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Multimodal composing and L2 learning: Rationales, empirical evidence, and future research agendas

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Abstract

This paper extends the inquiry into the language learning affordances of multimodal composing through a critical examination of past theoretical and empirical developments in the domain. It starts with an overview of a controversy related to theoretical positions on the language learning potential of multimodal writing. This is followed by a research synthesis of the theoretical frameworks, aims, methods, and findings of the relevant empirical research. It is concluded that research insights robustly support the centrality of linguistic processing in individual and collaborative multimodal writing conditions, which, in turn, appears to be the result of an intricate interplay of writer-internal and task-related factors. On the basis of this analysis, substantive and methodological directions for future empirical initiatives are proposed, crucially including a greater focus on language learning gains, as opposed to the prevailing emphasis on effects on performance.

Keywords: attention; second language learning; second language writing; linguistic processing; multimodal writing

1. Introduction

Multimodal composing has emerged as a robust topic of inquiry, as attested by the copious research accounted for in comprehensive reviews of multimodal writing (MMW) scholarship (see Introduction to the special issue). This upsurge of research has generated a rich body of empirical evidence on the outcomes and impact of MMW, which Yu et al. (2024, p. 2) have helpfully summarized as follows:

> Empirical research has demonstrated that DMC [digital multimodal composing] has the potential to offer students a range of benefits, which include heightened genre and audience awareness, enhanced semiotic awareness, improved critical thinking skills, facilitated identity construction, and more nuanced emotional expression.

Collectively, the accumulated empirical insights constitute notable scholarly responses to the key theoretical and applied concerns that prompted and have since guided research in the domain. However, a central concern in any discussion of the affordances of MMW ought to be its language learning potential. Yet, as noted by Kessler (2024) in his review of research up to 2022, "investigations of outcomes and evidence of learning are the least robust" (p. 45). Jiang and Hafner (2024) have similarly concluded that "research on the linguistic benefits of DMC remains limited" (p. 4).

This is not an ideal scenario from a dual perspective. First, from a writing angle, the goals and purposes of learning and teaching writing do vary across "learning to write" and "writing to learn language" instructional settings (Manchón, 2011, 2020; Manchón & Roca de Larios, 2023). I would argue that some of the attested/perceived affordances of MMW referred to above (e.g., those related to identity construction, creativity, or emotional expression) in effect may not be the most relevant ones the further we move away from academic contexts primarily concerned with scaffolding second language (L2) writers in the development of their academic writing competences. There are other equally relevant instructional settings (such as language programs that include a writing component) where it might be more pedagogically relevant to investigate whether or not MMW (in and by itself, or as compared to monomodal writing), *in addition to any other potential relevant affordances*, does bring about *language learning benefits,* why, how, and for whom. Second, from a second language acquisition (SLA) perspective, if we assume the centrality of literacy practices in instructed SLA (Manchón & Roca de Larios, 2023), a pertinent empirical question is to elucidate which forms of written literacy practices (multimodal or otherwise) are more conducive to advancing language competences.

Given the previous considerations, the current paper pursues the ultimate aim of ascertaining where this vibrant field of inquiry is and where it needs to go

in the search for valid answers to theoretically – and pedagogically – relevant questions on the connection between MMW and L2 learning. To frame the discussion, the paper starts with a controversy in the field regarding rationales for such potential language learning affordances. I would like to take this opportunity to revisit the cognitively oriented arguments articulated by Manchón (2017) in her response to Belcher's (2017) contribution to a Disciplinary Dialogues piece on multimodality and L2 writing published in the *Journal of Second Language Writing* in 2017. These arguments have been differentially (and at times not fully accurately) interpreted in the literature, which has led to a somewhat partially distorted perspective of her position. The rest of the article provides a synthetic review of the empirical strands within MMW research that have addressed the connection between multimodal writing and L2 learning. In line with benchmarks for contemporary research in language learning studies (as also exemplified in Kessler's contribution to this special issue), I adopt a research synthetic approach to ensure the systematicity and replicability of the analysis. On the basis of this review, substantive and methodological directions for future research agendas investigating multimodal composing as a potential site for L2 learning are outlined.

2. Multimodal composing and L2 learning: The controversy

The *Journal of Second Language Writing* published in 2017 a Disciplinary Dialogues (DD) piece entitled "Perspectives on multimodal composition," whose aim was to explore and stimulate disciplinary conversations on "challenges and unresolved issues" of "multimodal literacy and its implications for L2 writing research and instruction" (Xu & Matsuda, 2017, p. 79). It featured an anchor piece by Belcher (2017), and several responses by a number of scholars representing "different theoretical and disciplinary perspectives" (Xu & Masuda, 2017, p. 79). Manchón's (2017) contribution constituted the only response on the impact of MMW on language learning, which justifies its detailed analysis below.

2.1. Belcher's (2017) position

Belcher (2017) addressed three global questions in her anchor piece, of which the most relevant one for the present discussion is "Why should a multimodal design perspective on writing be viewed as especially valuable for literacy and language learners, and L2 writers in particular?" (p. 80). As part of Belcher's (2017) answer to this global question, worthy of consideration are her arguments regarding the "opportunities for growth that multilingual design presents . . . language learners"

(p. 82). Her suggested "digitally-enabled" affordances included a positive impact on: (i) L2 learner traits, such as increased sense of self-efficacy or autonomy; (ii) language learning-use opportunities, especially in terms of potential engagement in more naturalistic and authentic communicative interaction with a wider range of L2 users; and (iii) engagement in critical language learning processes, especially noticing processes (a potential effect mentioned only in passing). This tripartite set of affordances were part of Belcher's (2017) suggested global impact of multimodal writing, which she formulated in terms of how the "huge semiotic toolkit" made available by multimodal composing can empower L2 users "with an appealing array of learner-centric, autonomy-motivating, voice-enhancing, audience-engaging options" (p. 84).

2.2. Manchón's (2017) response and subsequent interpretations

In view of some of the concerns raised in the review of this paper, it is important to note at the outset that Manchón's (2017) response was approached exclusively from an SLA perspective, which differs substantially from multimodality theoretical and empirical work approached at the intersections of L2 writing, composition, and education. More precisely, her response was grounded in SLA-oriented theoretical formulations of the connection between L2 writing (in general, not just multimodal writing) and L2 learning. Importantly, her argumentation did not question or problematize Belcher's (2017) suggested global affordances of MMW at any point. Instead, her response theorized the connection between multimodality and language learning through the lens of the processing dimension of composing. Accordingly, Manchón (2017) argued that whether or not multimodal composing results in L2 learning gains "would be critically dependent on whether or not the authentic, motivating, multimodal tasks that facilitate transfer to the real world" that Belcher (2017) discussed "do entail and foster linguistic processing" (p. 94), language learning effects hence being a function of "whether a necessary requisite (*although surely not the only one*) for the successful completion of multimodal writing tasks is to *focus on and work with the L2*" (p. 94; emphasis added). It was therefore concluded that MMW could be valuable for language learning if Belcher's (2017) proposed "motivating, interactive, collaborative, multimodal writing tasks" entailed "an unavoidable demand to work with and through language in an attempt to create meaning with the 'huge semiotic toolkit' at the writer's disposal" (p. 95).

The above cognitively oriented position has been at times interpreted as representing "skepticism" or even denial of any potential impact of MMW on L2 learning. For instance, reference has been made to "some scholars' concerns about

multimodal writing, particularly their *fear that its use may stifle or impede linguistic development* (Manchón, 2017; Qu, 2017)" (Kessler, 2024, p. 46; emphasis added), or these same scholars' "concerns about using multimodal writing in L2 writing classrooms (e.g., Manchón, 2017; Qu, 2017) . . . *as potential distractions for language development and negative impacts on academic writing development*" (Lim & Kessler, 2022, p. 325; emphasis added). Such supposed reservations have additionally been interpreted as perhaps being "rooted in the conventional understanding of language development as acquiring target native-like implicit knowledge development" (Lim & Kessler, 2022, p. 325).

It must be admitted that, as argued by one of the reviewers, some of these observations may derive from Manchón's emphasis on the centrality of linguistic processing and her assertion that "seen from a language learning angle, language itself ought to be the central tool in the kit" (Manchón, 2017, p. 94). Nevertheless, I would respectfully disagree with the interpretations above. First, Manchón (2017) did not posit that MMW may impede linguistic development. Rather, arguments were presented in support of needed requirements for MMW to effectively lead to language learning. Second, her response did not contain a single covert or overt reference to her supposed "conventional understanding of language development as acquiring target native-like implicit knowledge development" referred to above. Instead, it was claimed that, according to SLA-based tenets, MMW would result in language learning gains when the completion of multimodal tasks entailed "a real struggle to transform ideas into language, a process propitious to language development because of the *learning mechanisms it would activate, and the corresponding possible changes in the L2 user's underlying linguistic system it might induce*" (p. 94; emphasis added). Hence, her central argument was solely related to learning processes and potential learning outcomes, the latter left unspecified as to whether they constituted evidence of development of (native users') implicit knowledge, the expansion/consolidation of L2 explicit knowledge, or the conversion of L2 explicit into implicit knowledge (see Manchón & Williams, 2016, for a fuller discussion of these possible options in relation to L2 learning through L2 writing).

Much more in line with Manchón's (2017) original position is Lim and Kessler's (2022) assertion that "What is expected from multimodal tasks is their potential to mediate linguistic knowledge development and to provide opportunities for language practices as emphasized in Manchón (2017)" (p. 326), or Alrajhi's (2023) interpretation of Manchón's argument as positing that "multimodality can offer opportunities for L2 learning when it promotes cognitive processing of language within DMC" (p. 3), adding that the extent to which multimodal writing "effectively facilitates the achievement of L2 learning objectives . . . remains unclear" (p.3).

In an attempt to advance in this direction, I conducted a research synthesis of the aims, methods, and findings of primary studies that have inspected

the connection between multimodal writing and L2 learning. The ultimate aim of the synthesis, as advanced in the opening section of the paper, is to ascertain where the field is and where it ought to go, substantially and methodologically.

3. Multimodal composing and language learning: Aims and methodology of the review process

3.1. Aims of the synthesis

The research synthesis was guided by the following research questions:

RQ1: Which research questions have guided empirical research on the language learning effects of MMW and which theoretical frameworks have informed the inquiry?
RQ2: Which methodological approaches have been employed in research on the language learning effects of MMW?
RQ3: What empirical evidence exists on the language learning effects of MMW?

3.2. Methodology of the review process

3.2.1. Operationalization of learning

On the basis of the theoretical underpinnings of language learning through writing delineated in the previous section (see also Manchón & Williams, 2026; Williams, 2012), "learning" was operationally defined as evidence of linguistic processing/attention to language, as manifested in all or some of the following: (i) language learning gains, that is, reported changes in consolidation/expansion of the L2 writer's linguistic system; (ii) effect on performance, that is, language use in monomodal/multimodal writing; and (iii) engagement in learning processes potentially conducive to language learning, such as noticing or individual/collaborative metalinguistic reflections.

This operationalization of learning makes the current synthesis narrower in scope than Lim and Kessler's (2024) annotated timeline as the research reviewed here corresponds to only two of the seven categories in Lim and Kessler's (2024) coding, namely, categories A (direct and/or indirect evidence of L2 learning) and partly D (learner perceptions and reflections) plus E (writers' multimodal composing processes). Excluded from the current synthesis were studies in the rest of Lim and Kessler's (2024) coding categories, namely, identity and authorial voice in

multimodal composing; teacher perceptions and beliefs; interplay of linguistic and nonlinguistic modes; outcomes and assessment of multimodal composing.

3.2.2. Study retrieval

The search process started by inspecting prior reviews to identify primary studies targeting learning as operationalized in the current synthesis, especially Zhang et al.'s (2023) and Lim and Kessler's (2022) SLA-oriented reviews of MMW, Lim and Kessler's (2024) annotated timeline of MMW and SLA research, the corresponding chapter in Kessler's (2024) narrative review of MMW scholarship, and Jiang and Hafner's (2024) suggested research agenda on digital multimodal composing in L2 classrooms. Results of this initial search were cross-checked with: (i) a search through the annotated bibliographies published in the *Journal of Second Language Writing* between 2022 and September 2025 (as previous reviews had covered up to 2022); (ii) an electronic search through relevant journals (high impact factor journals where previous multimodality studies had been published, as evidenced in previous reviews of the domain); and (iii) an additional search in Google Scholar. The search term for (i) and (ii) was *multtmodal*, whereas the Google Scholar search terms were *multimodal writing*, *multimodal composing*, and *digital multimodal composing.*

3.2.3. Inclusion and exclusion criteria

Guided by the operationalization of learning stated above, and after having identified categorizations of research trends in previous reviews of multimodality studies (Jiang & Hafner, 2024; Kessler, 2024; Li & Akoto, 2021; Lim & Kessler, 2022, 2024; Smith et al., 2020; Zhang et al., 2023), it was decided to limit the synthesis to two strands: (1) studies comparing effects of monomodal and multimodal L2 writing on language learning in terms of all or some of the dimensions in the operational definition of learning (comparison studies henceforth); and (2) studies of multimodal composing itself (not comparison with monomodal writing) that, as part of their research aims, investigated the impact of MMW on language learning as operationally defined above (multimodality studies henceforth).

This initial decision meant that, regarding *type of studies*, the strand investigating the transformation of a monomodal text into a multimodal product (e.g., Elola et al., 2025) was excluded. Regarding *research foci*, excluded from the review were multimodality studies that looked exclusively into affordances other than language learning, including: (i) impact on writers' traits, such as motivation (e.g.

Jiang & Luk, 2016), identity (e.g. Zuo, 2024), or self-efficacy (Abdelhaim, 2024); or (ii) their use/integration of semiotic resources (e.g. Zhang & Peng, 2025). Reports of teachers' perceptions of implementation of MMW tasks and/or teachers'/students' perceptions of the way in which MMW can facilitate language learning (e.g., Di Zhang & Yu, 2025) were excluded, with the exception of four studies (Alrajhi, 2023; Kang & Kim, 2023; Kim & Kang, 2020; Pan & Lei, 2025) that investigated students' perceptions/attitudes as part of more encompassing research aims related to language learning as operationalized here. It was additionally decided to exclude studies inspecting specific pedagogical approaches for the implementation of multimodal writing (e.g., Kim et al.'s [2022] study of effects of guided and unguided planning on multimodal composing), the exception being two studies comparing learning outcomes in individual and collaborative writing (e.g., Kim & Kang, 2020; Li & Pham, 2022) that provided relevant data on language learning as operationalized here. Finally, it was decided to limit the synthesis to empirical studies published in relevant journals (as specified above) up to July 2025.

Table 1 Primary studies included in the synthesis

Strand		Studies
Comparison studies	Process-oriented: Comparison of effects of monomodal and multimodal writing on writing processes	Liu et al (2024); Tan (2023); Zalazar (2025)
	Product-oriented: Comparison of effects of monomodal and multimodal writing on writing products	Alrajhi (2024); Cho and Kim (2021); Kim and Belcher (2020); Kim et al. (2023); Maghsoudi et al. (2022a, 2022b); Pan and Lei (2025); Xu, 2021; Zalazar (2025)
Multimodality studies	Multimodality studies shedding light on L2 learning	Akoto and Li (2025); Alrajhi (2023); Dzekoe (2017); Kang and Kim (2023); Kim and Kang (2020); Lee et al. (2021); Li and Pham (2022); Nishioka (2016); Vandommele et al. (2017)

Following the above search and selection process, a total of 20 primary studies (marked with * in the reference list; see also Table 1) were selected for inclusion in the synthesis. Of these, 11 were comparison studies on effects on processes (N = 3) and on products (N = 8). The remaining (N = 9) were multimodality studies.

Considering the adopted inclusion/exclusion criteria, the present synthesis is not intended to be all-encompassing for various reasons. First, books, book chapters, and PhD dissertations are not included. Second, the list of multimodality studies is not intended to be exhaustive but rather representative of research trends and findings across time (2017-2025).

3.2.4. Coding

In order to answer the research questions guiding the synthesis, each study was coded for the following dimensions:

1. Theoretical framework informing the study (when/if explicitly stated).
2. Aims/research questions guiding the research.
3. Methodological characteristics, including design, participants' characteristics and research contexts, data sources, task-related considerations as causal variables (see sub-categories in Table 2 below), and outcome variables and their measurement.
4. Findings. Studies were scrutinized for evidence of and insights into L2 learning as operationalized in the current synthesis, namely, (i) language learning gains; (ii) effect on performance; and/or (iii) engagement in learning processes potentially conducive to language learning.

I opted for intra-rater reliability in the coding process, which meant iterative analyses of primary studies over time, with a minimum of a 2-week spacing interval. No major issues emerged during coding.

4. Multimodal composing and L2 learning: The empirical evidence

In order to answer the three research questions guiding the synthesis, it was decided to conduct separate analyses for comparison studies and multimodality studies. This overarching organization criterion makes the current synthesis different from other reviews based on: (i) chronological order (e.g., Lim & Kessler's [2024] timeline); (ii) thematic categories (e.g., Jiang & Hafner, 2024); or (iii) methodological characteristics (e.g. Kessler's [2024] distinction between quantitative and qualitative studies).

4.1. Comparison studies

4.1.1. Theoretical frameworks

Comparison studies have addressed either effects on writing processes or effects on written texts, with one study (Zalazar, 2025) targeting both. The theoretical frameworks guiding these two groups vary substantively.

The theoretical underpinnings in *process-oriented studies* include Leijten et al.'s (2014) cognitive model of multimodal composition (Liu et al., 2024; Tan,

2023), and Leow's (2015) model of the L2 learning process (especially, his operationalization of "depth of processing", DoP), plus task-based language teaching (TBLT) principles (Zalazar, 2025). Importantly, these frameworks guided not only the study conceptualization, but also the coding scheme in the data analysis, especially in the case of Tan (2023) and Zalazar (2025).

In contrast, only two out of the eight *product-oriented studies* make explicit reference to their theoretical underpinnings: Cho and Kim (2021) indicated to have framed their study in multiliteracies and multimodalities frameworks together with SLA-oriented approaches (TBLT), and the multiliteracies framework was also explicitly identified as the framework guiding Maghsoudi et al.'s (2022a) study. The remaining primary studies simply referred in the literature review section to: (i) multiliteracies frameworks; and (ii) contributions to the 2017 JSLW Disciplinary Dialogues mentioned in an earlier section (e.g., Manchón, 2017; Qu, 2017). Others made generic reference to how the study in question "builds on earlier inquiries into multimodal composing and L2 writing instruction" (Xu, 2021, p.3).

4.1.2. Aims and research questions

Process-oriented studies have inspected effects of monomodal and multimodal writing on:

1. Macro-writing processes (searching, translation, transcription, and evaluation. Liu et al, 2024; Tan, 2023).
2. Depth of processing (DoP), together with correlations between DoP and accurate use of target forms (Zalazar, 2025).

For their part, *product-oriented studies* have investigated effects on:

1. Language learning gains, as manifested in the accuracy of use of specific target forms that had been the focus of instruction (Zalazar, 2025).
2. Language use, as manifested in the dimensions of accuracy and complexity of the text produced across conditions (see methods and Table 2 below).
3. Global dimensions of writing performance (including language use) across conditions, in one case as moderated by individual differences (self-efficacy, Maghsoudi et al., 2022b), and in some cases over time/across different tasks (see Table 2 below).
4. In three cases researchers additionally inspected the participants' perceptions of/attitudes towards the language learning affordances of multimodal composing (Alrajhi, 2024; Cho & Kim, 2021; Pan & Lei, 2025).

4.1.3. Methods

4.1.3.1. Designs

Comparison studies have made use of both descriptive and (pretest/posttest, Kim et al., 2023; Xu, 2021; Zalazar, 2025) quasi-experimental research designs (with a clear tendency towards the latter over the years), thereby including both intra-subject designs (in earlier studies, e.g., Cho & Kim, 2021, Kim & Belcher, 2020), and gradually more inter-subject designs (Alrajhi, 2024; Kim et al, 2023; Liu et al, 2024; Maghsoudi et al, 2022a, 2022b; Pan & Lei, 2025; Tan, 2023; Xu, 2021; Zalazar, 2025). Some of this research is longitudinal in nature (see Table 2), and most studies have been conducted in the context of a language and/or writing program, which is relevant in terms of their ecological validity and resulting potential implications for instruction.

4.1.3.2. Participants and contexts

The three p*rocess-oriented studies* included in the synthesis show evident similarities: In all cases the participants were college-level, mainly advanced learners of English L2 (Liu et al, 2024; Tan, 2023) and Spanish L2 (Zalazar, 2025), in one case in the context of a first year composition course (Tan, 2023), and in another as part of an advanced Spanish course (Zalazar, 2025). The participants in Liu et al.'s (2024) study were recruited from different degrees at the university where the study took place and their task performance was part of their degree studies. The number of participants was small in all cases: Liu et al. (2024) and Tan (2023) had a sample of eight participants (four participants per condition), and the 20 participants in Zalazar (2025) were differentially distributed across the two conditions: 12 performed the monomodal tasks and eight completed the multimodal tasks.

In contrast to the advanced participants in process-oriented studies, *product-oriented studies* targeted for the most part university, intermediate learners of English, the only exceptions being the (intermediate) high school students in Cho and Kim (2021), and the (university) advanced Chinese L2 learners in Pan and Lei (2025). Except for the 10/18 participants in Pan and Lei (2025) and Kim and Belcher (2020) respectively, the number of participants is substantially higher than in the process-oriented studies, sample sizes ranging from 31 (Cho & Kim, 2021) to 96 (Xu, 2021).

4.1.3.3. Predictor and outcome measures

The *predictor variable* is writing condition, that is, monomodal versus multimodal writing, in all cases conducted individually, which contrasts with the predominant

focus on collaborative writing in the multimodality studies to be analyzed below. The only exception is Xu (2021), where (surprisingly) the monomodal task was completed individually and the multimodal collaboratively, which constitutes a threat to the internal validity of the study.

Table 2 shows variation in crucial task-related dimensions. Thus, in terms of type of tasks used, variation can be observed not only across studies (especially the multimodal tasks, as the monomodal tasks were for the most part essay writing), but also within studies, which is problematic for internal validity considerations. In fact, at times authors themselves explain their results as a function of task differences across writing conditions and resulting linguistic outputs. For instance, Kim and Belcher (2020) ascribed the observed superior syntactic complexity of the texts written in the monomodal condition to the "written" nature of task output, in contrast to the "the nature of oral narration script writing" (p. 96) produced in the multimodal condition.

Table 2 also shows variation in terms of whether participants completed one or more than one task, in class or out of class, and in time-compressed or time-extended conditions. When written in time-compressed conditions, participants completed either one task (Xu, 2021) or several tasks over time (Alrajhi, 2024; Maghsoudi et al., 2022a, b, Pan & Lei, 2025), both in in-class and out-of-class conditions. The same variation exists with respect to the instructional support received in the process (even within studies, which is certainly problematic in terms of internal validity), a likely intervening variable in the observed effects.

Variation is also the norm regarding *outcome variables* and their measurement, especially in the product-oriented studies. Outcome measures in process-oriented studies were engagement in macro-writing processes (Liu et al, 2024; Tan, 2023), and degree of DoP (Zalazar, 2025). Outcome variables in product-oriented studies were language learning gains, written language use, written performance, and students' perceptions of language learning affordances of multimodal composing.

Learning gains were measured in terms of accuracy of use of the target of instruction (Zalazar, 2025). Measures of written language use included accuracy of performance, with variations in the inclusion or not of the additional measures of text length (Alrahi, 2024; Kim et al, 2023; Xu, 2021), syntactic complexity (Kim et al, 2023; Pan & Lei, 2025; Xu, 2021), or lexical complexity (Pan & Lei, 2025). It is important to note that measures of accuracy and complexity varied across studies, which makes comparisons difficult. Written performance was measured by several dimensions, including language use and use of diverse semiotic resources when analyzing multimodal outputs. Finally, three studies (Alrajhi, 2024; Kim & Belcher, 2020; Pan & Lei, 2025) analyzed the participants' perceptions of the affordances of multimodal writing in terms of degree of attention to language form (Kim & Belcher, 2020), impact on grammatical accuracy (Alrajhi, 2024), and helpfulness regarding improvement of writing skills (Pan & Lei, 2025).

Table 2 Task type and task implementation conditions

	Studies	Tasks	1/several tasks, in/out of class	Task time	Degree of instructional support/guidance
Process-oriented studies	Tan (2023)	Essay/video project	One task, out of class	Time-extended conditions over five weeks	Guided process, including feedback from teacher & peers
	Liu et al. (2024)	Essay/ppt	One task, out of class	Time-extended conditions over two weeks	Low (initial training)
	Zalazar (2025)	Blog post/letter to the editor	One task, out of class	Time-extended conditions over two weeks	Low (initial training)
Product-oriented studies	Kim and Belcher (2020)	Argumentative essay/ multimodal (oral) project	One task, out of class	Time-extended conditions over one month	Low (not mentioned)
	Cho and Kim (2021)	Monomodal and multimodal reading-to-write composition	One task, in class	Time-extended conditions over two weeks (monomodal) and five weeks (multimodal)	Low (video for the MMW group)
	Xu (2021)	Essys/video project	One task, out of class	Time-compressed over 3/4 weeks	High, including feedback
	Maghsoudi et al. (2022a, b)	Monomodal/multimodal essays	Five tasks, in class	Time-compressed (one hour) tasks over a semester	High through task instructions and shared rubric
	Kim et al. (2023)	Cause & effect and argumentative monomodal and multimodal essays	Two tasks (different genres), out of class	Time-extended conditions over 14/20 days	High, including initial training and provision of feedback
	Alrajhi (2024)	Post on blogger (with/ without integration of diverse semiotic resources)	Three tasks, in class	Time-compressed over time	Low (initial workshop on Blogger)
	Pan and Lei (2025)	Argumentative essays/ppt presentations	Three tasks, in class	Time-compressed over one-two weeks	High, before and after task completion

It must be noted that primary studies that inspected effects on language use and written performance encompass both pre/posttest design studies (which was performance – monomodal in all cases, important to note – before and after the intervention; Kim et al., 2023; Xu, 2021), and studies that compared written language use/global writing performance (over time in most cases) in the monomodal and multimodal conditions (Alrajhi, 2024; Cho & Kim, 2021; Kim & Belcher, 2020; Kim et al., 2023; Maghsoudi et al., 2022a. 2022b; Pan & Lei, 2025). Kim et al. (2023) did both.

4.1.3.4. Data sources

Data triangulation is the norm. Process-oriented studies and the only study that focused on both processes and learning gains (Zalazar, 2025) collected mono/multimodal products, pretest and posttest monomodal writing, together with concurrent data via screen recordings and think-aloud protocols. At times these data were supplemented

with additional data obtained via retrospective data collection instruments (post-task interviews and stimulated recalls). Product-oriented studies made use of the monomodal and multimodal products and (with the exception of Maghsoudi et al., 2022a and Xu, 2021) both concurrent and non-concurrent data elicitation instruments, including screen recordings (Kim et al, 2023, although the process data was not reported in the study), writing journals, reflection surveys, questionnaires, and interviews.

4.1.4. Findings and implications for language learning

Results on learning as operationalized in the current synthesis are diverse, inconsistent, and inconclusive, partly due to limited research (e.g., just one study targeted language learning gains and only three inspected effects of writing processes), and partly because of disparities in methods, especially participants' proficiency levels (advanced in process-oriented studies and intermediate in seven out of the eight product-oriented studies), task used (which, as already noted, varied within and across studies), and task implementation conditions (with relevant differences observed, for instance, as regards instructional materials and support). It is worth reiterating that, with the exception of Xu's (2021), all results to be reported below come from studies on individual writing.

In what follows, research findings are accounted for in terms of the outcome variables identified above, namely, language learning gains, language use, written performance, and participants' perceptions of language learning affordances of multimodal composing.

4.1.4.1. Language learning gains

Zalazar (2025) is the only study to date investigating the impact of monomodal and multimodal writing conditions on language learning gains, referred to in the study as "writing development in terms of specific linguistic structures" (p. 1). In a pretest/posttest design, learning was measured as the accuracy rate (correct instances over total obligatory contexts) of a specific L2 complex structure (Spanish imperfect subjunctive, which had been the object of instruction), as moderated by depth of processing (DoP), operationalized as "the relative amount of cognitive effort, level of analysis, and elaboration of intake, together with the usage of prior knowledge, hypothesis testing, and rule formation employed in decoding and encoding some grammatical or lexical item in the input" (Leow, 2015, p. 204). Results showed no effect of writing condition on accuracy rates but a likely moderating effect of DoP.

From a language learning perspective, some of the author's own conclusions are specially relevant. First, as the observed extra time in the multimodal condition did not result in improved accuracy rates, it was purported to be devoted to deeper engagement with "images, symbols and videos they chose but not with the linguistic target of this study" (Zalazar, 2025, p. 10). Confirming evidence for Zalazar's (2025) hypothesis can be found in some of the product-oriented primary studies. Thus, Pan and Lei (2025) associated the extra time-on-task observed in the multimodal condition with the attested improvement in content and structure in the multimodal texts, together with the diversification of attentional demands, including searching for information on the internet. Alrajhi (2024) adds an additional piece of the puzzle with his observed impact of writing profiles on the allocation of attentional resources during writing. Thus, he distinguished between "text-oriented" and "multimodality-oriented" students, and reported that while revising their multimodal outputs, the former "demonstrated a strong emphasis on ensuring grammatical accuracy in text," whereas the latter "directed their attention more toward images and audiovisuals or the relation between the nonlinguistic components and the accompanying text" (p.11). These data point to an intricate interplay of variables in L2 writers' cognitive responses to multimodal writing tasks worth exploring in future studies.

Second, given the observed effect of DoP on accuracy rates, Zalazar (2025) suggested that the impact of task design in promoting deeper processing and resulting language learning could constitute an important focus for future research. Such empirical initiatives would likely shed a strong light on the theoretical predictions (Manchón, 2017) discussed earlier in the paper regarding the connection between problem-solving behavior (surely linked to DoP) during multimodal writing and resulting language learning gains. Readers are referred to Jiang and Hafner's (2024) research agenda for insightful task design considerations in future multimodal writing research.

4.1.4.2. Effects on performance: Language use

The insights in the primary studies systematically show lack of statistically significant differences in the *accuracy* of the output produced in monomodal and multimodal writing conditions, regardless of task-related considerations (i.e., genre, task familiarity, or time-on-task conditions) or participants' proficiency level (although it should be reiterated that only two studies were conducted with advanced students: Pan & Lei [2025] and Zalazar [2025]).

More variation exists, however, regarding other language use dimensions, and here it is relevant to distinguish results in pretest/posttest design studies, on

the one hand, and results in studies that compared monomodal and multimodal writing performance, on the other. As shown in Table 3, pretest/posttest studies (which, in between-subject designs, analyzed monomodal texts written in time-compressed conditions) reported improved performance in terms of *text length and syntactic complexity* in the pretest/posttest texts created by participants who had produced multimodal products during treatment. However, as acknowledged in the studies themselves, this finding has to be taken with caution because of the difficulty in teasing out the influence of the multimodal writing practice itself during treatment from factors such as "the course curriculum that they followed, and possibly some unexamined confounding variables such as out-of-class self-sponsored literacy activities" (Kim et al, 2023, p. 10), or "the design of the intervention, which enabled students' peer scaffolding and prolonged involvement in the L2 learning community" (Alrajhi, 2024, p. 14). Added to these potential intervening variables, it is worth reiterating that pretest/posttest tasks were monomodal in nature, which therefore did not require the allocation of attention to the use and integration of diverse semiotic resources. Hence, it is an empirical question, an important one I would suggest, whether the observed performance improvements also apply to multimodal pretest/posttest design tasks.

Table 3 Results on text length and complexity

Studies	Text length	Complexity
Pretest/posttest design studies (Kim et al., 2023; Xu, 2021)	● Longer texts in the multimodal condition	● Greater gains in (some measures of) syntactic complexity in the multimodal condition
Comparison of monomodal and multimodal writing performance (Alrajhi, 2024; Kim Belcher, 2020; Kim et al., 2023; Pan & Lei, 2025)	● Longer texts in the monomodal condition (Alrajhi, 2024) ● Longer texts in the multimodal condition (Kim et al., 2023)	● Greater syntactic complexity in the monomodal condition (Kim & Belcher, 2020). ● Greater syntactic complexity in the multimodal condition (Pan & Lei, 2025) ● No differences in syntactic complexity (Kim et al., 2023) or lexical complexity (Pan & Lei, 2025) between conditions.

Results are more varied with respect to *text length and linguistic complexity* (see Table 3). Thus, whereas some studies found an advantage of MMW for syntactic complexity (e.g., Pam & Lei, 2025), others observed the opposite, as the effect was found in the monomodal condition, although only for some genres (Kim & Belcher, 2020). Yet, others found no differences in syntactic complexity (Kim et al., 2023) or lexical complexity (Pan & Lei, 2025). Given these conflicting findings and the limited number of studies targeting linguistic complexity, much further research is needed before firmer conclusions can be reached.

When interpreting the above findings from the perspective of language learning, the lack of differences in accuracy measures has been consistently interpreted as compelling evidence of attention to language in multimodal task completion and, hence, of the language learning affordances of MMW. Yet, a number of observations are pertinent as they help us to zoom deeper into what certainly constitutes remarkable empirical advancements in the domain.

To start with, regarding individual writing, when given ample task time conditions and/or repeated task iterations, both monomodal and multimodal writing tasks have been reported to promote attention to language, as manifested in (accurate) language use, which in effect reflects retrieval and use of already existing L2 knowledge. However, it is an empirical question whether such linguistic processing results in specific language learning gains in terms of consolidation or expansion of L2 knowledge. Recall that Zalazar (2025) is the only study to date investigating language learning gains.

A pertinent second observation is that primary studies have underscored the pivotal role of a range of critical variables in prompting L2 writers to engage in the problem-solving behavior and "struggle with language" that Manchón (2017) posited to be fundamental in bringing about language learning. Figure 1 is a graphical representation of my own interpretation of the (albeit limited but nevertheless truly insightful) available research insights. I conclude that the way in which L2 writers engage with and respond to multimodal tasks is ultimately mediated by their task conceptualization (a well-known concept in cognitively oriented L2 writing studies), which, in turn, has been found to be a function of an intricate interplay of writer-internal and task-related factors. As shown in Table 2, task-related variables include task design and implementation conditions, instructional materials, and the degree of instructional support (see Kim et al., 2023; Maghsoudi 2022a, 2022b). Learner-related variables include self-efficacy beliefs, cognitive styles, and writing profile, as seen below in the section on learners' perceptions.

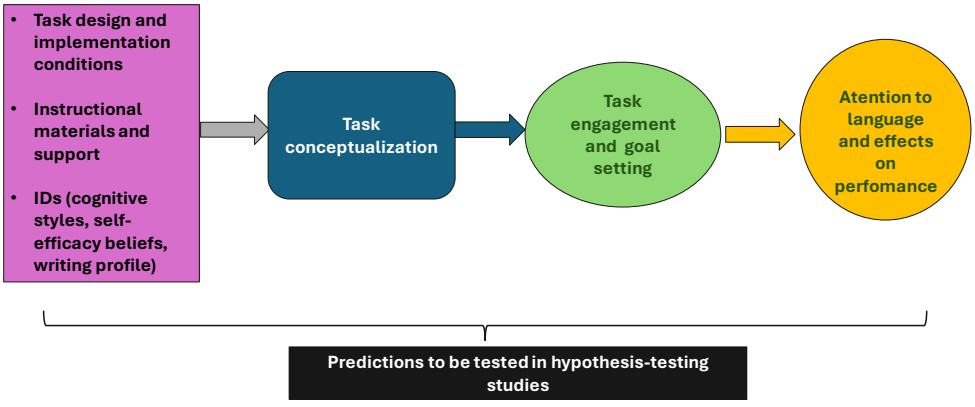

Figure 1 Interplay of variables in multimodal writing

As a way of illustration, Alrajhi (2024) concluded that the comparable level of grammatical accuracy observed in the monomodal and multimodal conditions in the study could be explained by two factors, the second one being related to "task conceptualization" in Figure 1: "(1) active engagement in each linguistic and nonlinguistic component, and (2) an awareness of the *essentiality of the text component, necessitating the prioritization of the linguistic resource* or the deliberate separation of text writing from other components within the DMW process" (p. 1; emphasis added). Similarly, regarding the variables in the left part of Figure 1, Tan (2023) referred to "the important role of instructional materials in shaping students' responses to and perceptions of multimodal composing" (p. 12).

4.1.4.3. Effects on writing processes

Process-oriented primary studies further reinforce the reported findings in product-oriented studies that multimodal writing does not distract L2 writers from linguistic processing, once again manifested in lack of differences in linguistic performance across conditions. This research, although limited to just three studies, provides additional insights that are especially relevant for future research agendas, as detailed next.

On the one hand, no differences were found in either engagement on writing processes or levels of DoP across conditions. Yet, as noted in earlier sections, DoP appeared to be more relevant than writing modality, at least for the advanced L2 users in Zalazar's (2025) study. This finding confirms the relevance of problem-solving behavior while completing multimodal tasks as a crucial variable in bringing about language learning.

It should be noted, however, that process-oriented studies were conducted with advanced L2 users performing individual writing. This casts doubt not only as to the generalizability of findings, but also with respect to the possibility of a likely moderating effect of proficiency, especially bearing in mind that in all cases participants had extended task time conditions to complete the research tasks. It is hence suggested that future research agendas examine and compare writing processes in individual and collaborative, monomodal and multimodal writing conditions, by L2 users at different proficiency levels.

On the other hand, it was noted in an earlier section that process-oriented studies systematically observed longer time spent in the multimodal condition. Yet, this difference did not translate into differences in writing process or accuracy rates, which, as also noted above, led Zalazar (2025) to conclude that the extra time in the multimodal condition must have been devoted to goals other than language-related concerns. Theoretically, it would be relevant to elucidate how writers of diverse proficiency levels distribute their composition time in time-

compressed monomodal and multimodal writing conditions. This would require controlled studies that, although less ecologically valid than the majority of curriculum-oriented studies to date, would shed a stronger light on the processing dimension of monomodal and multimodal writing, including goal setting and resulting allocation of attentional resources to diverse components of writing. This basic (not applied) research would serve to put some of Manchón's (2017) predictions to the empirical test, especially her claim that MMW would result in language learning gains when the completion of multimodal tasks entails "a real struggle to transform ideas into language, a process propitious to language development because of the *learning mechanisms it would activate*, and the corresponding possible changes in the L2 user's underlying linguistic system it might induce" (p. 94; emphasis added). It is important to note that I am not suggesting pedagogical procedures that foster multimodal task completion under control task time conditions. Instead, I am simply pointing to a theoretically motivated future research avenue.

4.1.4.4. L2 writers' perceptions of language learning affordances of multimodal writing

As already mentioned, some primary studies inspected participants' perceptions of the affordances of multimodal writing. Three findings are especially relevant. First, although intra-individual variation was observed (see Kim & Belcher, 2020; Pam & Lei, 2025), positive attitudes were generally reported, which is in line with findings in the multimodal studies to be analyzed next. Second, these positive attitudes have been purported (Kim & Belcher, 2020) or found (Alrajhi, 2024; Maghsoudi et al, 2022b) to be influenced by individual differences (hence their inclusion in Figure 1), namely, learning styles (Kim & Belcher, 2020), self-efficacy beliefs (with highly-efficacious learners showing more positive perceptions of multimodal writing; Maghsoudi et al, 2022b), and writing profiles (Alrajhi's [2024] distinction between text-oriented and multimodality-oriented students referred to above). Finally, L2 writers' perceptions do change over time as a result of other individual and contextual factors, in addition to reiterated multimodal writing practice (Alrajhi, 2024).

4.2. Multimodality studies

4.2.1. Theoretical frameworks

Only five out of the nine multimodality primary studies made explicit the theoretical framework guiding the research, which included: (i) cognitive SLA positions

and hypotheses (noticing hypothesis – Dzekoe, 2017 and TBLT principles – Vandommele et al., 2017); (ii) SLA sociocultural theories and associated concepts (e.g., collaborative dialogue, private speech), especially in studies of collaborative writing (Akoto & Li, 2025; Nishioka, 2016); and (iii) multimodality frameworks in combination with (ii) (Dzekoe, 2017), and social semiotic theory of multimodality (Akoto & Li, 2025; Alrajhi, 2023).

4.2.2. Research questions

The research questions guiding this strand fall into three groups. The first group corresponds to studies investigating development of text features over time (Dzekoe, 2017), in some cases moderated by task-related variables, including in-/out-of-school writing and +/- intervention (Vandommele et al., 2017), and individual/collaborative writing conditions (Li & Pham, 2022). A second group is made up of studies that have inspected process-product correlations/associations, process measures corresponding to patterns in/nature of the interaction during collaborative writing (Akoto & Li, 2025; Kim & Kang, 2020; Nishioka, 2016). Finally, three primary studies have additionally investigated learners' perceptions of the language learning affordances of multimodal writing (Alrajhi, 2023; Kang & Kim. 2023; Kim & Kang, 2020).

4.2.3. Methods

Clear tendencies can be observed as regards methods, as shown in Table 4. The *participants* were mainly college L2 users, except for the three studies conducted with high school students (Kang & Kim, 2023; Kim & Kang, 2020; Vandommele et al., 2017). Table 2 shows that mutimodality primary studies have targeted a wider range of L2s than in the comparison studies: Dutch, English, French, and Japanese. Proficiency levels are more varied than in comparison studies as participants ranged from beginner to advanced-low, the latter just in two studies (Dzekoe, 2017; Lee et al., 2021). Regarding sample size, one group of primary studies targeted few participants (e.g. three in Nishioka, 2016; seven in Akoto & Li, 2025), whereas sample sizes in the rest ranged from 20 (Dzekoe, 2017) to 60 (Kim & Kang, 2020), and 185 in Li and Pham (2022). As shown in Table 4, *designs* are primarily descriptive (at times longitudinal) and mainly qualitative in nature (in contrast with the predominantly quantitative nature of comparison studies), although two studies included measures of retention (Nishioka, 2016), and changes in writing performance in a pretest/posttest design (Vandommele et al., 2017).

As was the case with studies in the comparison group, Table 4 shows that *data triangulation* is the norm, the only exception being Vandommele et al. (2017). Data sources comprised the multimodal texts/artifacts produced, online measures (screen recordings, audio recordings of interaction/group discussions during collaborative writing, Google Docs history record), and diverse offline measures (stimulated recalls, post-project interviews/reflections/surveys).

Table 4 Overview of methods in multimodal studies

Studies	Participants & L2	Designs	Tasks & type of writing	In/out of school	Task time
Nishioka (2016)	Three Korean L1, college beginner to intermediate students of Japanese L2	Descriptive plus posttest	Digital story telling, collaborative writing	In class. Task as part of group assignment	Over weeks (reference made to "sessions")
Dzekoe (2017)	22 university, advanced-low ESL students	Descriptive case study with embedded quantitative data	Online posters, individual writing	Take-home assignments	Four weeks for each assignment
Vandommele et Al. (2017)	52 secondary school, beginner to intermediate Dutch L2 learners	Pretest/posttest with in-school intervention vs. out-of-school (leisure) no intervention	Webpage, collaborative writing	Comparison of in-school and out-of-school intervention	Two weeks
Kim and Kang (2020)	60 Korean high school beginner to intermediate, English L2 students	Descriptive	Argumentative reflection video, collaborative writing	Timed tasks during 3 regular classes (two hours and 30 min. in total)	
Lee et Al. (2021)	Nine groups of three/five, B2-C1, English L2 learners	Descriptive, longitudinal	Digital, multimodal booklet, collaborative writing	In- and out-of-school	1-year-long problem-solving project
Alrajhi (2023)	40 Arabic college English L2 students	Descriptive, longitudinal	5 multimodal essays, individual writing	In-class, timed (60-80 minutes per essay) over 10 weeks	
Kang and Kim (2023)	Three adolescent, intermediate EFL students	Multiple case study. Longitudinal (seven months)	Eight DMC, reading-to-write tasks, individual and collaborative writing	Out-of-school reading In-school writing over seven months. Three hours for each task	
Li and Pham, 2022	185 university, low intermediate, English as a foreign language (EFL) students	Descriptive	Infographic (2 tasks), individual and collaborative writing	Out of school	2 weeks
Akoto and Li (2025)	7 university, low-intermediate French L2 users	Descriptive	Digital postcards, collaborative writing	In-class, 2 hours per week over 4 weeks	

Several observations are pertinent as regards *tasks* used. First, as depicted in Table 4, in contrast to the focus on individual writing in comparison studies, Table 4 shows that most multimodality primary studies investigated collaborative multimodal writing. Just one study (Li & Pham, 2022) compared individual and collaborative multimodal writing, and two studies investigated individual multimodal writing (Alrajhi, 2023; Dzekoe, 2017). Second, Table 4 also shows that a range of multimodal tasks has been used, wider than in the comparison

studies: argumentative reflective videos, digital booklet, digital postcards, digital story telling, infographics, multimodal essays, and webpage. Finally, as was also the case with most comparison primary studies, multimodal tasks were completed over time (task time varying from two weeks to a whole academic year), in both in-class and out-of-class conditions.

The last methodological observation relates to *outcome variables*, which, as shown in Table 4, include dimensions of interactions during collaborative writing as well as text features, measured both holistically (rubrics including other dimensions apart from language use, i.e., content, use/integration of semiotic resources, visual effects, multimodal design, etc.) and analytically.

4.2.4. Main findings and implications for language learning

Insights in multimodality studies further confirm the association between attention to language and multimodal writing task completion. In line with primary comparison studies, this body of work has contributed relevant insights into the variables moderating task engagement and attention to language included in Figure 1. These are learner-related variables (primarily task novelty and resulting motivation, but see contradictory findings on task novelty in Alrajhi, 2023 and Vandommele et al., 2017), and task-related variables: inclusion of language use in rubrics and (crucially in my view) their sharing with the participants (see Li & Pham, 2022), task completion in extended task time conditions (except for the time-compressed task used as pretest/posttest in Vandommele et al., 2017) or in time-compressed conditions over time (e.g., Kim & Kang, 2020), materials and instructional support in the process (e.g., referred to as "meticulous scaffolding mechanism" in Lee et al., 2021, p. 66), and learning processes induced by task instructions. As an example of the latter, Alrajhi (2023) noted that the participants in his study engaged in processes and activities "conducive to L2 learning, such as L2 writing, online searching, surfing websites, watching audiovisual materials, and reading online content, hence extending their linguistic repertoire in the process" (p. 12).

This research has also shed light on manner in which the degree of language use is fostered or facilitated by the nature of the task, another critical concern for future inquiry. As a way of illustration, Li and Pham (2022) linked their participants' use of short sentences and bullet points to the nature of infographics.

Finally, primary multimodal studies reinforce the findings in the comparison studies regarding the changing nature of students' perceptions of the language learning benefits associated with multimodal writing (see Alrajhi, 2023; Kang & Kim, 2023), as well as the impact of the additional variable of degree of digital literacy (hence to be added to Figure 1 in shaping L2 writers' perceptions).

5. Conclusion

The research synthesis evidences that this burgeoning area of inquiry has undergone remarkable developments from a dual perspective. First, the empirical research reviewed has underscored the pivotal role of attention to language in multimodal writing task completion, as well as the impact of such linguistic processing on performance. Much less is known about effects on language learning, operationalized as either consolidation or expansion of L2 knowledge, which should constitute a critical concern in future inquiry. Open questions also exist as regards the role of multimodal writing in transforming L2 learners into linguistically expressive writers (as noted by one of the reviewers). However, the attested linguistic processing in multimodal writing provides confirming evidence of Manchón's (2017) theorized claim that language learning outcomes of MMW are a function of "whether a necessary requisite (*although surely not the only one*) for the successful completion of multimodal writing tasks is to *focus on and work with the L2*" (p. 94; emphasis added).

Second, the primary studies clearly point to an intricate and complex interplay of task-related and learner-related variables in prompting such "focus on and work with language." However, these variables have not been sufficiently or systematically investigated to discern meaningful or consistent patterns, nor robust effects. The insights obtained have nevertheless profound implications for future research agendas, which ideally should move in hypothesis-testing directions, at a minimum to put the content of Figure 1 to the empirical test with the systematic investigation of the predictor, moderator, and outcome variables.

These future empirical efforts would also benefit from theoretical and methodological refinements. Theoretically, in an attempt to overcome some of the limitations of extant research, future studies conducted from a writing-to-learn-language perspective must necessarily be informed by relevant frameworks, which, in agreement with Kessler (2024), ought to be an SLA theory, or a theory of education or of learning. Additionally, studies must explicitly state how such theoretical underpinnings both framed the study conceptualization and its aims, and informed its methods.

Methodologically, future hypothesis-testing research would require more complex designs as well as larger and more diverse sample sizes. A concerted effort is also needed to solve the internal validity problems detected in past research, especially relevant being the strict control of intervening variables in pretest/posttest designs, including the similarity/difference between experimental tasks during treatment and the pre-post tasks (see Vandommele et al., 2017). Similarly, a much stricter control of and much more convincing motivation for task selection is paramount (see Kessler's contribution to the special issue).

Future studies would also benefit from controlling or validating: (i) the attention to language use fostered by diverse experimental tasks; and (ii) the comparability of tasks across conditions in comparison studies. Internal validity problems identified in Xu (2021), where it was explicitly stated that the multimodal "condition essentially resulted in a task different from the traditional paper-based writing" (p. 8), must be avoided.

A critical and related concern for future inquiry relates to selected outcome measures of language use. The selection of measures ought to take stock of what studies of writing development had uncovered about how long it takes to make substantial progress in CALF (complexity, accuracy, lexis, fluency) dimensions. Rather than mentioning it as a potential variable explaining results/lack of effects observed in the discussion section of empirical reports, these considerations ought to be integral to the conceptualization and design of the study. The consistent use of rigorously selected product-oriented measures across studies would also facilitate cross-comparisons and hence firmer conclusions.

Finally, an important focus of future research ought to be the systematic investigation of writing processes and associated language learning gains. The operationalization of outcome variables in such inquiry would benefit from the copious research on writing processes, including its research methods (see Manchón & Roca de Larios, 2023, for an extensive treatment).

In short, we can in principle agree with Lim and Kessler (2024) that "while there is still considerable room for new and innovative research in the future, this developing body of empirical research has addressed many of SLA researchers' original concerns about the utility of multimodal composing for L2 learning" (p. 184). However, the current synthesis distinctively shows that the main "original concern" in Lim and Kessler's (2024) quote addressed so far is primarily whether or not attention to language is part and parcel of multimodal composing. In this sense, notable headway has been made with respect to whether, how, and why multimodal composing may not distract L2 writers from engaging in linguistic processing and may facilitate the activation and use of existing L2 knowledge.

The current synthesis further informs the "innovative" future research referred to in Lim and Kessler's (2024) quote, where productive avenues to be explored include experimentally testing the attested potential moderating role of learner-related and task-related variables in fostering the kind of linguistic problem-solving behavior purported to lead to language learning. Key developments also depend, as reiterated throughout the paper, on moving beyond effects on performance, hence finding valid ways of comparing the impact of monomodal and multimodal writing conditions on the expansion and consolidation of L2 knowledge, which is almost uncharted territory to date.

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