

Digital Social Reading in Second Language Learning and Teaching: Synthesis of Current Research and Pedagogical Practices

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RESEARCH ARTICLE

Digital Social Reading in Second Language Learning and Teaching: Synthesis of Current Research and Pedagogical Practices

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Abstract: Growing interest in digital social reading (DSR) has led to research on the use of social annotations in digital learning, but there is yet to be a comprehensive review specifically on DSR for second language (L2). This paper aims to fill the gap by synthesizing 28 research papers published in English-medium refereed journals from 2010 to 2022 to derive these conclusions: (1) The predominant platforms or applications and text types for DSR were Google Docs, eComma, HyLighter, Perusall, and SocialBook. (2) The main L2 studied was English, and the majority of the studies were conducted at the university level. Activities/tasks/pedagogical practices involved social reading/DSR, social annotation, annotating texts, collaborative reading, and enhancement of reading comprehension, and all studies had positive outcomes for DSR applications. (3) The theories and conceptual foundations for exploring DSR were related to reading, the social aspect of reading, and the digital environment of DSR. Conclusions drawn from the analysis of the data are used to make recommendations in terms of pedagogical practices using DSR to enhance learning and teaching for L2 learners and to highlight theoretical frameworks and areas of research in DSR for educators and researchers.

Keywords: digital social reading, second language, pedagogical practices, theories and conceptual foundations

Introduction

The rapid growth of digital social reading (DSR) has generated interest in concepts and classifications (e.g., Pianzola, 2021), platforms and applications (e.g., Barnett, 2015), and effects of DSR in second language (L2) education (e.g., Blyth, 2014; Thoms & Poole, 2017). Researchers have reviewed social annotation (SA) tools in higher education (Ghadirian & Salehi, 2018) and digital learning (Krouska et al., 2018), but there is yet to be a comprehensive review specifically on DSR in the L2 context. This paper aims to fill the gap by synthesizing current research and pedagogical practices specific to language learning and teaching in terms of types of platforms and applications for social reading and theoretical frameworks underpinning DSR. This paper reviews the literature by defining DSR and studies related to DSR/SA in teaching and learning contexts. Data collection

and analysis are described in the Methodology section before the presentation of the findings. Conclusions drawn from the analysis of the data are used to make recommendations for pedagogical practices in using DSR to enhance L2 learning and teaching. We discuss research implications in terms of types of theoretical frameworks and potential research areas related to DSR that are underexplored.

Literature Review

Defining DSR

Blyth (2014) defines DSR in terms of sharing thoughts regarding a text using “tools such as social media networks and collaborative annotation” (p. 205). It involves the use of digital media like websites, social media, and mobile apps (Pianzola, 2021) and any digital text such as webpages, pdfs, and MS Word documents from web browsers and Google Docs to learning management systems (Egbert et al., 2022). We adopt the definition where DSR is deemed a pedagogical approach enabling technology-mediated collaborative reading. Two or more readers can highlight the same virtual copy of a text available through a digital platform and discuss it via synchronous or asynchronous margin dialogues through a digital interface for specific passages. DSR can involve SA where users “collaboratively highlight important texts, make comments and discuss with each other on the same online document” (Sun et al., 2023, p. 1).

Researchers are increasingly interested in exploring the effects of DSR in the L2 context (Blyth, 2014). In this study, second language is referred to as L2 or “any language (also a third or fourth language) learned in addition to the native language” (Rieder-Bünemann, 2012, p. 2980) or foreign language.

Studies on DSR/SA in Teaching and Learning Contexts

Researchers have utilized various platforms and applications for DSR or digital annotation tools (DAT) and texts in studying DSR/SA and interaction for reading. In first language (L1) learning contexts, in terms of platforms and types of texts for online book reviews, Pianzola et al. (2020) looked at Wattpad, a platform for user-generated stories, including novels,

fanfiction, humor, classics, and poetry, as a resource for literary studies to find social bonding (affective interaction) in reading teen fiction and social-cognitive interaction when reading classics for 13 languages. Barnett (2014) looked at social reading in terms of the platform of Kindle by studying popular highlights in the social highlighting function to categorize comments for fictional and nonfictional books as “inspirational statements, total plot summation statements, famous lines and romantic sentiments” (p. 148). Pianzola et al. (2022) examined Twitter as a platform in the #MattiaTw project involving high school classes in a highly structured DSR activity by doing a quantitative analysis on the number of tweets/retweets generated by participants in terms of intensity of engagement and social interaction in commenting on a literary text. They found sharing of text excerpts through a strong retweeting activity. In terms of applications for DSR, customized annotation systems, or DAT, for SA of texts for comprehension, Chen et al. (2020) looked at a web-based collaborative reading annotation system (WCRAS) with gamification mechanisms to motivate students’ annotation behaviors and promote students’ reading comprehension performance for Chinese in digital reading. Though the experimental group made more high-quality annotations, there was no difference in reading comprehension performance between the control and experimental groups. Léger et al. (2019) investigated high school students’ reading comprehension through four mobile applications for digital annotation. Based on the students’ feedback, an ideal annotation tool allows font size customization and the use of e-annotation tools such as voice recording, note sharing, and hypermedia. Adams and Wilson (2022) analyzed over 400 annotations made on Perusall on three assigned readings by 12 novice teachers in the United States in an MEd program to understand their metacognitive, social, and critical practices during reading. Adam et al. (2023) examined the transactional practices in terms of comprehension strategies, critical literacy, and community of three literacy education graduate students as they read and annotated assigned texts in Perusall, an SA platform.

In L1 contexts, there are studies using platforms such as Wattpad, Kindle, and Twitter and, for DAT, Perusall, WCRAS, and mobile applications with readers and learners reading literary texts or assigned readings and providing anno-

tated comments in their L1. There is yet to be a comprehensive review on DSR platforms or applications and text types in the L2 context.

There are reviews on SA for education in general. For the present study, we looked at two reviews for issues related to SA as they included studies on L2 learning. Firstly, Sun et al. (2023) reviewed 32 studies for trends and issues of SA in education to find a lack of theoretical support for SA, focus on student uses and both cognitive and affective outcomes for SA technological features and activities, preference for self-designed technologies than commercial ones, and nearly all studies reporting positive findings. In terms of level of education, the most preferred setting by SA researchers was higher education (81%), followed by junior high school (13%), high school (3%), and primary school (3%). The review by Sun et al. (2023) has highlighted the need to look at the L2s, educational levels, nature of activities/tasks/pedagogical practices, and outcomes of DSR applications.

Secondly, Zhu et al. (2020) reviewed 39 articles about using Web annotation in K-12 and higher education classrooms for diverse subject areas, course level, and technology use in terms of five types of SA activity design: “processing domain specific knowledge, supporting argumentation and inquiry, improving literacy skills, supporting instructor and peer assessment and connecting online learning spaces” (p. 261). Zhu et al. (2020) identified these 10 studies on SA in online classes in L2: Chen et al. (2010), Chen et al. (2016), Hwang et al. (2011), Lo et al. (2013), Nor et al. (2013), Thoms et al. (2017), Tseng and Yeh (2018), Yeh and Lo (2009), Yeh et al. (2017), and Zhao et al. (2018). In the review by Sun et al. (2023), seven out of 32 studies (21.87%) were about language or literature: poetry, theory of language, English for educational technology, literacy instruction, reading, English reading, argument and persuasion. As our study looks at studies on L2, we have used studies from the two reviews pertaining to SA for DSR in L2 learning (see Methodology for studies included).

Sun et al. (2023) have highlighted a lack of theoretical support for SA studies though most of the studies for L1 reviewed have theoretical basis: reader response theory placing the reader at the center and recognizing the relevance of their responses in annotating (Pianzola et al., 2020), Hayles’s (2010) hyper and deeper attention as a framework for social reading (Barnett, 2014), social constructivist

theory (Chen et al., 2020), sociocultural models of literacy reading (Adams et al., 2023), cognitive load theory to assess types of digital annotations and reading comprehension (Léger et al., 2019), and Rosenblatt’s (1994) transactional theory for readers to build knowledge and understanding of text through annotations (Adams & Wilson, 2022). The present study thus looks specifically at studies on L2 for theories and conceptual foundations to address the gap identified by Sun et al. (2023).

Research Questions

- (1) What are the platforms or applications and text types for DSR?
- (2) What are the L2s, educational levels, nature of activities/tasks/pedagogical practices, and outcomes of DSR applications?
- (3) What are the theories and conceptual foundations used in DSR?

Methodology

This study involves a systematic review which “aims to provide a comprehensive, unbiased synthesis of many relevant studies...[and] attempts to uncover ‘all’ of the evidence relevant to a question” (Aromataris & Pearson, 2014, p. 54). According to Aromataris and Pearson (2014), a systematic review involves questions to be addressed, inclusion and exclusion criteria, a comprehensive search to identify all relevant studies, analysis of data extracted from the included research, and presentation and synthesis of the findings extracted.

Inclusion and Exclusion Criteria

Only research articles written in English and published in English-medium journals from 2010 to 2022 related to DSR in L2 learning and teaching were included. Papers were excluded if the focus was on (1) L1, (2) digital reading without reference to social reading, and (3) theoretical or conceptual papers.

Search

The papers in this study were identified by conducting a systematic search of the literature of the digital resources in our university’s library. The databases used were Scopus, Web of Science, and Google Scholar. The search was conducted using a

combination of the following terms: *digital*, *social*, *social reading*, *social annotation*, *L2 learning*, and *L2 teaching*. From the initial search, we retrieved 220 papers based on titles. We individually performed a first-stage screening looking at abstracts for 220 articles. Based on the first-stage screening of the abstracts, 80 full-text articles were selected for another round of screening. The second-stage screening of full texts was performed by us individually to minimize bias by either reviewer, and we used the following inclusion and exclusion criteria to select 28 articles for synthesis. We included papers (1) pertaining to DSR, (2) relevant to the three research questions, and (3) relevant to teaching and learning using DSR. We included three studies on L2 from Sun et al. (2023), Johnson et al. (2010), Su et al. (2010), and Yang and Lin (2015) and eight studies from Zhu et al. (2020) (because two studies were before 2010 or unavailable in the library database) for the present study focusing on DSR for language learning in terms of SA. Articles not written or available in the English language or those articles not between 2010 and 2022 were excluded. We excluded commentaries, editorials, and review articles. We excluded studies if the language involved in DSR was the participants' L1, if there was only description of theories for DSR, and if the article had no relevance to teaching and learning using DSR in relation to the three research questions (see Figure 1).

The 28 articles were read in detail for coding in terms of content analysis. We coded relevant information in terms of research question focus: Research Question 1: platforms or applications and text types for DSR; Research Question 2: L2s, educational levels, and activities/tasks/pedagogical practices and outcomes of DSR applications; and Research Question 3: theories for exploring DSR (see Table 3 for a summary table for the coding categories). Only excerpts that fitted the three research question focus were extracted from the articles as exemplification(s) (see Table 4 in Appendix for coding samples). Discrepancies in coding were resolved through discussions between the authors. The authors then reviewed and discussed together type of platforms and text types (Table 1), type of platforms, activities/pedagogical practices, and outcomes (Table 2) and country of study, L2, educational levels, platforms/applications/digital annotation tools (DAT), text types, theoretical approaches, focus of study, and outcomes (Table 3).

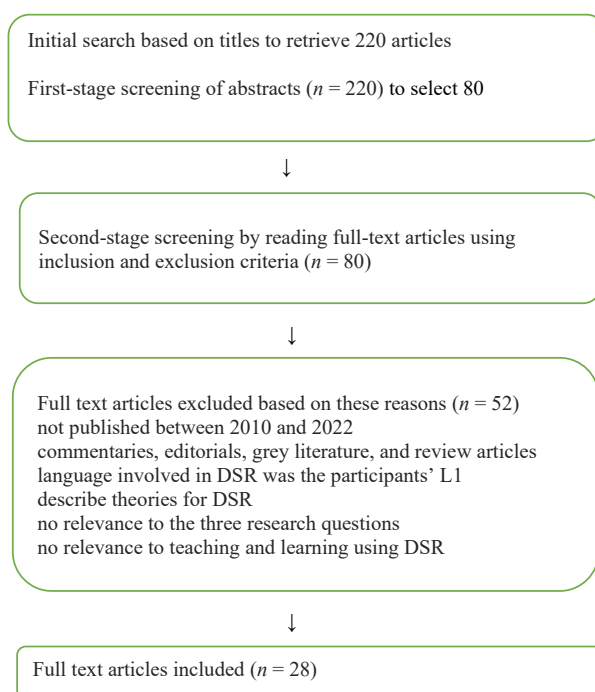


Figure 1. Screening Procedure

Findings

The findings for the 28 studies are presented in terms of the three research questions. The findings pertaining to Research Questions 1, 2, and 3 are summarized in Table 3 in the Appendix.

Research question 1: What are the platforms or applications and text types for DSR?

The findings are reported in terms of the platforms for DSR (see Table 1), functionalities of applications for DSR or DAT and text types (see Table 1 and also Table 3 in the Appendix).

Table 1. Type of Platform or Application and Text Types

Type of Platform or Application	Text Types	Number of Studies
DAT eComma	Song/digital literary texts/poems	3
(DAT) HyLighter	Assigned articles/poems	3
Perusall	Assigned readings/course readings/articles/range of genres	4
Google Documents	Short stories/articles/science texts	5
DAT SocialBook	Scholarly articles/various genres	3
A.nnotate	Expository texts	1
Annotation Tool	Online texts	1
Collaborative digital reading annotation system (CDRAS)	Articles	1
Computer-supported collaborative learning (CSCL)	Reading materials	1
Digital reading annotation system (DRAS)	Textbook	1
Personalized annotation management system 2.0 (PAMS 2.0)	Assigned articles	1
Paragraph Annotator	Six-paragraph essay	1
Tag-based collaborative reading learning system (TACO)	Assigned readings/articles	1
Virtual Pen (VPen)	Textbooks	1
Web-based collaborative reading annotation system (WCRAS-TQAFM)	Two-page digital text	1

Three studies used the DAT eComma—“an open educational resource that allows learners to annotate texts and make comments that others can collectively read in a virtual space” (Thoms et al., 2017, p. 39). Students read and annotated the lyrics of French songs (Law et al., 2020), collaboratively read and annotated short digital literary texts (Thoms et al., 2017), and annotated two poems (Zapata & Morales, 2019).

Three studies used the DAT HyLighter where students read uploaded texts to annotate/make comments and tag aspects such as vocabulary words, grammatical structures, or rhetorical devices (Thoms & Poole, 2017). Thoms and Poole (2017, 2018) used HyLighter for 18 poems that were an appropriate length and roughly the same amount of text. Johnson et al. (2010) used HyLighter in the Social Annotation Model-Learning System (SAM-LS), designed based

on SA, instructional design, team-based learning, and computer-supported collaborative learning (CSCL) frameworks, for 254 multilingual university students to read assigned articles.

Four DSR studies involved Perusall, a browser-based online software for teachers and students that allows reading and annotating readings digitally for free but needs payment for more features. Benedict's (2022) students read and annotated seven short course readings on the Perusall platform, Egbert et al.'s (2022) students read and annotated course articles, Woodward and Neunaber's (2020) students read and annotated assigned readings, and Kohnke and Har's (2022) students read and annotated a range of genres (e.g., fables, short stories, fantasy, graphic novels).

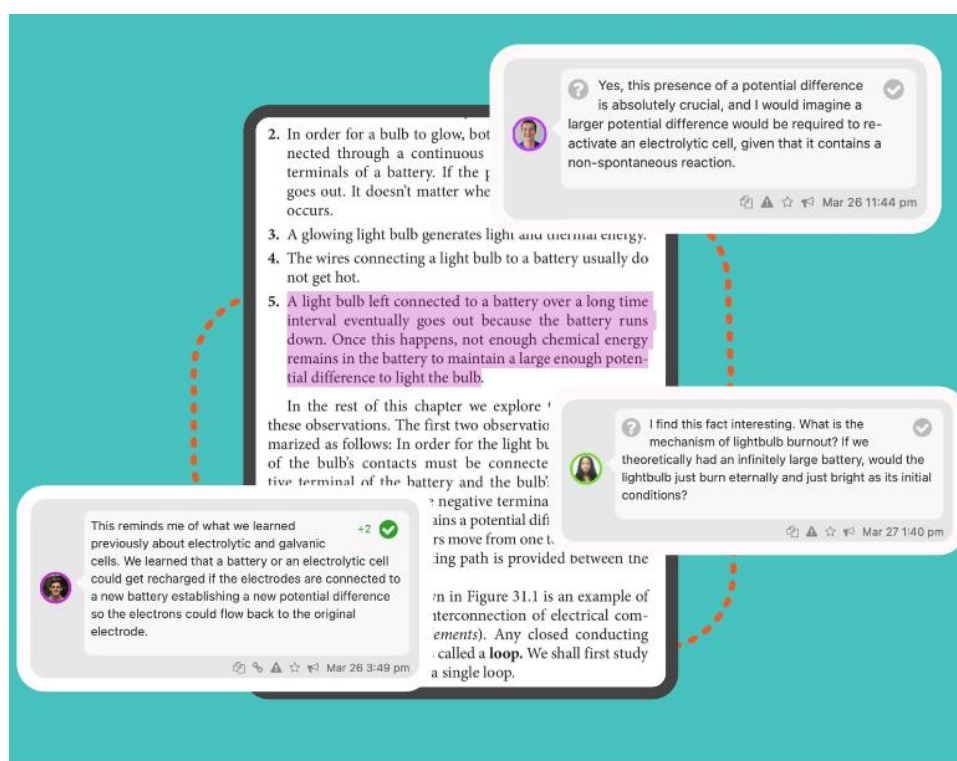


Figure 2. Perusall (Source: <https://www.perusall.com/>)

Five studies involved using Google Documents. Liu and Lan (2016) had students use the Annotation Tool for individual versus group editing of shared Google documents—six articles fewer than 300 words. Li and Lai (2022) used the SA tool Diigo and Google Docs for students to post comments for group analysis of short stories. The three studies on online-based reciprocal teaching (RT) made use of the annotation function of Google Docs to highlight and add comments, share annotated works with hyperlinks, and reply to others' comments or questions (Ningrum & Chakim, 2020). Students practiced RT and annotation using seven science texts (Ningrum & Chakim, 2020); three English articles, each 400–460 words (Tseng & Yeh, 2018); and six assigned articles (Yeh et al., 2017).

Three studies used DAT SocialBook, which allows for annotating through commenting, underlining, and integrating multimedia resources such as uploading images or inserting links (Solmaz, 2020a). The three studies involved students annotating and discussing various genres predetermined by the instructor (Solmaz, 2020a, 2020b) and annotating 11 scholarly articles asynchronously over four months (Burhan-

Horasanlı, 2022).

Tseng et al. (2015) used A.nnotate with these functions: “(1) adding and annotating documents, (2) sharing annotated documents, and (3) organizing annotated documents” (p. 44) for four expository texts of approximately 600 words. The Annotation Tool (Nor et al., 2013) allowed for a “mark-up” function, highlighting, underlining, and inserting prompts such as asking questions, expressing agreement, expressing disagreement, justifying claim, and making short notes, that is, textual annotation and multimedia annotation. Students read four online texts (Nor et al., 2013). Students read assigned articles through a collaborative digital reading annotation system (CDRAS) with these functionalities: create/modify/delete annotations, favorite annotation, and interactive discussion of annotated content (Chen et al., 2016). Yang and Lin (2015) developed CSCL (with annotations for keyword/phrase, topic sentence, other important sentence, and headnote) for ninth graders to read texts (up to 350 words) and write the main ideas using collaborative note-taking strategies.

There was one study on a digital reading annotation system (DRAS) with annotation functionalities of selection of annotation type, underlining, browsing, voting, and highlighting for students to annotate English-language texts from a textbook (Chen et al., 2014). Su et al. (2010) created a personalized annotation management system 2.0 (PAMS 2.0) where annotators could create, edit, and retrieve their own and others' annotations for assigned articles and share in collaborative learning context. The Paragraph Annotator designed by Lo et al. (2013) allows these functionalities for students to analyze paragraph elements of six-paragraph essays and add personal ideas: highlight (topic sentence, controlling idea, and supporting detail), comment, and dictionary. Students read assigned readings through a tag-based collaborative reading learning system (TACO) allowing users to interact and share information regarding their reading material (Chen et al., 2010). Students annotated seven learning activities related to topics in students' textbooks through VPen (Hwang et al., 2011) with a multimedia web annotation system—textual or audio annotation. Jan et al. (2016) designed a web-based collaborative reading annotation system with two quality annotation filtering mechanisms (WCRAS-TQAFM) with these functionalities: create/modify/delete the annotation, mark favorite annotation, set the annotated mode, discuss the annotation for an 80-minute reading activity of a two-page digital text on chemistry with two quality annotation filtering for digital texts.

In terms of functionalities of platforms of applications for DSR or DAT, three studies used DAT eComma and four used Perusall for collaborative reading and annotation while three studies used HyLighter to not only annotate/make comments but also tag aspects such as vocabulary words, grammatical structures, or rhetorical devices. For the five studies using Google Docs, three required annotations based on the reading strategy of RT. Three studies showed DAT SocialBook could integrate multimedia resources such as uploading images or inserting links similar to the Annotation Tool (Nor et al., 2013) for textual annotation and multimedia annotation and VPen—a multimedia web annotation system. Researchers have used other DAT tools such as A.nnotate, DRAS, PAMS 2.0, Paragraph Annotator, CDRAS for interactive discussion of annotated content, CSCL for collaborative note-taking strategies, and TACO for

interacting and sharing information.

There was a wide range of types of texts (see Table 1) ranging from songs, literary texts (poems, fables, short stories, fantasy, graphic novels, short stories), to expository texts (assigned readings, articles, science texts, scholarly articles), and most of these texts were assigned based on courses taught to the students. Though not all the authors stated the length of the texts used, most of the texts used ranged from 200 to 600 words (such as eComma using 226-word short digital literary texts or 245- and 455-word poems) with a few lengthy ones such as a two-page digital text on chemistry for WCRAS-TQAFM (Jan et al., 2016) and 11 scholarly articles for SocialBook (Burhan-Horasanlı, 2022).

Research question 2: What are the L2s, educational levels, and activities/tasks/pedagogical practices and outcomes of DSR applications?

The findings for Research Question 2 are reported in terms of L2s, educational levels, and the outcomes (operationalized as positive, negative, or mixed, i.e., both positive and negative) for focus of the studies pertaining to activities/tasks/pedagogical practices related to DSR (see Table 2).

L2 types

In terms of L2 studied (see Table 3 in the Appendix), there were 23 studies on English (82.1%), three on Spanish (10.7%), one on French (3.6%), and one on Chinese (3.6%).

Educational levels

For educational levels (see Table 3 in the Appendix), there was one study (3.6%) for primary/elementary or Grades 1–6, four studies (14.3%) for secondary/high school or Grades 7–12, and 23 studies (82.1%) for university (undergraduate, college, graduate, postgraduate).

Activities/tasks/pedagogical practices and outcomes of DSR applications

Table 2. Summary of Activities/Tasks/Pedagogical Practices and Outcomes

Type of Platform or Application	Activities/Tasks/Pedagogical Practices	Outcomes	Number of Studies
DAT eComma	Social reading/digital social reading	Positive: in-depth understanding Negative: majority of the annotations were literary affordances but social engagement decreased over time; queries about the meaning of vocabulary but frustrations with some technical aspects	3
(DAT) HyLighter	Reading comprehension, critical thinking, and metacognitive skills; learner–learner interactions	Mixed: literary and social affordances outnumbered the linguistic affordances; with increased lexical density, annotations with literary affordances decreased; better on reading comprehension and metacognitive skills, but not critical thinking; support for learning in focusing on text but challenges with DSR use such as the need to check new posts	3
Perusall	Social reading, course readings/articles, interactive reading, text comprehension	Positive: help for difficult words or confusing passages; motivation to complete reading assignments and deeper comprehension of texts; developing advanced reading skills and critical thinking skills	4
Google Documents	Social annotation, collaborative writing, reciprocal teaching strategy	Positive: vocabulary gains and motivation; quality of the text co-constructed by each group; enhancement in reading comprehension	5
DAT SocialBook	DSR annotations for academic language use, digital annotations	Positive: socialized into discipline-specific terminology, academic writing and educational research design, diverse networks, discourses, and genres; gains in reading, writing, and vocabulary	3
A.nnotate	Online annotations	Positive: helped students comprehend the online text	1
Annotation Tool	Annotating texts	Positive: read assigned online materials in a more structured and systematic manner	1

Collaborative digital reading annotation system (CDRAS)	Collaborative reading	Positive: reduced reading anxiety	1
Computer-supported collaborative learning (CSCL)	Annotate keyword/phrase, topic sentence	Positive: progress in note-taking strategies for text comprehension	1
Digital reading annotation system (DRAS)	Enhance reading performance	Positive: improve comprehension and reading annotation	1
Personalized annotation management system 2.0 (PAMS 2.0)	Annotating text	Positive: positive relationship between learning achievements and quantity of annotations	1
Paragraph Annotator	Reading comprehension	Positive: did significantly better on both cued and free recall tests	1
Tag-based collaborative reading learning system (TACO)	Collaborative reading comprehension	Positive: significant improvement in reading scores	1
Virtual Pen (VPen)	Multimedia web annotation	Positive: students' actual VPen usage correlated significantly with speaking and writing performance	1
Web-based collaborative reading annotation system (WCRAS-TQAFM)	Reading and annotation filtering mechanism	Positive: reading performance of readers who used the high-grade annotation filter was significantly better	1

Note. DSR = digital social reading.

Two of the three studies using DAT eComma reported mixed outcomes with one positive in outcomes. The positive study was by Zapata and Morales (2019) looking at the instructional benefits of DSR application for 44 L2 Spanish university students to find the textual and multimodal interpretations in students' annotations were indicative of in-depth understanding of the two Spanish poems. As for mixed outcomes, 215 students in a beginning university French course in the study by Law et al. (2020) used the DAT eComma to annotate six songs over three months. The authors did a quantitative analysis of 5,065 annotation tokens following the classification (linguistic, literary, or social) by Thoms and Poole (2017) to find the majority of the annotations were literary affordances meaning "any discursive move

that expresses insights related to textual analysis" (Thoms & Poole, 2018, p. 43), followed by linguistic affordances meaning "any discursive move that provides explicit linguistic information to the learner" (Thoms & Poole, 2018, p. 43). Social engagement, as measured by the frequency of questions and replies as well as word count, decreased over time. Thoms et al. (2017) looked at eComma to facilitate L2 reading for 11 undergraduate students. The results indicated that students predominantly used DSR to make queries about the meaning of vocabulary/Chinese characters for the Chinese digital literary texts. Drawbacks included students' frustrations with some technical aspects of the eComma tool and how to bridge DSR experiences outside of the class and in class.

All three studies using DAT HyLighter had mixed

outcomes. Thoms and Poole (2017) looked at 15 Spanish major undergraduate students collaboratively reading and annotating poems for linguistic, literary, and social affordances using HyLighter to find literary and social affordances outnumbered the linguistic affordances in students' threaded discussions. In the study on the incorporation of DSR in L2 environments by Thoms and Poole (2018), 15 undergraduate students collaboratively read 18 Spanish poems via HyLighter over a four-week period. Findings revealed that with increased lexical density in the poems, the number of annotations with literary affordances decreased. Johnson et al. (2010) developed the Social Annotation Model-Learning System (SAM-LS), an SA computer-supported and collaborative learning tool, and HyLighter, for 254 multilingual university students to increase engagement with selected essays and with classmates. When SAM-LS activities included small team collaborations, students did better on reading comprehension and metacognitive skills, but not critical thinking.

All five DSR studies using Google Documents reported positive outcomes. The English as Foreign Language (EFL) university students and the collaborators in the study by Liu and Lan (2016), who were subdivided into 10 small groups of 3 or 5 and who could edit and share the same documents using Google Docs, performed better than the individuals in terms of vocabulary gains and motivation to acquire knowledge and practice annotation using Google Documents. Li and Lai (2022) examined the use of an SA tool (Diigo) and online collaborative writing (Google Docs) for 27 EFL undergraduates from Hong Kong to find the quality of the text co-constructed by each group was significantly higher than those created using Moodle's forum. Three studies on RT using the annotation functions of Google Documents reported positive outcomes. Ningrum and Chakim (2020) found enhancement in reading comprehension for 69 EFL secondary students in online-based RT with Google Documents for reading science texts. Students highlighted texts, made comments, and shared annotated texts with hyperlinks. Low-achieving EFL undergraduates of the study by Tseng and Yeh (2018) reported the two most useful RT strategies as questioning and predicting to promote successful collaborative reading while summarizing and clarifying were the least useful because of their limited language proficiency. The 54 English language

university learners in the study by Yeh et al. (2017) read six assigned articles and completed online annotations using the Google Docs annotation tool based on RT procedure and the intervention enhanced their reading comprehension.

For the four studies on using Perusall for DSR, three reported positive outcomes with one reporting mixed results. Benedict's (2022) 45 EFL university students read and annotated seven short readings assigned. When surveyed, participants reported these as benefits for Perusall: help for difficult words or confusing passages, motivation to complete reading assignments and deeper comprehension of texts. Woodward and Neunaber (2020) used Perusall in advanced and academic ESL reading classes with scaffolding of annotating activities based on the level of text difficulty, and all students found the use of Perusall valuable in promoting text comprehension through active engagement and collaboration. Students used the Perusall platform for pre-class readings, highlighting and annotating text, and critically discussing and answering questions in the study by Kohnke and Har (2022). The majority of the students in the study deemed Perusall effective in developing advanced reading skills and critical thinking skills as Perusall increased engagement with texts and encouraged critical discussion through interactive reading tasks. For the mixed results, in terms of engagement in DSR, Egbert et al. (2022) looked at "who read, for how long, what parts of the articles were most read, and how many annotations (comments/ questions/ replies/ upvotes students made)" (p. 95) by 39 international graduate participants. These participants reported support for learning in focusing on text and emphasizing content through interaction. All participated in annotating the texts although the amount and type of comments differed. Eighteen comments talked about challenges with DSR use such as the need to check new posts.

All three DSR studies using DAT SocialBook reported positive outcomes. Burhan-Horasanlı (2022) studied academic discourse socialization for nine multilingual doctoral students in an L2 acquisition program in the U.S. when they annotated 11 scholarly articles asynchronously over four months to find them socialized into 1) discipline-specific terminology, 2) conventions of academic writing, and 3) educational research design. Solmaz's (2020a) study investigated digital annotations for the integration of SocialBook into an advanced EFL reading course for 12

undergraduate students to find participants perceived gains in reading, writing, and vocabulary. Learners' reflection journals highlighted learners' engagement within collaborative reading environments had to do with the quality of posts rather than mere quantity. Solmaz (2020b) found L2 learners in a university-level advanced reading course were socialized into diverse networks, discourses, and genres as benefits in L2 university learners' collaborative reading practices in a DAT system.

Tseng et al. (2015) reported the positive effects that an online annotation system, A.nnotate, had on reading comprehension for 50 EFL Taiwanese university students at surface-based, text-based, and situation-based levels, respectively. The core annotations that helped students comprehend the online text were marking text information and adding summary notes to each paragraph. The study by Nor et al. (2013) found 81 university students using the Annotation Tool read the assigned online materials in a more structured and systematic manner with facilitation of textual annotations, sharing of online notes, and discussion of online reading materials.

Chen et al. (2016) found collaborative annotation through a personalized reading anxiety prediction model (PRAPM) in a CDRAS reduced reading anxiety with an online instructor's support. Chen et al. (2014) combined self-regulated learning (SRL) with a digital reading annotation system (DRAS) to enhance Grade 7 students' ability to generate rich and high-quality annotations collaboratively to significantly improve their comprehension and reading annotation abilities. In the study by Yang and Lin (2015), the experimental group using CSCL made greater progress in note-taking strategies to comprehend the texts through clarifying and reflecting on reading and writing difficulties. Su et al. (2010), looking at 86 computer science major university students' knowledge sharing in collaborative learning environments, found a positive relationship between learning achievements and quantity of annotations in their PAMS 2.0.

To enhance EFL reading comprehension, Lo et al. (2013) examined the effects of Paragraph Annotator on 32 EFL Taiwanese university readers' ability to annotate paragraph elements such as topic sentences and supporting details on web pages. Students using Paragraph Annotator while reading English texts online did significantly better on both cued and free recall tests. The 56 EFL high school students in the study

by Chen et al. (2010) using annotations or TACO showed significant improvement in reading scores which were attributed to peer discussion activities and rereading when their tags received low scores. Jan et al. (2016) developed a web-based collaborative reading annotation system (WCRAS-TQAFM) to promote the reading performance of 97 senior high school Taiwanese students. The digital reading performance of readers who used the high-grade annotation filter was significantly better than those who read all annotations in all question types (i.e., recall, main idea, inference, and application). The 27 third-grade EFL students in the study by Hwang et al. (2011) generally had a positive attitude toward using VPen, a multimedia web annotation system. The students read the learning material, searched for a picture, and described the picture by adding textual annotations. Students' actual VPen usage correlated significantly with speaking and writing performance.

In summary, all 28 studies on diverse platforms and applications have highlighted mainly benefits of DSR as outcomes such as collaborative reading through annotations (textual or multimedia) with only five studies highlighting issues (see Table 2). Activities/tasks/pedagogical practices involved social reading/DSR, SA, annotating texts, collaborative reading, and enhancement of reading comprehension.

Research question 3: What are the theories and conceptual foundations for exploring DSR?

In terms of theories and conceptual foundations, researchers for DSR have utilized theories related to reading: the construction integration model, critical thinking, metacognitive skills, reading comprehension, cognitive-load theory (CLT), critical engagement, DSR, The New London Group's (1996) multiliteracies pedagogy, online reading, reading anxiety, RT Strategy (RTS) based on Palincsar and Brown (1984), SRL, and task engagement framework.

They have looked at the social aspect of reading: cooperative/collaborative learning, ecological theoretical perspectives on L2 learning, sociocultural theory, social reading, L2 socialization, language socialization theory for academic discourse socialization (Burhan-Horasanlı, 2022), SA and collaborative writing for knowledge co-construction through SA and online collaborative writing (Li & Lai, 2022).

There are also researchers focusing on the digital environment of DSR: CSCL, Computer- Assisted

Language Learning (CALL) for multimedia web annotation system and its effect on the EFL writing and speaking performance (Hwang et al., 2011), web-based collaborative learning for knowledge sharing in collaborative learning environments (Su et al., 2010), and collaborative learning for online collaborative note-taking strategies (Yang & Lin, 2015).

Discussion

Similar to the review of 32 studies (Sun et al., 2023) for trends and issues of SA in education, studies reviewed in our study have focused on cognitive and affective outcomes for SA technological features and activities with all the 28 studies highlighting the benefits of DSR despite mixed results for five studies. Our study has surfaced 17 more studies on DSR for L2 teaching and learning having used 11 studies from the reviews—three from Sun et al. (2023) and eight from Zhu et al. (2020). However, most of the studies have theoretical support for SA unlike the findings for Sun et al. (2023).

For Research Question 1, in terms of platforms, functionalities of applications for DSR or DAT, the present studies have shown these as predominant: Google Docs (five studies), eComma (three studies), HyLighter (three), Perusall (four studies), and SocialBook (three studies). There were 10 studies involving customized annotation systems not commercially available such as A.nnotate for collaborative reading through annotation/making comments or tagging vocabulary words, grammatical structures, or rhetorical devices.

The study has revealed how a wide range of types of texts ranging from songs, literary texts, to expository texts could be used for DSR based on courses taught to the students (see Table 1 for types of text used). However, most of the texts used ranged from 200 to 600 words (see Table 3 in the Appendix) probably because of the limit of the DSR platforms or applications used or the limited proficiency level of L2 students.

For Research Question 2, in terms of L2 (see Table 3 in the Appendix), studies were mainly on English (23 studies or 82.1%), three were on Spanish (10.7 %), one was on French (3.6%), and one was on Chinese (3.6%). Though DSR can be used across a variety of L2 learning and teaching contexts (e.g., primary, secondary, and higher education), analysis of educational levels has revealed that the majority

of the studies (82%) were conducted at the university level, similar to the review by Sun et al. (2022) where 81% of the 32 studies were conducted at the university level. Activities/tasks/pedagogical practices involved social reading/DSR, SA, annotating texts, collaborative reading, and enhancement of reading comprehension.

For Research Question 3, a range of theories (see findings for Research Question 3) were used which could be grouped in terms of reading theories (e.g., metacognitive skills, reading comprehension, RTS, SRL, multiliteracies pedagogy), social aspect of reading (e.g., cooperative/collaborative learning, ecological theoretical perspectives, DSR, L2 socialization, sociocultural theory), and the digital environment for DSR (e.g., CALL, online collaborative writing web annotation system). This highlights the complexity of studying DSR as researchers can choose to focus on one theory or multiple theories. Even if researchers focus on one aspect such as reading comprehension, reading can be studied in terms of test scores for improvement of reading comprehension, types of annotations in the act of reading, or the teaching of reading strategies such as RT or multiliteracies. There were few studies on multiliteracies pedagogies (The New London Group, 1996) as Law et al. (2020) stated explicitly multiliteracies pedagogies as the theory though there are multimedia annotations such as VPen.

Teaching implications

In terms of using DSR to enhance L2 learning and teaching, educators can consider adopting these more prevalent DSR platforms/applications based on teaching needs: Google Docs, eComma, HyLighter, Perusall, and SocialBook. For instance, eComma and Perusall could offer help for difficult words or confusing passages, HyLighter could develop reading comprehension and metacognitive skills, SocialBook could be used for academic discourse socialization through annotating, and reading comprehension could be enhanced using the annotation function of Google Docs through the reading strategy of RT for secondary students (Ningrum & Chakim, 2020) and university learners (Tseng & Yeh, 2018; Yeh et al., 2017).

Though the study has surfaced useful DSR applications, 10 of the applications are not commercially available. Some examples are A.nnotate for reading at surface-based, text-based, and situation-based levels (Tseng et al., 2015); the PRAPM used to forecast reading anxiety levels of learners for instructors to

apply appropriate reading strategies to reduce reading anxiety (Chen et al., 2016); and Paragraph Annotator to enable EFL students to learn paragraph structure (Lo et al., 2013).

Recommendations for future research directions

For research into L2s for DSR, as the studies were mainly about English, more studies could be about other languages (e.g., Chinese, Spanish, and French reviewed in the study) given that DSR can be used across a variety of L2 learning and teaching contexts. Since most of the studies were conducted at the university level, there could be more studies for primary and secondary levels.

There could be more studies on types of annotations such as annotation token classification (linguistic, literary, or social) by Thoms and Poole (2017) to enable educators to understand the affordances of different annotations. More studies could be on multimedia annotations (images, links) as in SocialBook, VPen, and the Annotation Tool. Most of the studies looked at annotations for texts not exceeding 600 words (other than a two-page digital text and 11 scholarly articles), so future studies can be on longer texts. However, given the vast amount of annotations generated with multiple texts and many users working individually, in pairs or groups, systems have to be developed for quantifying and categorizing the annotations immediately into predetermined categories for educators to apply in teaching practice.

Studies can compare and contrast the affordances of different platforms or applications for DSR for different groups of learners. For instance, SocialBook was used for academic discourse socialization through annotating scholarly articles asynchronously (Burhan-Horasanlı, 2022) and socialization into diverse networks, discourses, and genres (Solmaz, 2020b) besides enabling gains in reading, writing, and vocabulary (Solmaz, 2020a). eComma could be explored for contrasting English and French/Chinese/Spanish as comparative analysis of DSR for multilingual learners. Researchers using customized annotation systems could make their systems available for use by those interested such as a tag-based collaborative reading learning system (TACO) for users' interaction and sharing of information regarding their reading (Chen et al., 2010) or SRL with a CDRAS

to enhance comprehension and reading annotation abilities (Chen et al., 2016).

In terms of types of theoretical frameworks for research, researchers can consider the wide range of theories reviewed. There could be more research on certain theories. For instance, only Law et al. (2020) looked at multiliteracies pedagogies (The New London Group, 1996), and given the prevalence of research into multiliteracies, there can be more research into multimedia/multimodal annotations. Other than multiliteracies, future studies can look into task engagement framework, SRL, and ecological theoretical perspectives. Researchers can study why SAM-LS improved reading comprehension and metacognitive skills, but not critical thinking.

Conclusion

This study has looked at 28 studies on DSR in L2 to inform researchers about types of platforms and applications for DSR (such as Google Docs, eComma, HyLighter, Perusall, SocialBook, A.nnotate, VPen, the Annotation Tool) for collaborative reading through annotations which could be textual or multimedia. Future studies can compare and contrast the affordances of different platforms or applications for DSR as well as devise a system to classify the different annotations such as annotation token classification (linguistic, literary, or social) by Thoms and Poole (2017). Findings from this review have revealed how DSR can be used as pedagogical practice to enhance reading comprehension through RT, collaborative note-taking strategies through CSCL, or interactive discussion of annotated content through DRAS and CDRAS. Regardless of the platforms and applications, all 28 studies have highlighted mainly benefits of DSR (see Table 2 for outcomes) though the majority of the studies (82%) were conducted at the university level—pointing to the need for more studies for primary and secondary levels. As studies were mainly on English (82.1%) as L2, there could be more research on other languages such as Spanish, French, and Chinese. The study has surfaced diverse theoretical frameworks in relation to reading theories (e.g., metacognitive skills, RTS), social aspect of reading (e.g., L2 socialization, sociocultural theory), and the digital environment for DSR (e.g., CALL).

In terms of limitations of the review, we focused only on empirical studies published in peer reviewed

journals and conference proceedings. Book chapters, nonempirical theoretical papers, and unpublished doctoral dissertations were excluded. We also excluded papers not written in English. The comprehensiveness of the review could be limited by such exclusions.

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Appendix

Table 3. Summary Table—Country of Study, L2, Educational Levels, Platforms/Applications/Digital Annotation Tools (DAT), Text Types, Theoretical Approaches, Focus of Study, and Outcomes ($n = 28$)

Authors	Country of Study	L2s	Educational Levels	Platform, Application, Digital Annotation Tools (DAT)	Text Types	Theoretical Approaches	Focus of Study	Outcomes
Benedict (2022)	Japan	English	EFL university	Perusall	7 short assigned readings	Computer-supported collaborative learning (CSCL)	Social reading increases comprehension of difficult texts and motivate reading	Positive
Burhan-Horasanlı (2022)	USA	English	Multilingual graduate	SocialBook	11 scholarly articles	Language socialization theory	DSR annotations for academic language use	Mainly positive
Chen et al. (2014)	Taiwan	English	Grade 7	Digital reading annotation system (DRAS)	Textbook	Self-regulated learning (SRL)	SRL and DRAS to enhance reading performance	Positive
Chen et al. (2010)	Taiwan	English	EFL high school	Tag-based collaborative reading learning system (TACO)	Assigned readings/articles	Cooperative/ collaborative learning	Collaborative reading comprehension	Positive
Chen et al. (2016).	Taiwan	English	EFL Grade 7	Collaborative digital reading annotation system (CDRAS)	Articles based on General English Proficiency Test	Collaborative reading, reading anxiety	Forecast reading anxiety based on individual learners' reading annotation behavior	Positive
Egbert et al. (2022)	USA	English	International graduate	Hypothes.is, Perusall app	Course readings/articles	Task engagement framework	Who read, for how long, most read, and number of annotations	Mixed
Hwang et al. (2011)	Taiwan (X pictures for story writing)	English	EFL third grade	Virtual Pen (VPen)	Textbooks	Computer-assisted language learning (CALL)	Multimedia web annotation system to improve writing and speaking performance	Positive
Jan et al. (2016)	Taiwan	English	EFL high school	Web-based collaborative reading annotation system (WCRAS-TQAFM)	Two-page digital text on chemistry	Reading, cognitive-load theory (CLT), cooperative/ collaborative learning	Annotation filtering mechanisms to promote reading	Positive

Johnson et al. (2010)	USA	English	University diverse linguistic and literacy backgrounds	Social Annotation Model-Learning System (SAM-LS), HyLighter	Assigned articles	Reading comprehension, critical thinking, and metacognitive skills	Individual and team annotation effects on students' reading comprehension, critical thinking, and metacognitive skills	Mixed
Kohnke and Har (2022)	Hong Kong	English	EFL university	Perusall	Range of genres (e.g. fables, short stories, fantasy, graphic novels)	Critical engagement, reading	Engagement with texts and interactive reading tasks	Positive
Law et al. (2020)	USA	French	French as foreign language university	DAT eComma	Song—longest 226 words	Multiliteracies approach, social reading	Interactional patterns in social reading—social engagement	Mixed
Li and Lai (2022)	Hong Kong	English	EFL university	Social annotation tool (Diigo) and Google Docs	Two short stories	Social annotation, collaborative writing	How Diigo and online collaborative writing affect students' learning outcomes	Positive
Liu and Lan (2016)	Taiwan	English	EFL university	Google Docs	Six articles—fewer than 300 words	Social constructivism	Motivation, vocabulary gain, and perceptions on using Google Docs	Positive
Lo et al. (2013)	Taiwan	English	EFL university	Paragraph Annotator	Six-paragraph essay	Reading comprehension	The effect of Paragraph Annotator on reading comprehension	Positive
Ningrum and Chakim (2020)	Indonesia	English	EFL secondary	Google Documents	Seven science texts ranging from 150 to 350 words	Reciprocal teaching strategy (RTS)	Whether RTS with annotation enhances comprehension	Positive
Nor et al. (2013)	Malaysia	English	EFL university	Annotation tool	Four online texts	Online reading	What annotation tools are used for and type of annotations	Positive
Solmaz (2020a)	Turkey	English	EFL university	SocialBook	Various genres	Second language socialization	Nature of L2 learners' engagement through digital annotations	Positive

Solmaz (2020b)	Turkey Various genres	English	EFL university	SocialBook	Various genres	Second language socialization	Comments in the DAT	Positive
Su et al. (2010)	Taiwan	English	English as medium of instruction (EMI) university	Personalized annotation management system 2.0 (PAMS 2.0)	Assigned articles	Collaborative and Web-based collaborative learning	Effects of different annotation sharing on quantity of annotation and its influence on learning achievements	Positive
Thoms and Poole (2017)	USA	Spanish	University (Spanish as second or foreign language)	DAT HyLighter	18 poems that were an appropriate length	Ecological theoretical perspectives on L2 learning	Learner–learner interactions and linguistic, literary, and social affordances	Mixed
Thoms et al. (2017)	USA	Chinese	ESL university	eComma	Short digital literary texts	Sociocultural theory	Linguistic and pedagogical benefits and challenges	Mixed
Thoms and Poole (2018)	USA	Spanish	University (Spanish as second or foreign language)	DAT HyLighter	18 poems that were an appropriate length	Ecological theoretical perspective	How linguistic characteristics affect the nature of learners' annotations and how annotations change over time	Mixed
Tseng and Yeh (2018)	Taiwan	English	EFL university	Google Docs	Three English articles—each 400–460 words	Reciprocal teaching (RT)	Whether RT strategies with annotation improve low-achieving students' English reading comprehension	Positive
Tseng et al. (2015)	Taiwan	English	EFL university	A.nnotate	Four expository texts approximately 600 words	Construction integration model	Online annotations to scaffold reading comprehension at different levels	Positive
Woodward and Neunaber (2020)	USA	English	ESL university	Perusall	Assigned readings	—	Text comprehension through active engagement and collaboration	Positive

Yang and Lin (2015)	Taiwan	English	Ninth grade	Computer-supported collaborative learning (CSCL)	Reading materials (up to 350 words)	Collaborative learning	Annotate keyword/phrase, topic sentence, headnote as collaborative note-taking strategies	Positive
Yeh et al. (2017)	Taiwan	English	EFL university	Google Docs	Six articles	Reciprocal teaching (RT)	Online annotations based on the RT procedure	Positive
Zapata and Morales (2019)	USA	Spanish	L2 Spanish university	eComma	245- and 455-word poems	Digital social reading	Participants digital annotations	Positive

Note. DSR = digital social reading, L2 = second language.

Table 4. Coding Samples

Categories	Coding	Evidence From Article/Internet
Authors	Benedict (2022)	
Country of study	Japanese	Japanese university classroom
L2s	English	The course was primarily taught in English and required students to read seven short English language readings on Perusall.
Educational levels	EFL university	Japanese university classroom
Platforms/applications (C = commercial)	Perusall (C)	Perusall is a free browser-based online software.
Pedagogical activities and texts	Read to annotate assigned readings	Read seven short English language readings on Perusall
Theoretical approaches	Computer-supported collaborative learning (CSCL)	When used effectively, the use of computers and online technology for social reading and annotation, also referred to as computer-supported collaborative learning (CSCL), has many benefits for students (Roberts, 2005).
Outcomes	Positive	Suggests that use of digital social reading and annotation software can help motivate students to complete reading assignments and is effective in encouraging collaborative learning.

Note. L2 = second language.

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Statement of Originality

The authors of this manuscript attest that this work is the result of original study, that it is not currently under review in other journals, that it was not published before in any format except in abstract form in conferences/university repositories. The authors have properly cited and referenced all the readings.

Declaration of Conflict of Interest

The authors of this manuscript declare that they have no conflicts of interest.

Declaration of AI Use

The authors have not used any AI tools or technologies to prepare this article.