AI tools may reduce authentic interpersonal interaction if not pedagogically balanced (Imamah & Suryani, 2025).

Together, these studies affirm that digital platforms can replicate and sometimes amplify naturalistic exposure by presenting linguistically comprehensible and affectively

engaging materials. Yet, despite their consistent outcomes, many experiments have measured output-specific gains rather than directly analyzing input comprehension processes. Also, AI enables personalized input through automatic adjustment of linguistic difficulty and topic relevance. Across different classroom settings. AI systems act as facilitators of comprehensible input by offering meaningful, immediate, and adaptive linguistic stimuli.

In light of the technological advancements discussed above, there is a critical need to systematically evaluate how the input hypothesis is implemented in modern digital and AI contexts. This study aims to provide a comprehensive review of how Krashen's Input Hypothesis has been interpreted and implemented within technology-enhanced and AI-assisted language learning environments over the past decade. At the same time, the review seeks to identify emerging research trends that characterize this integration and to critically expose the methodological and theoretical research gaps in recent studies.

## The Present Study

As mentioned above, this systematic review is guided by the following research questions:

1. How has Krashen's Input Hypothesis been interpreted and applied in technology-enhanced and AI-assisted language learning environments over the past decade?
2. What research gaps exist in recent studies testing the Input Hypothesis in technology-enhanced language learning contexts?
3. What research trends have emerged in studies applying Krashen's Input Hypothesis in technology-enhanced and AI-assisted language learning environments?

# Methodology

## Article selection

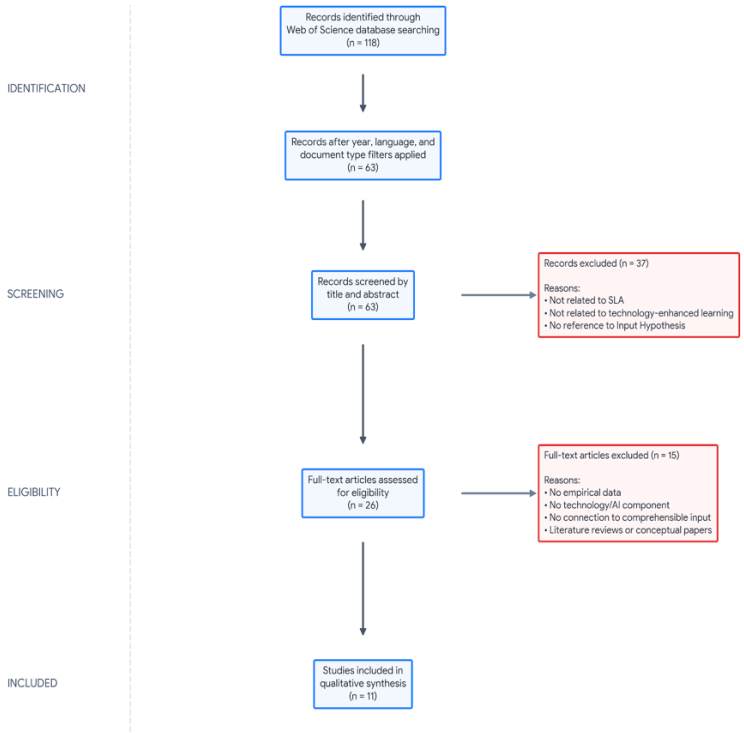


*Figure 1*

As shown in Figure 1, this study is a conceptual systematic review (Grant & Booth, 2009), meaning it synthesizes existing empirical evidence to map theoretical applications of Krashen's Input Hypothesis rather than generating new empirical data. The article selection process was conducted systematically from the Web of Science (WoS) database to enhance validity and relevance. The author searched for highly relevant articles about "Krashen's Input Hypothesis in Technology-Enhanced and AI-Assisted Language Learning Environments" (Birkle et al., 2020).

This study aims to examine how Krashen's Input Hypothesis has been conceptualized and applied in AI-assisted and technology-enhanced language learning environments, with a particular focus on EFL contexts. The search strategy was designed to capture research situated in these modern instructional contexts. In the last five years, artificial intelligence and digital technologies have become inseparable components of educational practice, transforming the ways learners access, process, and interact with input (Chen & Zhu, 2023; Li & Hafner, 2022). To reflect this shift, the keywords *"*AI-assisted," "technology-enhanced," "artificial intelligence," and "technology-integrated instruction*"* were included in the Boolean search formula with "Input Hypothesis" and "comprehensible input."

Using the Boolean terms on WoS as TS ('Input Hypothesis' OR 'i + 1' OR 'Krashen' OR 'comprehensible input') AND ('technology-integrated instruction' OR 'AI-integrated instruction' OR 'artificial intelligence' OR 'technology enhanced learning' OR 'second language acquisition') resulted in 118 articles in total. I chose articles from "2018 to 2025" in the publication date category and "article", "English" from the related categories to limit the data and capture the most relevant literature in the field. After applying these, I reached 63 articles in total.

By selecting the education-related categories in the WoS database "Education Educational Research, Linguistics, Language Linguistics, and Education Special" and limiting the results to journals indexed in the "Social Sciences Citation Index (SSCI)", the search was further narrowed down, resulting in a total of 26 articles.

The author carefully examined the titles and abstracts of the collected studies, paying particular attention to the variables of each. After this process, 11 articles were kept for the final review. Based on the research questions, the study adopted the following inclusion and exclusion criteria.

### *Inclusion criteria*

Articles were included based on these criteria:

1. The research was published between January 2018 and November 2025, explicitly or implicitly showing the most recent developments in technology-mediated or AI-driven language education.
2. The publication was written in English.
3. The study explicitly or implicitly explored Krashen's Input Hypothesis or its major constructs, such as "comprehensible input" or "i+1 theory" (within technology-supported or AI-integrated contexts).
4. The focus of the study was on English language learning or teaching as a foreign or second language (EFL/ESL).
5. The research adopted an empirical design; quantitative, qualitative, or mixed methods, providing data-based findings.
6. The article was included in the Web of Science (WoS) database and indexed in the Social Sciences Citation Index (SSCI).
7. The full text of the article was accessible for detailed analysis.

### *Exclusion criteria*

Articles were excluded based on these criteria:

1. The study did not address Krashen's Input Hypothesis or its key concepts related to technology-enhanced or AI-assisted language learning.
2. It was a review-based paper with no empirical evidence.
3. It appeared as a conference paper, book chapter, or thesis/dissertation not listed in an SSCI-indexed source.

4. The publication was not available in English.
5. Studies that examined tools outside the scope of language input within the EFL/ESL context were excluded to maintain focus on the central constructs of the review.

**Coding**

The author developed a coding framework by reviewing existing literature relevant to the study's aims. To ensure coding consistency and reduce subjectivity, a two-stage verification process was followed: codes were first applied independently, then reviewed against each article a second time to confirm accuracy. The primary aim of this study is to systematically review the articles in relation to Krashen's Input Hypothesis in technology-enhanced and AI-assisted language learning environments; therefore, the Input Hypothesis served as the primary organizing code. After full examination of the articles, 8 codes were established: Foci (focus of the study), current trends, participants, research design, research method, type of TELL-specific tool/AI, context (country), and findings.

These 8 categories were sub-coded to acquire the most accurate representation of the data, and each category was created through both inductive and deductive reasoning. The researcher searched for specific information (bottom up) in the selected studies, stating their focus, and if the information is implicit, subcodes are used based on a deductive approach (top down) (Saldana, 2016).

Because of the diverse roles of technology in the Input Hypothesis as a second language acquisition method, foci ( focus of the study) were divided into 3 subcodes based on the foundational Krashen's Input Hypothesis principles and use of technology identified in the literature. These included: 1) *comprehensible input* tools like subtitles, glosses, and machine translation to ensure *i+1* defined by the provision of understandable language data, 2)

*affective filter*, relating to emotional variables in language acquisition, and 3) *authentic technological input,* focusing on providing real-world, unscripted language through media such as podcasts and films. This category captures exposure to language as it is genuinely used by native speakers — rather than pedagogically simplified versions — delivered through digital media platforms. In Krashen's framework, "meaningful exposure" refers to encountering language in context where comprehension of the message, rather than analysis of its form, drives acquisition. Study designs were coded based on the most common types of research frameworks: quantitative, qualitative, and mixed-methods (Creswell, 2014). Articles employing both qualitative and quantitative methods were coded as mixed-methods. At the same time, research methods were coded based on these subcodes: experimental, survey, case study, and quasi experimental. If the study does not explicitly state the type of research method, author mentioned them as "not explicitly stated".

In parallel with the foci, type of technological tool code was created to categorize and identify the nature of the digital tools for language input. This category was classified into three subcodes: AI and generative systems (e.g., ChatGPT, AI-assisted learning platforms), which represent adaptive and intelligent input sources; immersive and multimedia technologies (e.g., Virtual Reality, podcasts), which provide sensory-rich and authentic environments; and general web-based platforms (e.g., web-based tools, computer-assisted learning tools), covering standard digital interfaces for language practice. This classification was intended to reveal the technological shift from static learning platforms to dynamic, AI-driven, and immersive environments in providing comprehensible input.

In order to identify the specific apps, web-site or landscape, the current trends code was created. Unlike generic categorizations, this code tracked the specific commercial applications utilized to facilitate input. This category was classified into three

subcodes: digital scaffolding and translation utilities (e.g., Google Translate, Papago, DeepL, Language Reactor), which are specifically employed to lower the linguistic barrier and ensure comprehensibility; generative and robotic agents (e.g., GenAI/ChatGPT, educational robots like Kebbi and Hello Ludi), representing the trend toward interactive and communicative input partners; and immersive content delivery systems (e.g., VR apps like EduVenture, Google Cardboard HMDs, EdPuzzle), which provide the specific environments for authentic and multimodal exposure. This level of coding was essential to pinpoint the exact tools driving the practical application of input-based learning in current literature.

## Findings

This systematic review's purpose is to inform readers about the existed research and contribute to future research by emphasizing limitations and the gaps in the literature. As noted in the methodology section, this review will be guided by three research questions.

To identify the existing literature, author searched the articles from WOS database. In the *Table 1,* the publication years of the articles are shown. In 2022 and 2024, three studies were conducted, and recently in 2025 there were two studies in the field. Furthermore, in 2018, 2021 and 2023 only one study found in Input Hypothesis. As it is shown in table 2, most of the articles come from Computer Assisted Language Learning (CALL) (N=3). The second most of the articles are from System (N=2). Other articles are from Frontiers, SAGE, Interactive Learning Environments, International Journal of Applied Linguistics, and International Journal of Emerging Technologies in Learning (N=1) (*Table 2*).

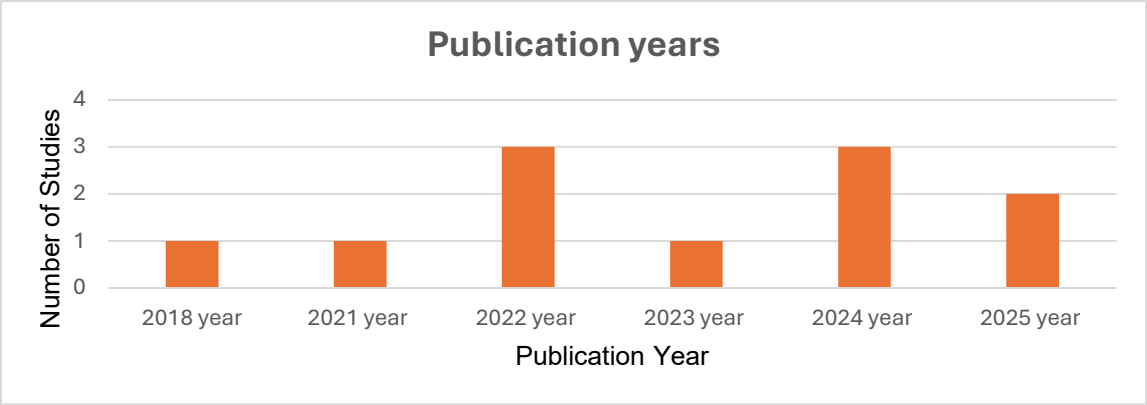


*Table 1*

*Distribution of Studies by Publication Year (2018–2025)*

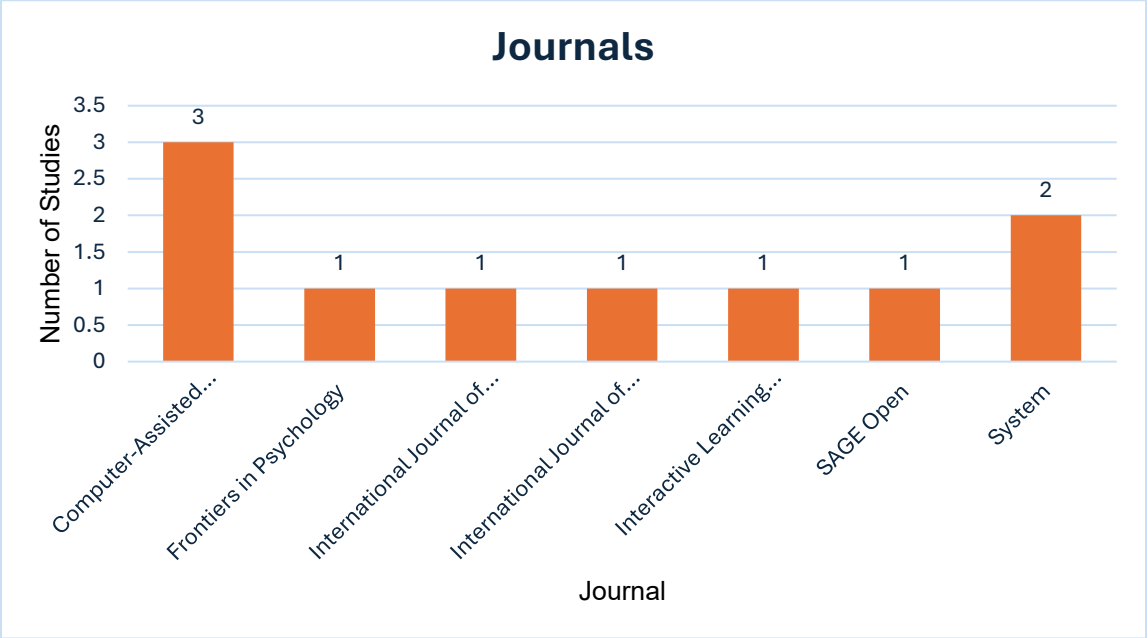


*Table 2*

*Distribution of Studies by Journal Source*

RQ1. How has Krashen's Input Hypothesis been interpreted and applied in technology-enhanced and AI-assisted language learning environments over the past decade?

To respond the first research question, there are two subtitles in the following section: focus of the studies (foci) and the context of the studies (country).

**Focus of the study (foci)**

In this systematic review 11 articles were analyzed carefully to understand the focus of the study under the title of Krashen's Input Hypothesis. In terms of research focus, three subcodes emerged. These codes are comprehensible input, authentic technological input and affective processing of input.

*Table 3*

*Distribution of Studies by Research Focus (Foci)*

Most of the studies emphasized the comprehensible input (N=5). For instance, Chen et al. (2022) investigated the use of an educational robot and an Internet of Things (IoT)-based 3D book to demonstrate how auditory input support learners' understanding through interaction and scaffolds linguistic accessibility also to enhance EFL vocabulary acquisition these tools offered comprehensible input for learners. Similarly, Chen et al. (2021) examined the integration of Virtual Reality (VR) technology into problem-based learning contexts,

highlighting how interactive environments provide learners with exposure to meaningful language use but the difference in this study is authors also focusing on authentic technological language input while simultaneously enhancing comprehensibility during vocabulary learning tasks. Kim (2025) studied learners' listening and reading development in AI-assisted learning environments that provided personalized, interactive, and adaptive information to give learners enriched comprehensible input. Almusharraf and Bailey (2023) explored learners' use of machine translation tools, they framed this tool as a strategy for transforming linguistic input into comprehensible input by enabling immediate access to lexical information. Similarly, Rouaghe and Waluyo (2025) further extended this machine translation framing by examining AI-assisted translanguaging practices in EFL contexts, where learners relied on translation tools to convert challenging input into comprehensible input to support second language acquisition in a clear way. Finally in the Turkish context, Çekiç (2024) investigated the effects of traditional glosses, multiple-choice glosses, and no-gloss conditions on vocabulary learning by using animated short videos and he treated glosses as input enhancement devices that facilitate form and meaning connections to support the processing of comprehensible input.

Other studies emphasized the role of technology in providing learners with authentic language input, they align with Krashen's emphasis on meaningful exposure to spoken language. Bozorgian and Shamsi (2022) investigated the autonomous use of podcasts and authors identified them as sources of authentic and comprehensible auditory input that support listening development. In the same year, Hu et al. (2022) analyzed the educational function of English children's films and movies, emphasizing these multimedia tools as an authentic language input that support listening ability, oral expression, and learner motivation while maintaining comprehensibility. In the last study of this subcode, Lo (2024) examined the effects of dual-subtitled viewing on vocabulary acquisition, he mentioned dual subtitles as

multimodal input that supports learners' comprehension of target language forms and meanings

As another important component, some studies focused on affective processing of input. They explicitly mention Krashen's Affective Filter Hypothesis. In the first study, Yuan (2018) developed a multimedia teaching model focusing on Krashen's Language Input Theory. Author emphasized not only the delivery of i+1 input but also the management of affective variables such as interest and self-confidence to lower the affective filter. In the second study, Wang and Zhi (2024) examined the relationship between EFL learners' attitudes about artificial intelligence, teacher immediacy, and willingness to communicate, they highlighted the role of affective factors in learners' engagement with technology-supported language input.

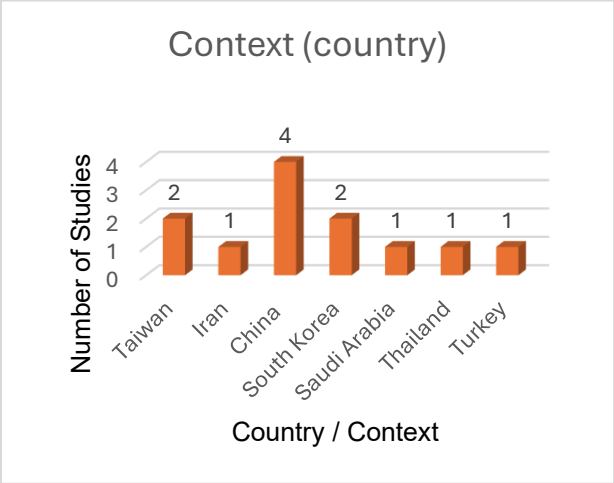


*Table 4*

*Distribution of Studies by Country/Context*

The studies conducted in various educational contexts (*Table 4*). They are mostly situated in Asia and the Middle East. In Taiwan, authors conducted studies to examine technology-enhanced input through educational robotics and immersive digital tools (Lin et

al., 2022; Chen et al., 2021). South Korea also emerged as a research context, authors focused especially on AI-assisted and interactive learning environments to deliver adaptive language input (Kim, 2025). Almusharraf and Bailey (2023) investigated students' reliance on machine translation tools to facilitate immediate comprehension in Saudi Arabia and South Korea.

In Iran research was conducted to explore the role of authentic technological input, such as podcasts, in enhancing EFL learners' listening comprehension (Bozorgian & Shamsi, 2022). Macao (China) appeared as the research context for studies examining multimedia input through dual-subtitled viewing in technology-supported learning environments (Lo, 2024). Similarly, in Turkey the research was conducted to investigate multimodal input enhancement through glossing techniques with gloss and no gloss conditions, in animated video-based vocabulary learning tasks (Çekiç, 2024).

Most of the studies were conducted in China, reflecting a strong research interest in technology-enhanced applications of Krashen's Input Hypothesis. These studies examined multimedia-based teaching models with input theory (Yuan, 2018), English-language films and movies as sources of authentic input for education (Hu et al., 2022), and learners' affective outcomes to artificial intelligence in relation to willingness to communicate (Wang & Zhi, 2024). Finally, Thailand explored students' translanguaging practices supported by AI translation tools in EFL contexts (Rouaghe & Waluyo, 2025).

RQ2. What research gaps exist in recent studies testing the Input Hypothesis in technology-enhanced language learning contexts?

To respond research question number two, research gaps are analyzed under three codes; research design, research approach and participants and these reveal several methodological gaps. These codes are described in detail below.

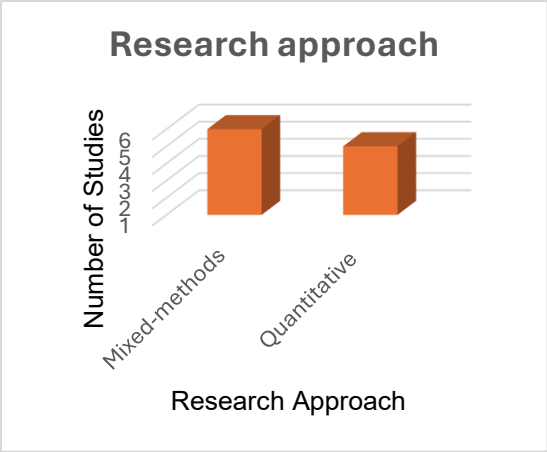


*Table 5*

*Distribution of Studies by Research Approach*

As it is shown in *Table 5*, the reviewed literature includes quantitative and mixed-methods approaches. The articles were mostly carried out in mixed-methods design (N=6) (Almusharraf & Bailey, 2023; Bozorgian & Shamsi, 2022; Lin et al., 2022; Hu et al., 2022; Rouaghe & Waluyo, 2025) and this approach is followed by quantitative method (N=5) (Çekiç, 2024; Kim, 2025; Lo, 2024; Wang & Zhi, 2024; Yuan, 2018). Qualitative design is absent in this review which indicates a gap in the literature.

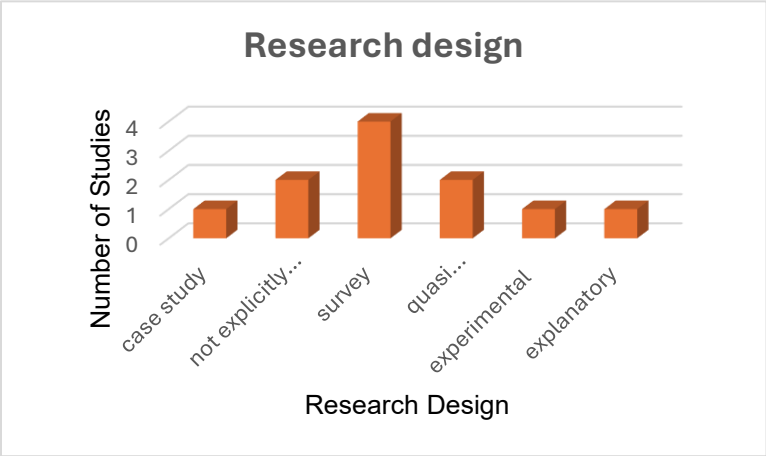


*Table 6*

*Distribution of Studies by Research Design*

As it is explicitly stated in the *Table 6*, the reviewed studies mostly consist of survey (N=4) design on Krashen's Input Hypothesis in technology-enhanced and AI-assisted language learning contexts. First study seen employing survey design is from Almusharraf & Bailey (2023), authors compared 470 students in Saudi Arabia and South Korea by conducting a survey to understand the benefits and limitations of MT (machine translation) tools. Similarly, Zhi & Wang (2024) used survey design and SEM analysis. They explored students' attitudes EFL students' attitudes, contradictions, and perceptions in the context of AI integration and the researchers used four related questionnaires. Hu et al. (2022) employed survey design to analyze the application effect of English films in children's English teaching. The researchers handed 300 questionnaires to primary school students to measure their interest and cultural knowledge after watching films. As a last study, Bozorgian & Shamsi (2022) conducted a post-study questionnaire as a main data collection tool. The survey includes thirteen 5 scale items applied to 12 adult learners to investigate the participants' autonomous listening using podcasts.

The second most used design is Quasi-Experimental (N=2). Chen et al. (2021) explicitly stated their study was a quasi-experimental study. The study included 84 engineering students divided as an experimental (VR-assisted) or control (non-VR) group to examine their vocabulary gains. Similarly, Lo (2024) used experimental design. They utilized intact classroom settings and focused on four dual-subtitled viewing sessions through rotating sessions.

The final studies (N=2) do not explicitly state their research design; they merely mention the span of the study. Yuan (2018) states that he used a multimedia teaching model based on Krashen's theory throughout one semester and Kim (2025) conducted his study as a short-term longitudinal study.

The last study designs in this review is a case study (N=1), an experimental study (N=1), and an explanatory study (N=1). Lin et al. (2022) conducted a case study through two phases (exploratory and enhancement) to test the effectiveness of a 3D book system with two participants who are fourth graders. Çekiç (2024) used experimental design with Turkish EFL learners and these students were randomly assigned to three gloss conditions: Multiple-Choice gloss, Traditional gloss and no gloss conditions. The author of this study analyzed the effects of glosses on vocabulary learning through animated videos and correlation analysis with prior vocabulary knowledge. As an explanatory design study, Waluyo and Rouaghe (2025) explicitly stated their design. Researchers first collected quantitative data and then used thematic analysis of student stories to explain statistical results to understand how students independently use AI tools.

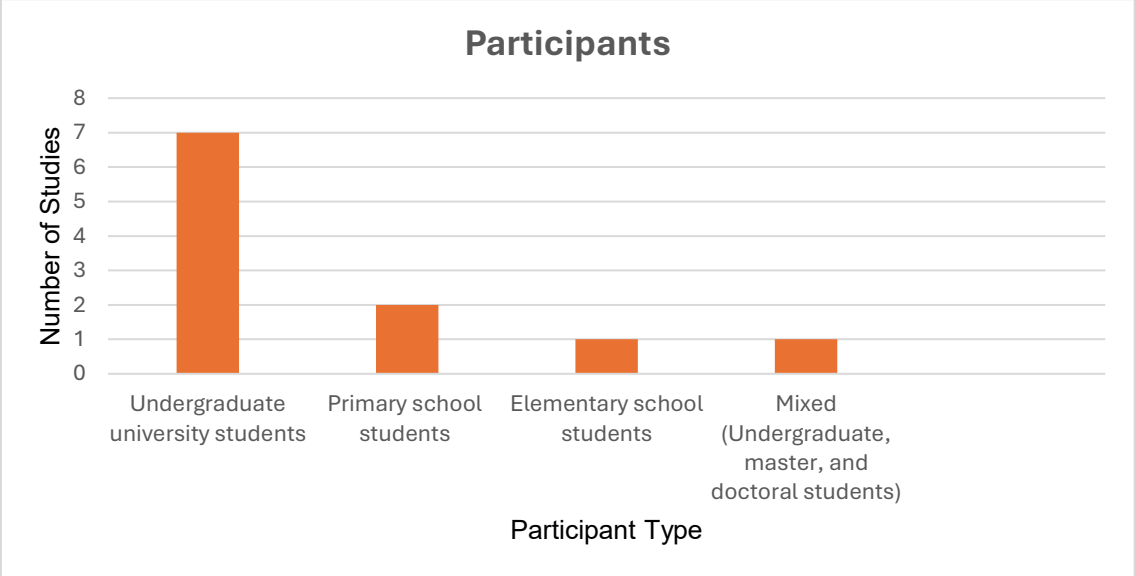


*Table 7*

*Participants*

Within this category, there are studies including undergraduate university students (N=1), primary school students (N=2), elementary school students (N=1) and mixed university students (Undergraduate, master, doctoral students) (N=1).

As it is shown in *Table 7*, most of the studies conducted their research with undergraduate university students. Waluyo and Rouaghe (2025) conducted their study with 69 Thai undergraduate students from different disciplines such as health, technology and accounting. Mean age of the participants was 18 and they had strong engagement with digital tools. Almost half of them has used translation tools for over five years. In VR technology context, Chen et al. (2021) conducted their study with 84 sophomores in university, and their majors were mechanical and electrical engineering in Taiwan. Most of them were low intermediate learners due to a lack of practical context before. Similarly, low intermediate students are investigated in Lo (2024)'s study, there were 72 EFL learners in Macao (China). They were aged 18 to 21, and their mother tongue was Chinese. Their English exposure year was at least 12 years. To investigate types of gloss conditions, Çekiç (2024) studied 127 (88 females + 39 males)  Turkish students majoring in ELT or ELL departments. Their level of English was between upper-intermediate to advanced learners. Finally, to understand multimedia teaching model, Yuan (2018) involved Chinese university students who were taking College English course at Henan University. The number of participants in this study is not explicitly mentioned.

Two of the studies focused on primary school students in Asia. First, to understand the educational function of movies, Hu et al. (2022) selected 300 primary school students from four classes in China. These students were 11 years old. Second, Lin et al. (2022) conducted their study on educational robot and 3D book with two male fourth graders and both of them were A1 level students.

In Bozorgian & Shamsi (2022) had participants from different degrees, 12 EFL university students in Iran, and their age was from 18 to 25 years, and students studying multiple fields were selected. Among them, five were males, and seven were females. Almusharraf & Bailey (2023) surveyed 470 university, master's, and doctoral degree students aged 18 to 29; 310 from Saudi Arabia and 160 from South Korea. Their majors were engineering, nursing and computer science. Saudi students performed higher English proficiency when compared to Korean students.

Finally, Kim (2025) conducted a longitudinal study of 566 fourth-grade students (292 males, 274 females) from public elementary schools in South Korea.

RQ3. What research trends have emerged in studies applying Krashen's Input Hypothesis in technology-enhanced and AI-assisted language learning environments?

To respond the research question number three, the code used was current trends. Under this code there are five subcodes: web-based tools, Artificial Intelligence tools, computer-generated tools, multimedia-based tools, and 'no specific tool'. The 'no specific tool' subcode indicates the absence of a technological trend.

**Current trends**

In this code, there are four different subcodes: Web-based tool, AI-assisted tool, Computer-generated tool and Multimedia-based technology and under these titles, there are many varied platforms, apps and technological teaching models as current trends. They are explicitly shown table by table below.

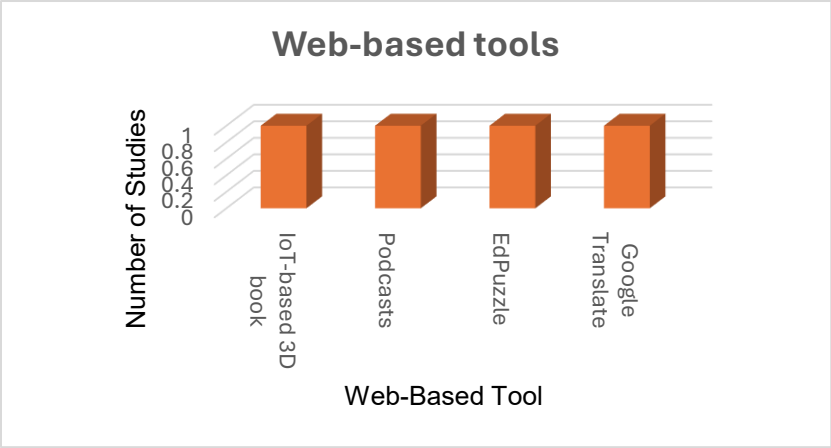


*Table 8*

*Web-Based and Digital Language Learning Tools*

In *Table 8,* web-based tools are explicitly shown. Waluyo and Rouaghe (2025) examined student-initiated translanguaging using Google Translate and authors investigated their perceptions of using Google Translate as a language input through a questionnaire. In Çekiç (2024), author employed EdPuzzle, which is a web-based interactive video platform. This platform was used to deliver animated videos with different glosses. In another study within this category, Bozorgian and Shamsi (2022) implemented the All Ears English podcast series as a source of extensive listening input. As a last study of this category, Lin et al. (2022) used two types of technology: a humanoid robot and IoT sensors embedded in a 3D book. The robot provided conversational feedback to learners (greetings, prompts, and feedback) via a tablet display.

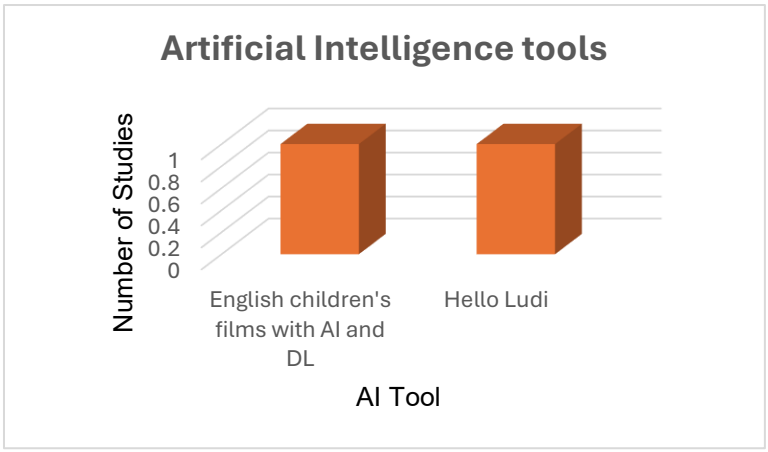


*Table 9*

*Artificial Intelligence-Assisted Learning Tools*

In *Table 9*, there are two different trends under the title of Artificial Intelligence tool. Kim (2025) used Hello Ludi platform and this platform includes immersive scenarios for contextual vocabulary learning, dialogue-based tasks with the corrective feedback from AI. Hu et al. (2022) implemented concepts of Artificial Intelligence and Deep Learning into language teaching using English children's movies as an input to enhance learners' cultural literacy.

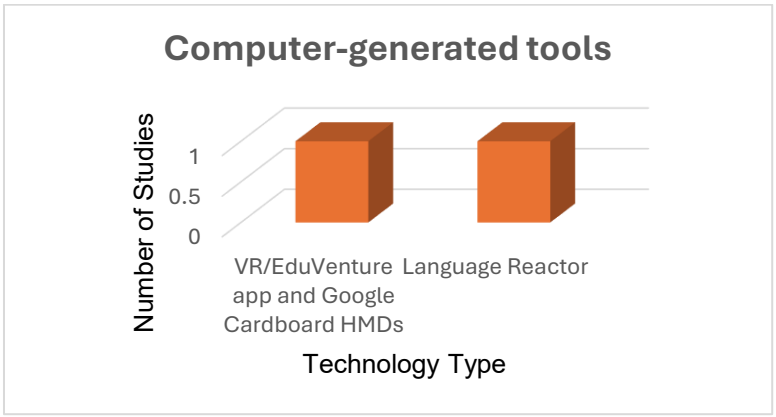


*Table 10*

*Computer-generated Tools*

In *Table 10*, there are two different tools under computer-generated tool title. Lo (2024) used Language Reactor tool as a Chrome extension to display dual subtitles on screen text in both learner's first language and the second language, while watching something on platforms like Netflix. In the study by Chen et al. (2021), authors integrated VR (Virtual Reality) and this technology was implemented by two primary tools: first one is EduVenture app, this app allowed students to interact with language input visually; second one is Google Cardboard HMDs, this tool provides an interactive experience of 3D spaces as a language input.

### Computer-Generated and Immersive Language Learning Tools

The rest of the studies are under these titles: multimedia-based technology (N=1) and no specific tools (N=2). Yuan (2018) applied multimedia technology to create an interactive teaching model based on Krashen's Input Hypothesis, and he focused on student-computer interactions. In Zhi & Wang (2024), the study did not mention a specific AI learning tool for the students to use during the study. The researchers examined students' general perceptions and beliefs about AI. Finally, Almusharraf & Bailey (2023) investigated the perceptions and practices of university students in Saudi Arabia and South Korea regarding the use of Machine Translation tools in their language learning but there was not a specifically stated tool.

## Discussion

The key findings indicate that technology and AI function as a bridge for meaningful input and scaffolding. For instance, Chen et al. (2021) demonstrated that VR as a learning tool allowed learners to become knowledge creators from knowledge consumers. This tool boosted specialized vocabulary acquisition for learners. Research about scaffolding indicates

that glosses and dual subtitles foster strong memory traces when learners use them as a multimedia learning input (Çekiç, 2024; Lo, 2024). Most of the research focuses on comprehensible input in terms of how technology converts linguistically challenging input into meaningful input. For instance, Lin et al. (2022) focus on integrating educational robots and 3D books to provide comprehensible input to enhance vocabulary acquisition with the help of auditory cues. This study indicates comprehensible input is not the cause but the result of the speaking outcome, as Krashen (1985) says, because these tools improved children's oral production by linking language to physical daily routines. Regarding the effectiveness of these tools, I found that these tools appeared to be domain specific. For instance, longitudinal data on AI platforms from Kim's study suggest significant development in reading comprehension, however listening comprehension remained stagnant (Kim, 2025). The reason is due to a lack of auditory input, which we saw in Lin et al. (2022). Similarly, machine translation tools are widely known for their convenience; however, they do not translate into improved speaking skills (Almusharraf & Bailey, 2023). This result aligns with previous research that warns against over-reliance on AI translation tools for effective verbal communication (Groves & Mundt, 2015).

Many studies view the learners as the center of the learning process, and with the help of technology, learners take charge of their own linguistic development. Bozorgian and Shamsi (2022) demonstrate this centricity with podcast training, and in this training, learners are taught to plan and monitor their own listening activities. Similarly, Waluyo and Rouaghe (2025) identify that students use AI translation tools to understand challenging texts and verify their comprehension, and this helps learners to be linguistically confident and supports autonomous vocabulary acquisition.

Although there are many benefits of autonomous tool use, the previous research emphasizes that technology cannot replace the support of human teachers. Wang and Zhi (2024) provide empirical evidence that Teacher and Student Rapport (TSR) is a more powerful factor of learning than technology. Similarly, this result aligns with Sanner and Bunderson (2015) study; they explored the effect of TSR on students' communication apprehension in second-language classrooms. The findings indicated that a strong rapport between teachers and students facilitated greater willingness to communicate in the second language (Gao et al., 2018; Mellati et al., 2022; Sanner & Bunderson, 2015).

In today's technological era, we try to integrate technological tools and Artificial Intelligence as a meaningful input into our teaching process. Over-reliance on these tools may result in a boring classroom environment where teacher and student interaction is lost. Yuan (2018) emphasizes the "blind dependence" of multimedia sources makes the learning quality low for the students. To avoid this, AI tools should be integrated as a part of the learning ecosystem in a way that does not decrease the teacher's role (Yuan, 2018).

Finally, findings of the reviewed articles revealed that most of the articles (9 out of 11) indicated positive effects of technological and AI-assisted input on Krashen's Input Hypothesis. The primary focus of the studies was on vocabulary acquisition, oral production, and listening comprehension. Studies mentioned that technology-enhanced input, such as auditory and visual input, allowed meaningful comprehension and language development (Chen et al., 2021; Çekiç, 2024; Hu et al., 2022; Lin et al., 2022; Lo, 2024). Although these results generally draw a positive picture, some studies reported limited effects of technology and AI across language skills. For instance, Kim (2025) mentioned that learners showed significant improvements in reading comprehension through AI-assisted platforms, while listening development remained unchanged. Therefore, this study suggests that AI tools can

be domain-specific. Overall, the dominance of the positive findings shows that AI and technology-enhanced tools are beneficial for input hypothesis and supporting second language acquisition. However, the presence of negative results highlights the importance of integration into the classrooms and domain-specific design in terms of skills when employing AI-enhanced input in second language acquisition contexts.

Taken as a whole, the reviewed literature points to a productive but uneven application of Krashen's Input Hypothesis in technology-enhanced and AI-assisted contexts. Two tensions recur across studies: first, a gap between the measurement of output gains (vocabulary scores, comprehension tests) and the analysis of input processing itself — which is the core of the Input Hypothesis. Most studies infer that comprehensible input was delivered because outcomes improved, without directly examining the nature or quality of the input received. This represents a methodological blind spot that future research should address through think-aloud protocols, eye-tracking, or process-oriented designs. Second, the near-total reliance on quantitative and mixed-methods designs means that learners' subjective experience of input — how they perceive, negotiate, and internalize it — remains theoretically underexplored. Qualitative inquiry is not merely a gap in the literature, it is a prerequisite for a fuller understanding of the affective filter in digital contexts.

Returning to the research questions: RQ1 asked how Krashen's Input Hypothesis has been interpreted and applied in technology-enhanced contexts over the past decade. The reviewed studies show that the hypothesis is operationalized primarily through the concept of comprehensible input (i+1), with AR, VR, AI chatbots, and multimedia tools all serving as delivery mechanisms. The affective filter component, while mentioned, receives less systematic attention. RQ2 asked what research gaps exist. The analysis reveals three primary gaps: (a) the underrepresentation of qualitative designs; (b) the geographic concentration of

studies in Asian and Middle Eastern contexts, limiting generalizability; and (c) the absence of longitudinal studies that track input comprehension processes rather than only measuring short-term output. These gaps should guide the next phase of empirical inquiry in this field.

## Conclusion

From the very beginning of human life, people are exposed to language. In time, this exposure leads to language acquisition and becomes a common medium that enables communication. Krashen was inspired by this L1 acquisition process, and he proposed the Input Hypothesis as a theory of second language acquisition. He mentioned that second language acquisition can occur like L1 acquisition through exposure, which he termed comprehensible input.

This systematic review examined articles published between 2018 and 2025. These articles conceptualize artificial intelligence and technological tools as sources of language input, referring to Krashen's Input Hypothesis either explicitly or implicitly. Furthermore, the review identified current trends in educational technology and explored how these tools can be more effectively integrated into educational contexts.

The findings of this review suggest many pedagogical implications for EFL educators. First, multimodal cues should be adaptable to the learning style of the students. For instance, students with higher listening abilities benefit from auditory robotic feedback. Second, teachers should allow students to be creators in the classroom instead of being merely passive observers, and to do this, educators are encouraged to utilize tools such as "Language Reactor" or interactive "glosses". Furthermore, teachers may prioritize the use of AI-assisted tools for warm-up activities in vocabulary teaching, extensive reading, and listening activities. AI platforms such as "Hello Ludi" are effective for learner engagement through gamified

elements. These tools foster an enjoyable and relaxed learning environment, which helps reduce learners' affective filters.

Despite many encouraging trends, this study reveals several limitations within the current research. First, most of the studies were short-term (8-12 weeks), and these studies focused on specific demographics, which limits the generalizability of the findings. Second, there is a need for a qualitative approach because the reviewed studies utilized mixed-method or quantitative methods. Third, educators should balance the use of technology with human interactions. AI and technological tools should complement, rather than replace, our teaching roles. Future research in this area can further investigate Krashen's Input hypothesis within AI and technology-assisted learning environments.

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