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Leveraging Educational Technologies to Boost and Assess Spoken Fluency: A Systematic Review in Elementary and Secondary Schools

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Abstract

This systematic review examines how educational technologies enhance and assess spoken English fluency in elementary and secondary school. Analysing 20 studies (2010–2025) using PRISMA 2020, findings reveal linguistic gains in terms of speech rate, decrease in pauses and self-corrections. Common instructional strategies included task repetition, pre-task planning, and awareness raising through role-playing, video production, and gamification. Web 2.0 tools (45%) were most prevalent, followed by CALL/MALL (30%), social medias (25%), and generative AI (20%); percentages sum to over 100% as studies utilized multiple tools. Assessment practices shifted from manual recordings and rubrics to AI-driven automated scoring (ASR/NLP), enabling real-time feedback and interactive tools like chatbots. Despite these advances, challenges such as technical limitations, bias, and language standardization remain, highlighting the need to supplement AI-based practice with classroom role-play for fairness and authenticity. Results suggest educational technologies significantly improve fluency, offering insights for educators and researchers in technology-enhanced language learning.

Keywords: Systematic Review, Education Technologies, Speaking Fluency, Young Learners, Generative Ai

Introduction

The advances in technology have significantly changed learners' needs. In today's society, students are expected not only to be technologically competent but are increasingly required to exhibit sophisticated communicative abilities in the English language that go beyond grammar accuracy and vocabulary knowledge. Amidst these developments, the outbreak of COVID-19 further accelerated the integration of technology in English language education, as ministries of education worldwide shifted to online learning to ensure continuity of education during the pandemic. As a result, technology integration in English language teaching has become even more widespread. However, despite this increased reliance on digital tools, instructional focus has largely remained on receptive skills and writing, with relatively few studies fostering spontaneous oral production (Wong & Yunus, 2023; Zhao et al., 2024). At the same time, existing speaking research tends to prioritize pronunciation and accuracy

rather than fluency-related metrics. Consequently, research examining the role of technology in developing spoken fluency remains limited. This gap is particularly evident in the context of younger learners, where empirical studies on AI-assisted fluency development are still scarce (Xing & Saeed, 2025). Therefore, this systematic review addresses this gap by examining how educational technologies support and assess spoken English fluency among school students, focusing on their effectiveness, limitations, commonly used fluency tasks, and assessment practices.

Literature Review

Previous studies on education technologies for spoken fluency

Previous reviews give emphasis on studies that utilized education technologies to enhance speaking in general. Crompton et al. (2024) conducted a systematic review on 43 studies from 2014 to 2023, exploring how Artificial Intelligence (AI) is utilised in English teaching and learning. Findings revealed that 72% of studies on AI is conducted in Asia and focused on university students. The study identified four primary challenges – technical issues, limited capabilities, fear or anxiety, and language standardization. This study did not address the role of AI in developing and assessing spoken fluency.

Zhao et al. (2024) did a study investigating the effectiveness of MALL in developing oral English in higher education. Analysing 47 studies from 2013 to 2023, it identified that MALL generally have positive impact on learners' oral proficiency. Most teachers adapt mobile applications like Whatsapp for the purpose of practice and feedback. In regards to assessment, human rated band scoring (68%) are popular followed by CAF based quantitative measures (20%). Only 12% of the studies utilised automated scoring. This review remained centred on adult learners.

The review by Yanwar et al. (2022) analysed 21 empirical studies from 2015 to 2021 on how education technologies tools are implemented to teach English skills. This review included studies from all stages of learning. Results revealed that education technologies positively support English learning especially in vocabulary, speaking, and writing. However, there was insufficient research on younger learners. This study established eight categories of education technologies – games, MALL, e-learning systems, Web 2.0 tools (including social medias), robotics, Virtual reality (VR), Artificial Intelligence (AI), and web-based simulations.

While fluency has since long been recognised as a multifaceted construct encompassing cognitive, utterance, and perceived dimensions, classroom practices still tend to rely on narrow temporal measures and subjective teacher judgements. Traditional methods are now insufficient to foster spontaneous real-time, interactive speech. In response, teachers are gearing towards the integration of education technologies. These digital tools enable dynamic, interactive learning environment that promote fluency development through real-time practice and feedback. Nevertheless, existing studies concentrate on university learners, leaving limited understanding on how these tools function for younger learners whose cognitive and linguistic development differ significantly. Furthermore, fluency assessment remains predominantly subjective, underscoring the need for technology-supported systems to measure young learners' spoken fluency more validly.

Corresponding to the gaps *Aims of the Systematic Review*
, the research questions are as such:

Research Question 1	What is the perceived linguistics effectiveness as well as the drawbacks of utilizing education technologies in teaching and assessing spoken fluency in English language learning?
Research Question 2	What are the types of activities English teachers use with education technologies to enhance students' spoken fluency?
Research Question 3	What are the education technologies commonly used for teaching and assessing spoken fluency?
Research Question 4	How are educational technologies used to assess students' spoken fluency in English?

Method

The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) 2020 checklist was utilized for this systematic review. The study was implemented in four phases – Identification, Screening, Eligibility, and Inclusion.

Phase I: Identification

Relevant studies were selected. At this stage, no exclusion and inclusion of studies were conducted yet. This study utilized two databases – Google Scholar and ERIC. Wong and Yunus (2023) noted that Google Scholar is feasible as it enables users to access the full texts of online academic journals. Meanwhile, ERIC is an online library supported by the Institute of Education Sciences (IES) of the U.S. Department of Education, providing approved journal and article sources that conform to its standard of selection. The keywords applied are listed in Table 1. A total of 187 articles were retrieved – 98 articles from Google Scholar and 89 articles from ERIC respectively**.**

Table 1
Keywords to find articles

Databases	Keywords
Google Scholar and ERIC	((“Education technology*” OR “Digital Platform*” OR “SNS*” OR “AI*”) AND (“Second Language*” OR “L2*”) AND (“Teach*” OR “Learn*” OR “Assess*”) AND (“Perception*” OR “Method*” OR “Technique*” OR “Approach*”) AND (“Speaking*” OR “Oral Proficiency*” OR “Spoken English*”))

Phase 2: Screening

The articles were then screened, and duplicates were eliminated. 93 articles were retained for further analysis. 73 articles were duplicates, 3 were not retrieved as the reviewer was not granted full access to the article and 18 were not included due to their non-significant results. 93 articles were then assessed for eligibility.

Phase 3: Eligibility

To further specify the articles chosen, the inclusion and exclusion criteria in Table 2 were applied.

Table 2
Inclusion and Exclusion Criteria

Criterion	Inclusion	Exclusion
Language	English	Non-English
Year	2010 - 2025	before 2010
Type of article	Journal Articles	Books, Conference papers, Dissertations, Conference Articles
Perceptions	Teachers/Educators/Teachers-trainee/Pre-service teachers/Student-teacher, Students/Students at Primary/Elementary/ Secondary/Junior high/Senior high schools, Children, Young learners	Parents, Pre-schoolers, University students, Lecturers

University students' perceptions were excluded due to the abundance of existing research on this demographic. School-aged learners whose spoken fluency is strongly influenced by educational technology-mediated environments compared to the self-directed learning patterns characteristic of university students were prioritized. Out of the 93 articles initially screened, 24 were relevant to the review. 9 articles were not English, 8 articles were written before 2010, 3 were books, and 49 articles were written from the perspectives of parents, university students, and lecturers. Following the PRISMA 2020 guidelines, to ensure intra-rater reliability, all 93 articles underwent duplicate screening after a two months. The second screening yielded almost identical results as 20 articles were retained in both rounds, demonstrating strong intra-rater reliability in the selection process. Four articles initially included in Round 1 were excluded upon closer inspection during Round 2. The articles were review articles rather than empirical studies (k = 2), one was not published in peer-reviewed journals, and one was a thesis.

Referring to Table 3, Cohen's Kappa was calculated to assess intra-rater reliability.
Table 3
Agreement Between the Round 1 and Round 2 of Screening

	Round 2: Included	**Round 2: Excluded**	**Row Totals**
Round 1: Included	**20**	**4**	**24**
Round 1: Excluded	**0**	**69**	**69**
Column Totals	**20**	**73**	**93**

The observed agreement (Po) was 0.95699, and the expected agreement by chance (Pe) was 0.6379. A Kappa value of 0.8813 indicated "almost perfect agreement", suggesting that the inclusion and exclusion criteria were applied consistently (Landis and Koch, 1977).

Phase 4: Inclusion
After going through 4 phases, 20 articles were included in the review. The selected articles encompassed of qualitative, quantitative, and mixed-method research designs. All were published in English between 2010 and 2025. These studies explored the perspectives of both teachers and students at the primary and secondary school levels.

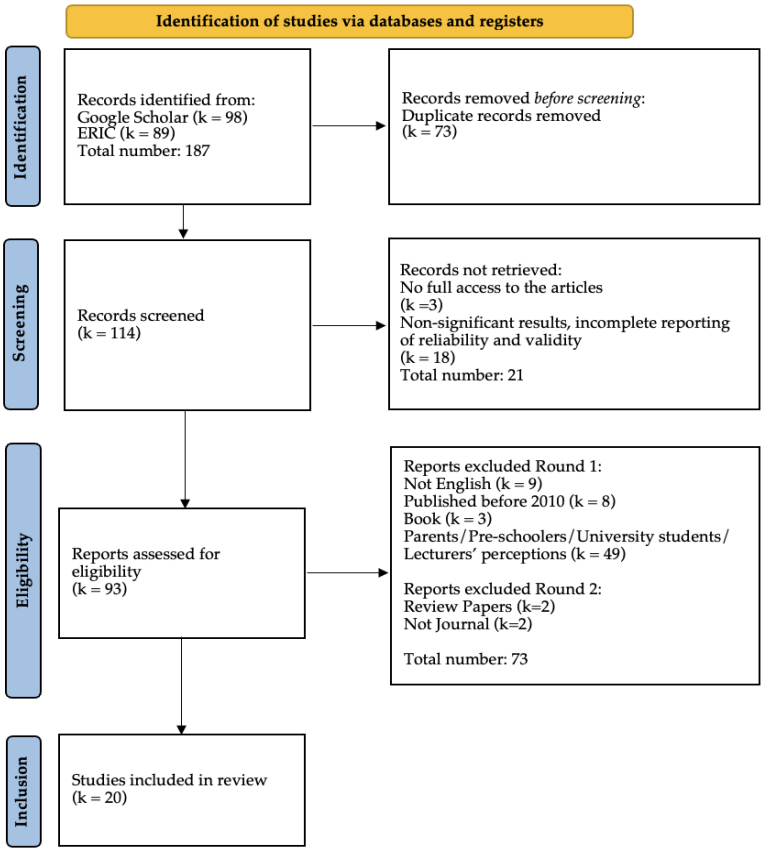

Figure 1: Chart of the research articles selection process

Results and Discussions

Before addressing the four research questions, an overview of the studies' methodologies and contexts is provided. Table 4 and Table 5 (refer to Appendix) summarize the methodologies and contexts employed across the studies, along with the educational technologies utilized. The studies revealed a diverse range of methodologies, tools, and outcomes in educational-technology-enhanced language learning. Of the 20 articles reviewed, 3 (15%) were qualitative studies, 5 (25%) were quantitative studies, and 12 (60%) were mixed-methods studies. Sample sizes ranged from 7 to 2100 participants. Most studies utilized pre-/post-tests, interviews, and questionnaires as data sources, with descriptive and inferential statistics as the predominant analytic methods. The average study duration was approximately eight weeks, ranging from 20 days to ten months. Four studies did not specify timeframes yet were included due to their substantive contributions to understanding the role of educational technologies in spoken-fluency development.

Perceived Linguistics Effectiveness of Utilizing Education Technologies

Recent studies highlighted how educational technology could enhance spoken fluency by addressing key linguistic components – speech rate, pausing patterns, and repair behaviors that collectively influence communicative effectiveness. De Jong (2023) emphasized that fluency development often involved reducing inappropriate pauses and improving pause placement while Segalowitz (2010) note that disfluencies occur due to limited automatization. Suzuki and Révész's (2023) meta-analysis situated fluency within a three-part framework: utterance fluency, cognitive fluency, and perceived fluency. This review focuses

on utterance fluency—speed, breakdown, and repair. Table 6 (*refer to Appendix)* synthesizes the linguistic effectiveness across these dimensions. Table 7 and Figure 2 summarizes these studies into the types of fluency and percentages of articles in which they appeared in.

Table 7
Perceived Linguistic Effectiveness of Utilizing Education Technologies

Types of Fluency	Number of Articles	Percentage (%)
Speed Fluency	**7/20**	**35**
Repair Fluency	**4/20**	**20**
Breakdown Fluency	**5/20**	**25**
General Fluency	**8/20**	**40**

Note. Percentages sum to more than 100% as some analyzed studies reported multiple types of fluency.

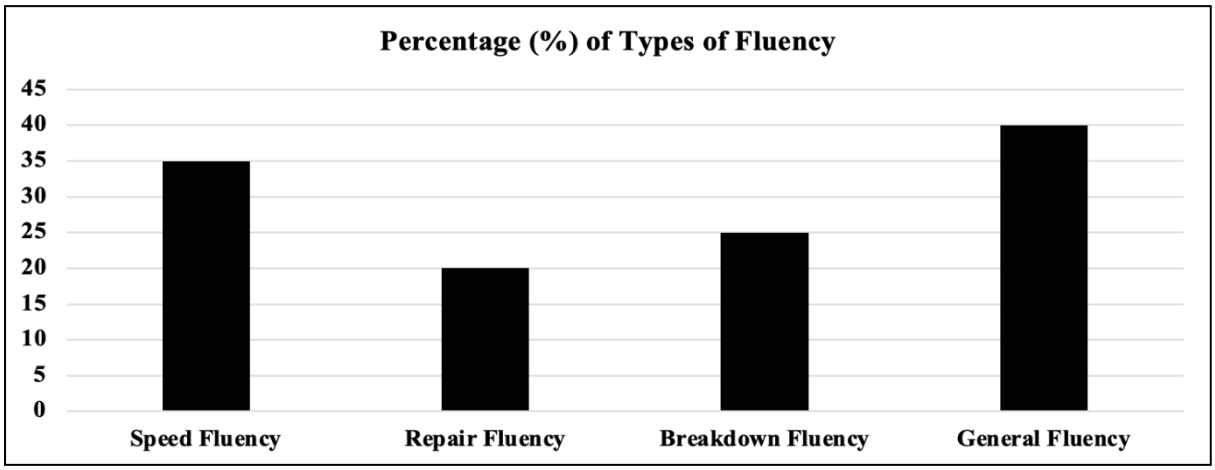

Figure 2: Percentage of Types of Fluency

The integration of educational technologies in language learning has shown significant effectiveness in the linguistic aspects of spoken fluency acquisition. According to the analysis of the 20 articles, only 60% explicitly examined specific dimensions of fluency – speed, breakdown, and repair, while 40% treated "fluency" as a general construct without detailing its subcomponents. Eight articles (40%) reported improvement in fluency generally, seven articles (35%) highlighted gains in terms of speed fluency among pupils, five articles (255%) noted improvement in breakdown fluency and four articles (20%) noted linguistic improvement in terms of self-repairs.

The integration of education technologies into language learning has been shown to significantly enhance speed fluency. Onoda (2014) defined speed fluency as speech rate, the number of words per minute and between pauses and linked speech rate to automatization, where learners retrieved and produced language more efficiently and achieved greater consistency in their spoken output. Through repeated, focused practice, students' cognitive load is reduced during real-time production, minimizing disfluency. For instance, sentence memorization via CALL enabled students to produce speech at a faster rate as they reproduced memorized text, gradually increasing their resemblance to model utterances (Kitagaki, 2013). Toleuzhan et al. (2023) reported similar gains through YouTube shadowing

as students mimicked authentic speech, internalizing prosody, and developing greater naturalness in spoken delivery. Repair fluency which reflected the ability to self-correct, signaled self-monitoring rather than linguistic deficiency. Zhong et al. (2017), using Papa, documented "I very like my black cat." Although ungrammatical, the utterance conveyed intended meaning by illustrating repair in service of communication. The students reported feeling more confident and "heard" due to immediate interaction, which enabled on-the-spot repairs. Similarly, Doghonadze and Kintsurashvili (2023) found that AI role-plays helped learners practice real-time repairs, enhancing confidence and increasing total speaking output. Breakdown fluency, defined as the frequency of silent pauses and could be framed as a form of hesitation and lack of response. In this review, improvements were observed via strategic use of fillers to maintain flow. Awang et al. (2022) recognized fillers such as "well," "erm" as effective turn-holding strategies under time-pressure. Combining traditional shadowing techniques with Youtube practice reduced the number and length of pauses during speech. By learning to manage the flow of speech through fillers strategically, students managed to buy themselves some time to think, masking hesitation when speaking (Kusuma, 2022). In Toleuzhan et al. (2023), Web 2.0 tools like Voki were utilized to support monitoring and repairing through tasks like describing memories and practicing hesitation phrases. The social features embedded in these tools facilitated peer review and collaboration, creating safe, interactive spaces for fluency practice.

Although most studies focus on utterance-fluency measures, eight, do not specify subcomponents and report general gains linked to pragmatic markers. Brown et al. (2023) noted that monologic, temporally focused research tend to dominate, which could at times make research overlook interactional competence – a core component in speaking in which fluency is co-constructed. Brown et al. (2023) shed light on pragmatic markers that contribute to perceived fluency in dialogic speech especially in maintain flow and signalling engagement. In this review, game-based activities were found to enhance overall fluency and stimulate peer feedback through words of encouragement (Ndayishimiye et al., 2024) while digital storytelling increased learners' comfort and spontaneity, prompting the use of supportive cues during recordings (Lustenberger, 2024). Even though the target of this analysis is younger learners, the findings of this review is consistent with that of Zhao at al. (2024) and Crompton et al. (2024) who targeted students in higher education. Education technologies had generally positive impact on learners' fluency. They not only improve temporal fluency but also strengthen interactional skills by encouraging the use of pragmatic markers and supportive expressions that sustain dialogic communication.

Drawbacks of Utilizing Education Technologies

Only 12 of the 20 articles (60%) explicitly discussed limitations. Referring to Table 8 and Figure 3, the most cited drawback included technological background (30%), followed by limited capabilities and fear (20% each), with language standardization being the least mentioned (10%). While effectiveness is documented, a substantial minority did not address potential disadvantages, underscoring the need for balanced reporting.

Table 8
Drawbacks of Utilizing Education Technologies

Drawbacks	Number of Articles	Percentage (%)
Technology Background	**6/20**	**30**
Limited Capabilities	**4/20**	**20**
Language Standardization	**4/20**	**20**
Fear	**2/20**	**10**

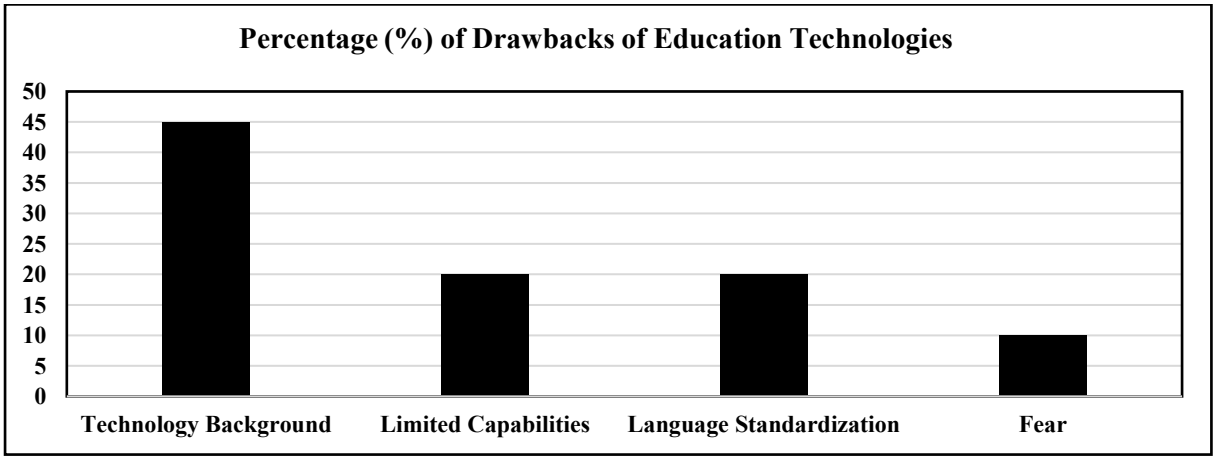

Figure 3: Drawbacks of Education Technologies for Spoken Fluency

Technological background is characterized as hardware or connectivity failures, software malfunctions, and erroneous outputs. Such issues impeded learning and diminished engagement through login delays and system lags, potentially hindered fluency development. Limited access to connectivity exacerbated inequity implementation of the education technologies, leading to uneven participation among the students (Zhong et. al., 2017). As learners without regular access to computers or unstable connections continue to be at disadvantaged, education technologies risked reflecting persistent socio-economic divides, further enlarging the education gap between the privileged and less privileged (Ndayishimiye et al., 2024). Meanwhile, limited capabilities reflected user dissatisfaction with the education technologies functional constraints. Kusuma et al. (2021) found teachers supplemented primary platforms with tools like Flipgrid and Schoology with later studies (Kusuma, 2022; Lustenberger, 2024) reporting similar outcomes as teachers are left frustrated as they deemed creating materials themselves as time-consuming. This raised concerns regarding over-reliance on education technologies. Technologies should be treated as aids and not replacement for teachers. To add, in relation to constraints on education technologies, current AI and MALL assessments often prioritized discrete elements of vocabulary and grammar, giving less emphasis on more productive skills like speaking (Syafrizal et al., 2022).

MALL tools like Duolingo provided more translation and grammar exercises than that of speaking practice (Kazu & Kuvvetli, 2024). Although these exercises support the formation of formulaic sequences, their overuse may compromise holistic oral proficiency. Fear in this review manifests as data-privacy concerns, opacity in decision-making, and worries about eroding authentic communication. As the use of education technologies had yielded positive results over the years, it was easy for teachers to over-rely on them. Nonetheless, over-reliance risks eroding interactional strategies like reading gestures or turn-taking, skills that students could only obtain through face-to-face interactions. As generative AIs were still not

able to fully replicate non-verbal nuance or adaptive dialogic flow, their use for fluency practice should be supplement with in-person interaction. Additionally, language standardization could overtime cause linguistic hegemony which is evident in the study by Manggiasih et al. (2023) as they expressed fear that the AI inability to recognize pronunciation variations in certain accents and dialects might cause fairness and inequality in the evaluation process. The previously noted limitation of AI in grasping cultural-linguistic nuances became a critical issue of fairness in high-stakes assessment. This underscores the need for hybrid scoring models where a teacher can verify and contextualize the automated score.

The findings of this section were parallel to those of Crompton et al. (2024), who also identified four major challenges in employing education technologies, particularly AI for teaching and assessing speaking – technology background, limited capabilities, fear, and language standardization. Both reviews emphasized that students were not always understood or responded to as intended, reflecting the limitations of current AI communication systems. A similar sense of apprehension was also observed in perception studies, where students expressed concern about losing natural interaction when communication with AI. Despite these drawbacks, the benefits of education technologies for fluency improvement are substantial. With awareness of limitations, teachers and students can mitigate risks and leverage these tools within a balanced approach.

Types of Fluency Activities

Tavakoli and Hunter (2018) identified five evidence-based fluency practices – formulaic sequences, pre-task planning, task repetition, the 4/3/2 technique, and awareness-raising activities, four of which were utilized in the 20 studies analysed. Task repetition via role-play or video involved performing the same or slightly modified tasks multiple times, improving subsequent performance whilst pre-task planning allowed learners to organize ideas and forms prior to the speaking task. Awareness-raising via gamification helped students recognize patterns and formulaic sequences entailed the use of fixed or semi-fixed combinations of words such as collocations and phrasal verbs that streamlined speech by reducing the speaker's cognitive load. Types of fluency practices utilized in the 20 articles were summarized in Table 9 and Figure 4. Analysis of the 20 articles revealed that teachers tended to apply task repetition most with education technologies as it appeared in 9 articles (45%). This was followed by pre-task planning and awareness raising which were equally represented, each appearing in 7 articles (35%), indicating their balanced used. Formulaic Sequences were discussed in 5 articles (25%), reflecting a comparatively smaller but still notable practice for improving spoken fluency. These percentages indicated the varying degrees of interest in different practices when it came to teaching and assessing spoken fluency. Task Repetition emerged as the most prominent, likely due to its noteworthy benefits in refining fluency.

Table 9
Types of Fluency Practices

Types of Fluency Practices	Number of articles	Percentage (%)
Task Repetition	**9/20**	**45**
Pre-Task Planning	**7/20**	**35**
Awareness Raising	**7/20**	**35**
Formulaic Sequences	**5/20**	**25**

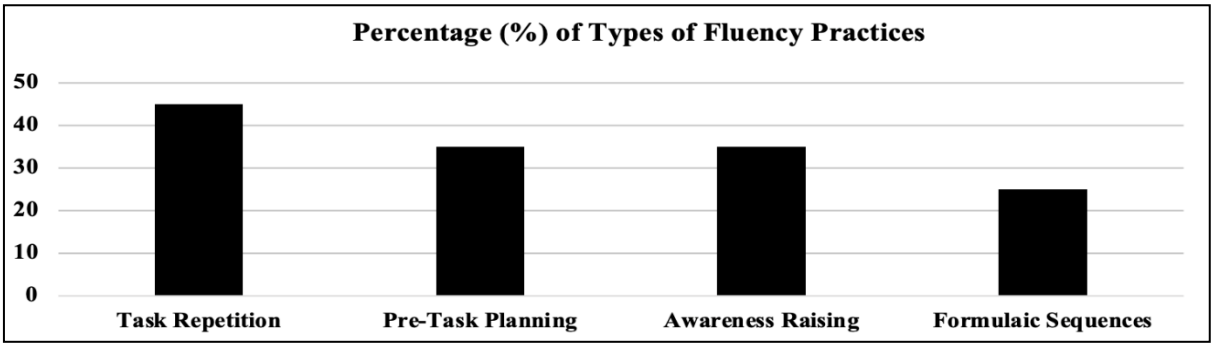

Figure 4: Percentage (%) of Types of Fluency Activities and Assessments

Video production, role play, and gamification were frequently employed across the 20 articles. Video production emphasized task repetition and pre-task planning, involving iterative scripting and repeated recordings to refine the final output. This repetitive practice enhanced students' fluency and overall language production. Web 2.0 tools like Vocaroo (Terzioğlu & Kurt, 2022) and Seesaw (Cahyani et al., 2024) enabled students to track their progress through self and peer reviews. In Cahyani's et al. (2024) study, result of the paired sample t-test revealed a significant improvement in their participants' scores, rising from 68.40 to 85.20 after implementing Seesaw. The platform allowed students to capture images or record videos related to their speaking topics, enhancing message clarity and providing contextual support for more effective communication. Similarly, Flipgrid integrated e-portfolios to streamline fluency development and assessment by organizing, storing, and sharing speaking tasks (Kusuma et al., 2021). Role-playing integrated pre-task planning with task repetition. By using AIs as conversation partners, shy students gradually enhanced their fluency, as the reduced fear of judgment allowed them to focus more on expressing their thoughts rather than avoiding mistakes. Doghonadze and Kintsurashvili (2023) highlighted that 90% of their participants expressed positive experiences when AI was utilized. Teachers involved in their study claimed that AI had helped their students improve their speaking abilities as it offered interactive language learning and virtual language instructors, enabling their students to practice speaking in a simulated environment. When mistakes occurred, the AI prompted them to self-correct, and through adaptive learning, they received targeted practice to improve the areas they were weak in. With repeated role-play sessions, students demonstrated noticeable progress in speaking fluency. They applied knowledge from past conversations to new topics, gradually minimizing pauses and hesitations in their speech. Meanwhile, awareness-raising practices utilized interactive, low-pressure environments to enhance the students' fluency. Duolingo and Quizizz incorporated game-like elements that made speaking practice more engaging and enjoyable. These tools extended learning beyond the classroom, allowing students to practice anytime, anywhere, seamlessly incorporating the

use of English into their daily routines. The bite-sized activities took only 5 to 10 minutes to complete, ensuring accessibility and sustained engagement. Gamification enabled students to apply knowledge learnt in practical settings by embedding learning into meaningful scenarios (Ndayishimiye et al., 2024). Gamification supported the students' vocabulary acquisition through formulaic sequences exercises, reinforcing collocations through multiple quizzes. As the students encountered these word pairs repeatedly in games, they internalize them and gradually incorporated them into everyday speech.

Analysis of the articles revealed that video productions, AI-driven role-playing, and gamification were particularly favored by educators in fostering fluency. Nonetheless, other fluency-based activities such as Digital Storytelling, memorization, and mimicking were also worth mentioning. Lustenberger's (2024) study found that 77.8% of the students perceived improved oral English skills through digital storytelling tasks (DST), reporting increased confidence, vocabulary, and computer proficiency while their teacher noted DST's game-like motivation boosted fluency and pronunciation through the low-pressure, repeated practice. Likewise, Toleuzhan's et al. (2023) study reported that the students perceived mimicking YouTube videos as effective tools for advancing their oral production. They attributed it to the meaningful learning experience that mimicked real-world environments. The incorporation of these activities helped students strategically use fillers through task repetitions, which they gradually adopted into daily conversations to develop more natural-sounding speech.

Education Technologies Commonly used for Teaching and Assessing Spoken Fluency

Elementary and secondary school teachers employed a wide range of educational technologies to assess and enhance students' fluency. These tools could be categorized into four main themes – Social Media, Web 2.0 Tools, Generative AI, and Computer-Assisted Language Learning (CALL) / Mobile-Assisted Language Learning (MALL). This classification aligned with Yanwar et al. (2022), who examined educational technologies in English teaching and identified seven tool types, four of which were like that of this review. This review classified Generative AI as tools that leverage advanced language models to create adaptive, interactive speaking practice, including both conversational chatbots and responsive tutoring systems. Meanwhile, CALL refers to any computer-based tool designed for structured language learning, while MALL is its mobile branch, covering applications that can be downloaded and used on smartphones for flexible learning. Hence, Duolingo is classified under MALL.

Referring to Table 11 and Figure 5, Web 2.0 tools and CALL/MALL emerged as the most prevalent technologies in the studies, both appearing in 40% of the studies, demonstrating their crucial role in promoting interactive learning environments. Social medias followed closely, being employed in 25% of the studies, while generative AI tools were the least common, appearing in only 20% of the studies. These findings underscored the growing integration of digital tools in teaching and assessing spoken fluency with Web 2.0, CALL and MALL technologies leading the way.

Table 11
Education Technologies Commonly used for Teaching and Assessing Spoken Fluency

Education Technologies	Number of articles	Percentage (%)
Web 2.0 Tools	**8/20**	**40**
(CALL/MALL)	**8/20**	**40**
Social Medias	**5/20**	**25**
Generative AI	**4/20**	**20**
Others	**1/20**	**5**

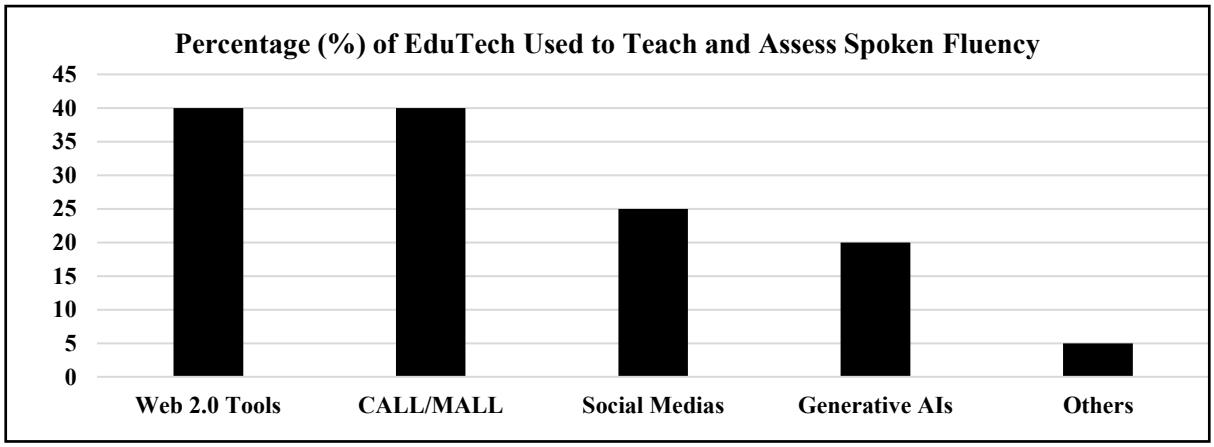

Figure 5: Percentage (%) of EduTech Used to Teach and Assess Spoken Fluency

Web 2.0 tools played a crucial role in fostering interactive and collaborative learning environments by supporting activities such as digital storytelling, video production, and even voice recording exercises via Vocaroo and Voki. Terzioğlu and Kurt (2022) observed increased fluency among their experimental group after utilising Edmodo. Elverici (2024) corroborated this as he reported a similar finding through the application of Voki, claiming that it provided his learners with a dynamic speaking practice, eventually outperforming the control groups. Additionally, gamification elements incorporated through Quizziz and Kahoot enhanced engagement, leveraging game-like features to motivate students in communicating in the language (Pacurucu & Garzón, 2022). The variety of activities highlighted a shift towards personalized language learning experiences that cater to different learning styles and objectives. These findings suggested that structured, technology-mediated practice through memorization and gamification could significantly enhanced the students' oral fluency. Unexpectedly, despite the recent attention on AIs, CALL and MALL still remained relevant. Essentially CALL and MALL enabled on-the-go learning through different applications, offering greater flexibility and accessibility. Their application had remained dominant as teachers recognized their contribution to the teaching and assessment of spoken fluency. Duolingo appeared five times across the studies, possibly emerging as one of the most used MALL for fluency enhancement. Dualingo is particularly notable for its translation exercises, matching activities, and speech-based challenges that reinforce language acquisition. Syafrizal et al. (2023) mentioned that post introduction of Dualingo the experimental group exhibited significantly higher mean ranks (51.44 and 57.64, respectively) compared to the control group (29.09 and 24.58, respectively). They became more willing to speak after using Duolingo since the structured speaking practices helped them become more familiar with certain language patterns. Meanwhile Zhong et al. (2017) through their utilization of the MALL, Papa, yielded

positive result as Papa provided an encouraging environment, was feasible, and provided them with situated learning where they could practice in an authentic context through simple assignments about their daily life. While applications like Duolingo and Papa assisted students with speaking practice, they primarily focus on translation exercises, which might enhance learners' familiarity with formulaic sequences and pre-task preparation. These tools are effective for assessment purposes, as they provided instant feedback, allowing learners to track their progress. For teachers, such application offered a practical way to assign bite-sized activities, ensuring consistent language practice beyond classroom hours and supporting continuous learning. However, without opportunities to apply this knowledge in meaningful contexts, there is a risk that students might struggle to transfer what they had learnt into actual speaking. In regards to social media, Facebook (Madhavi et al., 2023) and Youtube (Kuzuma; 2022, Toleuzhan et al., 2023) were often integrated. These social medias were mainly utilised for sharing speaking performances and engaging in real-world language practice through movies and discussions. YouTube was used mainly for imitation exercises, helping students improved grammar, filled speaking gaps, and mimicked phrases from actors. These activities exposed students to authentic language use, emphasizing real-world application through meaningful dialogues and contextual learning. A teacher in Kusuma (2022) mentioned that Youtube was beneficial in providing “further explanation and speaking examples” to her students. Additionally, by posting their work online, students gained confidence and learnt to accept peer feedback, fostering self and peer-assessment. Watching and evaluating their peers' videos allowed students to reflect on their own speaking skills and made improvements accordingly. Video production tasks provided teachers with a valuable tool for tracking their learner’s oral proficiency development over time. The ability to replay videos also enabled more detailed and reflective evaluation. However, a key limitation arose from students' ability to edit and reshoot their videos, meaning the final product may not authentically represent their spontaneous speaking abilities. To ensure accurate assessment, teachers should complement video tasks with in-person speaking evaluations on similar topics when conducting formal tests or compiling academic reports. YouTube submissions could then serve as supporting evidence rather than primary assessment material.

Despite the recent focused in AIs, only a small number of studies in this review employed generative AI. This could be attributed to the fact that this review targeted younger learners and teachers might still be cautious about using AI with children due to concerns about suitability or safety. Nonetheless, their growing importance in personalized language instruction and instant feedback should be acknowledged. Generative AI applications in this review focus on facilitating role-playing exercises providing speaking practice with AI-powered avatars. As digital natives, students are accustomed to instant access to information, making AI-driven tools a natural fit for their learning habits. Huda and Rahmawati (2024) examined the use of ELSA AI to improve students' spoken fluency through structured role-playing activities. A notable strength of ELSA AI is its adaptive learning feature, which personalized interactions based on individual progress, promoting more natural and dynamic speaking practice. Another AI, SmallTalk2Me also proved to be convenient as the students could practice speaking and obtained evaluation regardless of the time and location (Manggiasih’s et al., 2023). SmallTalk2Me offered immediate feedback, allowing students to pinpoint areas that require their close attention. As the students often conducted the sessions at home, the AIs provided them with privacy and comfort, allowing them to speak in a secure environment free of judgement. In regards to assessment, AIs held significant potential by

providing impartial evaluations based on predefined criteria and data-driven analysis (Al-Khresheh, 2024). They delivered personalized learning experiences tailored to individual needs and enhanced fluency through contextualized, scenario-based practice. However, as AI systems still struggle to fully grasp linguistic nuances, cultural context, and non-verbal cues (Doghonadze and Kintsurashvili, 2023), they should not be used in isolation. Instead, they should complement teacher assessments, with human verification ensuring accuracy before finalizing grades.

Education Technologies for Assessing Spoken Fluency

According to Table 12 *(refer to Appendix)* and Table 13 *(also Figure 6),* educational technologies for assessing students' spoken English fluency varied in use across elementary schools, secondary schools, and teacher-led contexts. Automatic Speech Recognition (ASR) was applied in 25% of the studies, while Natural Language Processing (NLP) appeared in 20% of the studies. Audio recording was used across 5 studies (25%), and video creation in 4 studies (20%). Among the technologies used, chatbots and virtual tutors appeared to be less common, at 5%, while gamification was employed 3 times, at 15%, with both approaches used exclusively in secondary schools. This distribution showed a stronger preference for ASR, NLP, and the more traditional recording tools over gamified or conversational AI approaches, with teachers leaning towards technologies that enabled automated linguistic analysis (refer to Table 15).

Table 13
Underlying Technology

Underlying Technologies	Number of Articles			Total Articles	Percentage (%)
	Primary School	Secondary School	Teacher		
Automatic Speech Recognition	1	2	2	5/20	25
Natural Language Processing	1	1	2	4/20	20
Audio recording	3	2	0	5/20	25
Video creation	1	3	0	4/20	20
Chatbots, Virtual Tutor	0	1	0	1/20	5
Gamification	0	3	0	3/20	15

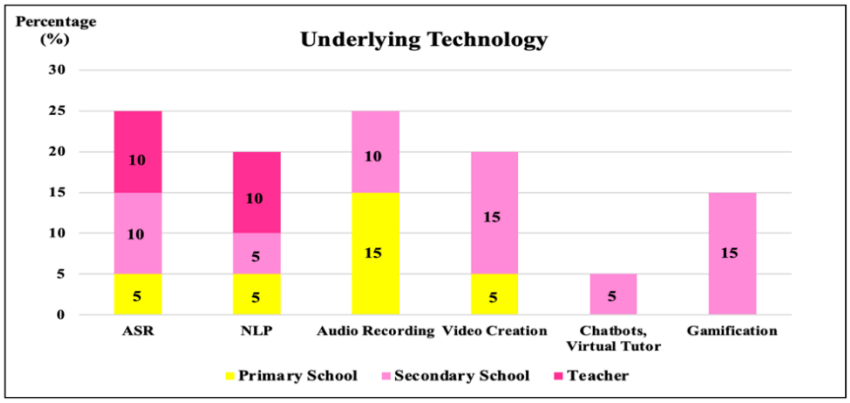

Figure 6: Underlying Technology

For measurement methods (Table 14, Figure 7), researcher-developed rubrics were most common at 50% with 8 articles. Feedback in the form of comments followed at 31.25%. Other

band scoring methods also included in the studies were Harris's Oral Rating Scale, Cambridge Speaking Rubric, and Hybrid CEFR-IELTS, all of which only appeared once with 6.25% at the elementary setting. These suggested that teachers were more prone to employ flexible, self-designed rubrics and feedback in assessing spoken fluency. Meanwhile, as shown in Table 15 and Figure 8, automated scoring was employed in 56.25% of the studies and manual scoring in 50%. As these categories are not mutually exclusive, please note that the total percentage exceeds 100%. The near-equal prevalence strongly indicated teachers value hybrid assessment models. This preference responded to the inherent limitations of automated systems previously outlined, such as their struggle with cultural-linguistic nuances and non-verbal cues, which were crucial for a holistic evaluation of fluency. Consequently, educators leveraged the efficiency and consistency of automated scoring while retaining essential human judgement for qualitative, interactional aspects that technology could not yet capture. Automated scoring reflected the integration of ASR and NLP, enabling on the spot, consistent evaluation and observed to be employed more in secondary schools. However, the continued presence of manual scoring especially in elementary schools indicated the importance of qualitative judgment and demonstrated teacher's limited trust in students' ability to independently engage with AI at that age.

Table 14
Measurement Type

Measurements	Number of Articles			Total Articles	Percentage (%)
	Primary School	Secondary School	Teacher		
Band Scoring (Harris's Oral Rating Scale)	1	0	0	1/16	6.25
Band Scoring (Researcher-Developed Rubric)	2	5	1	8/16	50
Band Scoring (Cambridge Speaking Rubric)	1	0	0	1/16	6.25
Band Scoring (Hybrid CEFR and IELTS)	0	0	1	1/18	6.25
Feedback in the form of comments	1	3	1	5/16	31.25

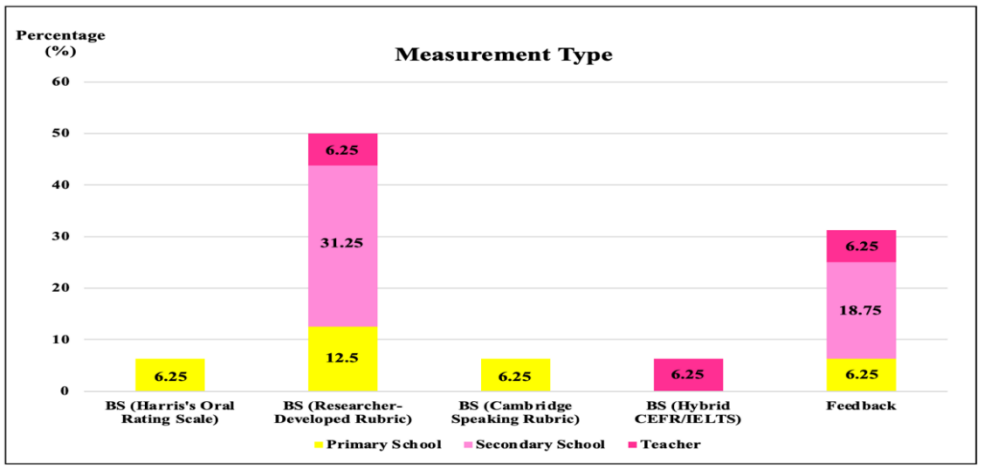

Figure 7: Measurement Type

Table 15
Assessment Approach

Assessment Approaches	Number of Articles			Total Articles	Percentage (%)
	Primary School	Secondary School	Teacher		
Automated Scoring	**1**	**5**	**3**	**9/16**	**56.25**
Manual Scoring	**4**	**3**	**1**	**8/16**	**50**

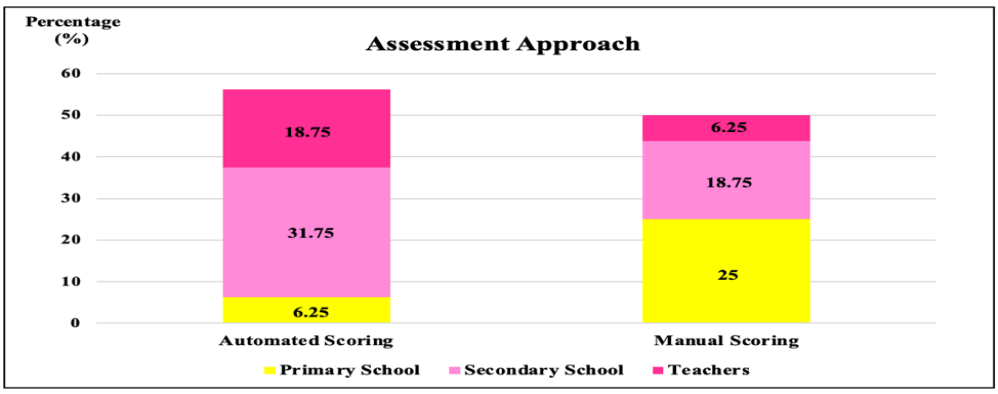

Figure 8: Assessment Approach

To better understand the assessment trends for spoken fluency, the discussion will be divided into three periods – 2010 to 2015, 2016 to 2020, and 2021 to 2025. Referring to Figure 9 and Figure 10, based on the analysis of the 20 articles, the period from 2010 to 2015 and 2016 to 2020 saw the foundational adoption of basic recording technology and traditional text-presentation through CALL and social media. The data showed a reliance on audio recording (Kitagaki, 2013) and presentation (Zhong et al., 2017), which were likely the primary tool during this era. Unlike the automated feature of generative AIs, these technologies facilitated manual assessment of fluency, allowing teachers to first capture the speech for later evaluation using their self-developed rubrics. This result was parallel to that of Hasami and Chiu (2024) in which they mentioned that the period from 2010 to 2015 and 2016 to 2020 observed the early use of MALL and audio tools to improve listening and speaking performance. At this time, there was a sharp rise in student-centred learning, focusing more on reducing students' anxiety, allowing them to practice fluency through task-repetition and pre-task planning.

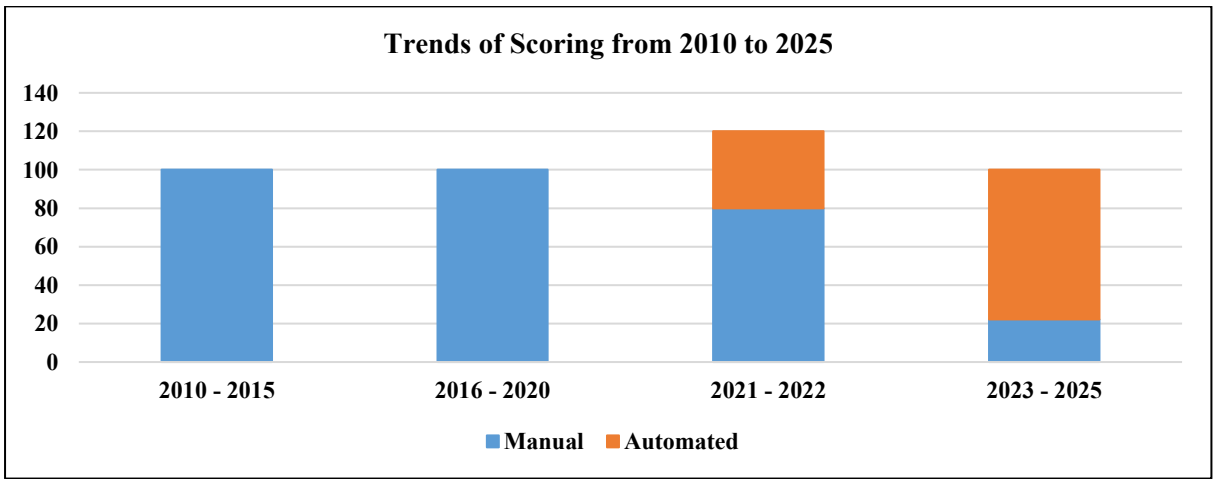

Figure 9: Trends of Scoring from 2010 to 2025

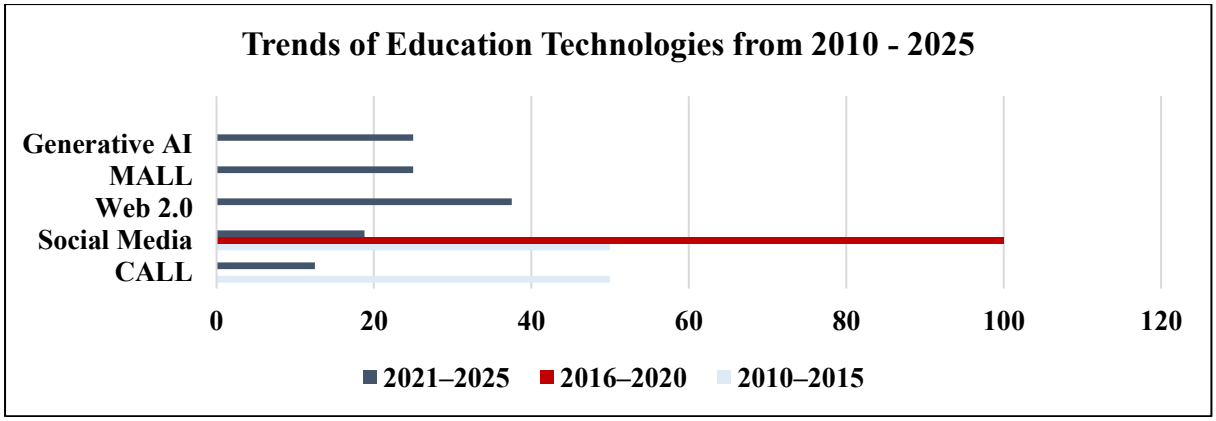

Figure 10: Trends of Education Technologies used from 2010 to 2025

Contrastingly, the periods from 2021 to 2025 demonstrated a clear shift towards automation in assessing fluency. At the beginning of this period, the emergence of Automatic Speech Recognition (ASR) and Natural Language Processing (NLP), collectively appearing in 45% of the studies, was likely in nascent stages, focusing more on simpler scoring models, paving the way for future automation. Beginning 2023, the maturation of AI-driven tools became evident in the dominance of Automated Scoring (56.25%) as the leading assessment approach, particularly in secondary schools (31.25%). This could have been attributed to the release of ChatGPT in late 2022, marking a turning point in education, rapidly popularising the use of generative AI in the classroom. This trend indicated that ASR and NLP had evolved beyond basic transcription to enable robust, real-time fluency analytics and feedback. The data suggested a move towards hybrid assessment models, combining the efficiency of automated scoring for consistency with targeted manual scoring for nuanced qualitative judgment, especially in elementary education. This evolution pointed to a future where technology would not just be used for assessment but would become integral to creating personalized, adaptive, and engaging learning pathways for spoken language. Similarly, Hasami and Chiu (2024) claimed that the period from 2021 to 2025 witnessed a considerable progress in the development of web-based applications and AI conversational tool to support the students' learning environment. During this timeline, test developers were observed to be gearing towards integrating audio, video, and interactive stimuli into fluency assessments, making assessments more authentic and allowing responses to be stored, shared, and rated more efficiently. Meanwhile, the period encompassing COVID-19 and the post-pandemic years was characterised by interactive virtual tasks through generative AIs, providing robust, contextually valid assessment environments that supported fairness and authenticity while leveraging automation for reliability and cost-effectiveness.

Over the course of 15 years, with particular emphasis on the last five years, it became evident that educational technologies offered significant advantages in both personalized learning and assessment. AI-powered platforms were typically favoured as they could analyse learner's performance and adapt content to address specific weaknesses, delivering targeted exercises that matched each student's needs and learning pace. Their ability in providing real-time feedback enabled learners to identify areas for improvement immediately, while ensuring consistent and fair evaluation criteria. Looking from the teachers' perspective, students' progress could be tracked overtime, aiding teachers in gaining valuable insights into their language acquisition journey and making informed instructional decisions. Nonetheless, educational technologies were not without limitations. They had a tendency to focus heavily

on specific language aspects, such as vocabulary and grammar, with MALL tools like Duolingo often providing more translation and grammar exercises than role-play opportunities (Kazu & Kuvvetli, 2024; Zeng & Fisher, 2024). Additionally, these systems carried inherent biases, potentially disadvantaging some learners. To address this, it was recommended that teachers supplement AI or MALL-based communication practice with classroom dialogic speaking activities. As such, technology served as a supplementary tool, inspiring ideas and acting as a catalyst for in-person speaking activities.

Conclusion

This systematic review provides valuable insights into the use of educational technologies for enhancing and assessing spoken fluency among elementary and secondary school students. The findings reveal several key points. In relation to research question 1 on the linguistic effectiveness and drawbacks of education technologies, this review identifies that educational technologies demonstrated benefits in promoting spoken fluency particularly in terms of speech rate, pause management, and self-repair. Digital tools and AI-assisted platforms facilitate automization by providing repetitive speaking practice and immediate feedback. This aids learners in reducing appropriate pauses and enhances their speech naturalness (de Jong, 2023; Suzuki & Revesz, 2023). Nonetheless, the success in implementing education technologies is not without challenges in terms of technological background, limited capabilities, language standardization, and fear of losing interaction. Research Objective 2 explored the types of activities teachers used to enhance pupils' spoken fluency. Teachers commonly employed task repetition, pre-task planning, and awareness-raising when using education technologies. In studies reviewed, video-production, AI- assisted role-play, and gamification emerged as dominant activities often paired with the three fluency practices aforementioned. Moreover, more traditional methods like memorization, and mimicking through quizzes and Duolingo were noteworthy and also contributed to fluency gains by reinforcing the strategic use of fillers in oral production. Research Objective 3 aimed to determine the education technologies commonly used for teaching and assessing spoken fluency. The review determined Web 2.0 tools, CALL/MALL, social medias and generative AI as the preferred education technologies. Web 2.0 tools and CALL/MALL emerged as the most prevalent, underscoring their central role in fostering interactive and collaborative language learning. Social media platforms followed, primarily through Youtube and Facebook for authentic communication as well as peer interaction. Surprisingly, generative AI, though showing great potential for adaptive, personalized feedback, appeared in only 20% of the studies – likely due to limited classroom access or ethical concerns when applied to younger learners. Collectively, these findings indicate a gradual yet significant shift toward digitally mediated fluency development with Web 2.0 and CALL/MALL continuing to dominate while generative AI remains an emerging tool. Zooming into research objective 4, between 2010 and 2015, assessment of spoken fluency in schools mainly relied on audio and video recordings with manual rubrics. 2016 onwards, early ASR and NLP tools begin to emerge in basic forms and the field shifted toward automated scoring powered by advanced AI. While education technologies have undoubtedly advanced fluency instruction, their applications are not without complications. As the field of educational technology continues to evolve, it is crucial to explore innovative ways to harness these technologies while addressing the challenges they present.

Limitations and Recommendations for Future Research

This systematic literature review provides valuable insights for elementary and secondary school teachers on the potential of educational technologies for teaching and assessing spoken fluency. It highlights that both students and teachers generally viewed the implementation of education technologies positively in supporting fluency development. However, certain limitations should be acknowledged, as they present gaps in the existing body of knowledge that future researchers could further explore. One key limitation is that this review analyzed only 20 articles from Google Scholar and ERIC, as the researcher, being a prospective doctoral student, lacked access to widely recognized databases. To address this, future studies should incorporate sources from databases such as Web of Science (WoS) and Scopus to enhance the depth and breadth of research findings. Additionally, this review focuses solely on the perspectives of elementary and secondary school teachers and students, making the scope somewhat limited. Future research could include insights from other stakeholders, such as parents and the community. Furthermore, given the growing interest in AI, future studies could compare the scoring and feedback provided by AI with that of teachers to determine their reliability and impact on fluency development. Researchers may also explore other aspects of language beyond fluency, such as functional adequacy. Overall, this systematic review contributes to the existing body of knowledge by shedding light on students and teachers' perceptions in utilizing education technologies for enhancing and assessing spoken fluency.

Contributions of the study

This study addresses critical gaps left by literature on technology-enhanced speaking development. Firstly, it shifts the focus from predominantly adult, university-based research to elementary and secondary school learners by offering developmentally grounded insights into how educational technologies support younger learners' spoken fluency. Next, it documents a clear transition in assessment practices, highlighting the movement from traditional manual scoring toward AI-driven and hybrid models that combine the interpretive strengths of human judgement and the efficiency of automated systems. Essentially, the review also identifies several persistent limitations which include technological constraints, concerns on biasness in regards to language standardization, and the limited integration of AI in younger learner contexts. To add, it reveals that existing research tends to prioritize temporal aspects of fluency, with insufficient attention to broader constructs such as interactional competence. Finally, by synthesizing these findings, the study provides a strong foundation for future research on AI-mediated speaking assessment with more holistic frameworks that goes beyond fluency to include constructs such as functional adequacy and interactive communication.

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Appendix

Supplementary materials for this article can be found online at: https://osf.io/h295d/overview?view_only=2772c9dbde174c9881de83a00346244b