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Revisiting Hong's (2010) model of CALL integration through conceptual replication



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The integration of computer-assisted language learning (CALL) has held increasing interest among the community over the last three decades. One paper which has taken stock of this interest and modelled the factors that impact integration has been written by Hong (2010). While Hong's model has significantly contributed to understanding technology integration in language classrooms, several methodological shortcomings limit its validity. Specifically, Hong's (2010) reliance on a limited number of studies and the lack of systematic evidence to support the centrality of CALL teacher education raise concerns about the model's robustness. Furthermore, the literature review process used to position the individual and contextual factors remains unclear, leaving the strength of the evidence base uncertain. Given these shortcomings, this study conceptually replicated the literature review and subsequent spherical model from Hong (2010) to determine the validity of this model and understand the current complexities of CALL integration. The conceptual replication was based on 138 studies from eight Q1-ranked CALL journals. From this literature, we found that Hong's three spheres: CALL teacher education, individual teacher, and contextual factors, continued to represent the majority of CALL integration factors validly. However, we found a much broader range of relevant sub-factors within these three broad spheres. For CALL teacher education factors, we found teachers desired pedagogically-linked training. For individual teacher factors, time management was a pertinent factor. For contextual factors, we found an intricate split between institutional and country-specific factors and a mixed picture of country and institutional responsibility. This latter mixed picture included inflexible teaching methods.

Keywords: Computer-Assisted Language Learning (CALL), CALL teacher education, CALL integration factors, replication study, conceptual replication

Background

The integration of computer-assisted language learning (CALL) into language classrooms involves a complex interplay of various factors, including technology availability, teacher training, individual preferences, and institutional support (see, Tafazoli & Picard, 2023). Understanding the multifaceted nature of how CALL is integrated into the language classroom has occupied a consistent space in language education research for more than three decades (Levy, 1997). CALL's multifaceted nature stems from the diverse environments in which technology is used, including variations in teacher expertise, student needs, technological infrastructure, and cultural attitudes toward technology (see McCallum & Tafazoli, 2025). These complexities demand a more nuanced understanding of how technology can be effectively integrated into language learning environments.

The field of CALL has grown significantly over the past decades, with increasing attention given to how teacher education plays a central role in ensuring successful technology integration. Numerous studies have highlighted how teacher familiarity and knowledge significantly influence the adoption and effective use of technology in language classrooms (e.g., Son, 2018; Torsani, 2016; Tafazoli & Picard, 2023). This growing emphasis underscores the importance of preparing teachers with the necessary pedagogical skills to navigate the complexities of CALL implementation. As the use of technology in education evolves, it is crucial to examine not only the tools available but also how teacher education contributes to fostering an environment conducive to technology-enhanced learning.

One relatively recent attempt at understanding the multifaceted nature of CALL integration has been Hong's spherical CALL integration model (2010), which received great attention among CALL scholars (e.g., Cardenas-Claros & Oyanedel, 2016; Curtim Schmid, 2017; Son, 2018). In educational research, spherical models are often used to represent the interrelationships among multiple factors or variables in a holistic way. The model's spherical shape is not only a visual representation but also a metaphor for the dynamic, interconnected nature of the factors involved. Hong's model was inspired by a growing body of literature that sought to understand the relationship between teacher education, individual teacher factors, and contextual factors within the broader framework of CALL integration. The impetus for Hong's study came from the recognition that existing studies often focused on isolated factors of CALL integration without accounting for how these factors interact in real-world teaching contexts. This review led to Hong (2010) developing a spherical model to represent the different factors which play a role in integrating technology into the language classroom.

The model is comprised of three interrelated spheres: CALL teacher education, individual teacher factors, and contextual factors. Hong's model, CALL teacher education is placed at the core, representing its perceived central role in successful technology integration, with individual teacher factors and contextual factors orbiting around it (Figure 1). The relative positioning of these spheres reflects the prominence of each factor, with teacher education seen as

the most influential, individual factors slightly less so, and contextual factors further removed. According to the relative positioning of these three spheres, Hong (2010) highlights the prevailing popularity of CALL teacher education as the key factor impacting integration with individual and contextual factors less prominent in the studies reviewed. The prominence of this group of factors is symbolised in the model as the central sphere which ‘orbits around the equator’ of the model. Individual factors are positioned slightly above CALL teacher education while contextual factors orbit further away still. Importantly, the review indicates that contextual factors are taken to be relatively independent of CALL teacher education. For example, Hong (2010, p. 61) notes that “a lack of computers in and little support from the school where L2 teachers work has nothing to do with CALL teacher education”.

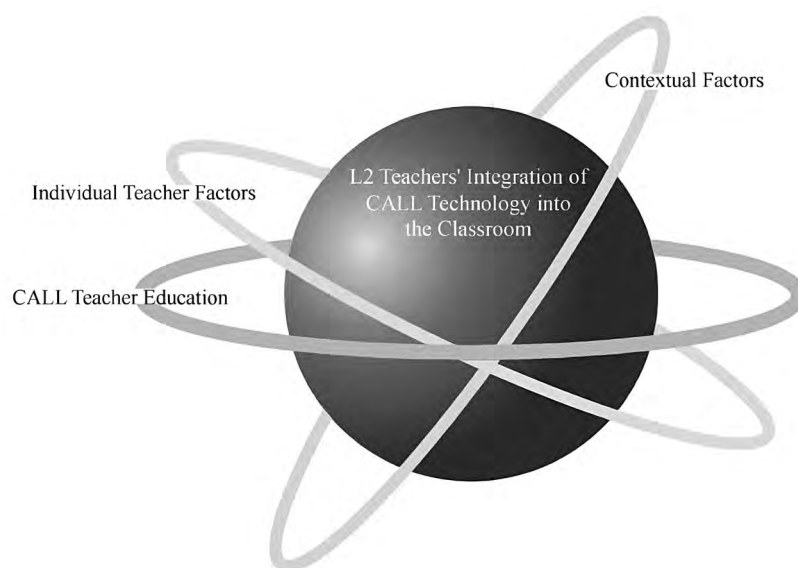


Figure 1. Hong's (2010, p. 61) spherical model of L2 teachers' integration of CALL technology into the classroom © Cambridge University Press

While Hong's (2010) model undoubtedly has helped CALL researchers to understand the complexities of CALL integration (e.g., Curtim Schmid, 2017), there are several shortcomings that need to be addressed. These shortcomings include questions about the study's rationale and its conceptualisation, transparency in the literature review process, and the model's applicability to different contexts.

First, the limited number of studies cited as evidence for placing CALL teacher education at the centre of the model weakens the rationale for its prominence. Hong (2010) places much emphasis on CALL teacher education as a factor that is central to understanding CALL integration. This emphasis runs throughout the narrative of the study; however, there is little clear-cut systematic evidence to support this inference. Hong (2010, p. 60) draws on a limited set of studies (i.e., Egbert et al., 2002; Lam, 2000; Meskill et al., 2002; Wong & Benson, 2006) focusing heavily on research from the early 2000s to support

this inference: “previous studies suggest that well-organised and well-prepared CALL technology education is considered to be relatively more salient to teachers’ integration of technology than teachers’ individual factors and contextual factors.” Hong (2010, p. 60) recognises that “the importance of these factors cannot be placed, with absolute certainty, in a sequential order.”

While the referenced studies provided valuable insights into the integration of CALL, Hong’s heavy reliance on a limited number of studies raises concerns regarding the inclusiveness and comprehensiveness of the literature base. This approach may potentially overlook more recent and varied findings related to the interplay of individual factors, contextual components, and CALL teacher education. For example, recent studies, such as Hubbard (2023), emphasise the evolving nature of teacher training in CALL and the importance of contextualising CALL education within broader institutional and cultural contexts. Additionally, Stockwell (2022) highlights the necessity for ongoing research to consider rapid technological advances and how these changes impact both teacher attitudes and institutional support systems. These works offer perspectives that might challenge or expand the three-sphere framework of Hong’s model, suggesting that CALL teacher education is just one piece of a more dynamic and interconnected system.

Second, the literature review process itself lacks transparency. The development of such a model typically relies on a systematic review of existing literature, where the researcher synthesises findings from multiple studies to identify common themes and patterns. The strength of any model derived from such reviews depends on the rigor with which the literature is reviewed and the consistency of the evidence used to support the model’s structure. However, in Hong’s model, the lack of systematicity and a clear explanation of how the focus and prominence of each of the three spheres was determined, has implications for the validity of the model. There is an absence of the total number of studies and a list of the exact studies which were used to present the three spheres in the model and especially support the claim that CALL teacher education is the most salient sphere/factor level. The lack of potential for true replicability in Hong’s (2010) work leads us to question the model’s validity. This validity issue is especially relevant at the current time, as the number of CALL integration studies has seen exponential growth in the years since Hong’s model was introduced.

Third, the model’s applicability to different contexts is another point of concern. Since the number of CALL integration studies has grown exponentially since 2010, it is crucial to evaluate whether Hong’s model can still capture the complexities of technology integration in diverse teaching environments. By not accounting for the expansion of research in this area, the model may no longer fully represent the factors influencing CALL integration in contemporary classrooms.

It is important to recognise that the highlighted drawbacks are not just a subjective interpretation but rather reflect broader concerns in systematic reviews and theoretical model construction. For example, as highlighted by Gough et al. (2017), transparent reporting of evidence is essential for ensuring

the validity and reliability of a model. In the case of Hong's model, the lack of detailed reporting on the number of reviewed studies and the methodology for weighing evidence raises concerns about the study's methodological rigor. In addition, Norris and Ortega (2006) stress the importance of establishing clear criteria for weighting evidence in language education research. The absence of such clarity in Hong's (2010) study, where individual and contextual factors are depicted as less significant, makes it difficult to determine whether this reduced emphasis is due to inherent characteristics in the literature or simply a result of selective study inclusion.

Given these shortcomings, we, therefore, frame our contribution to understanding CALL integration factors around the value of a conceptual replication of Hong's original literature review and subsequent spherical model. Morrison (2022, p. 35) defines conceptual replications as "studies which seek to apply the original study's 'concept' in contexts, settings, and conditions that differ from those in the original study. There is therefore a comparison made between the original and conceptual replication study to understand "where, when, with whom, how, how well, why, under what conditions, and in what settings the conceptual replication confirms, disconfirms, partially confirms or, indeed, is unable to confirm or disconfirm the original study's findings" (Morrison, 2022, p. 35). A similar understanding of conceptual replication exists in SLA whereby Polio and Gass (1997) highlight how conceptual replications allow researchers to assess the generalisability/external validity of the research.

By carrying out a conceptual replication, we can add or reduce the validity of Hong's (2010) model and determine how well the model stands the test of time when the literature base has been carefully updated, documented and systematically analysed. Our conceptual replication is guided by one broad research question:

To what extent does Hong's (2010) spherical model remain valid in its original shape and emphasis when the literature base is systematically documented, updated, and analysed?

By addressing this question, we aim to determine whether the centrality of CALL teacher education remains as prominent as Hong originally suggested, or if individual and contextual factors have become more influential in the years since the model was first proposed. This study contributes to the ongoing dialogue on the factors that drive successful CALL integration, providing a more up-to-date understanding of the complexities involved.

Methods: Conceptual replication through systematic review

We conceptually replicate Hong's (2010) theoretical idea of presenting a CALL integration model grounded in the literature. However, unlike Hong's approach, we prioritise transparency in our procedures to facilitate potential future replications (Tschichold & Alzahrani, 2018) through a systematic review. Our approach follows Cooper and Hedges' (2009) five-step framework for research synthesis: (1) the problem articulation, (2) data collection, (3) data evaluation, (4) data analysis and interpretation, and (5) the presentation (and discussion)

of the results. The subsequent sections detail our implementation of these measures to reproduce and expand upon Hong's (2010) review.

Problem articulation

The rationale behind this study stems from the changing landscape of integrating CALL, driven by rapid technological advancements and evolving educational settings since 2010. Moreover, the need for revisiting and updating a model of CALL integration arises from the increasing complexity of factors that influence the successful integration of technology in language learning environments. While Hong's (2010) model laid the groundwork, it is essential to reassess whether this model effectively encompasses the influencing factors of CALL integration in today's classrooms, such as the expansion of digital tools and the shift toward hybrid and online learning (e.g., Ulla & Espique, 2022), and CALL teacher education as the central factor in this model continues to hold relevance in light of the complex and dynamic interactions between teachers, students, institutions, and technological tools, all demand a more nuanced understanding of CALL integration.

Furthermore, it is important to revisit and potentially update this model, as it has practical implications for teacher training programs and policy development. For instance, gaining a better understanding of how contextual factors such as infrastructure, institutional policies, and teacher collaboration influence technology use can help in designing more effective computer-assisted language learning (CALL) teacher education programs. This updated model can provide a framework for policymakers and educators to create more responsive and adaptable CALL curricula that can better address the needs of modern language learners and teachers.

In accordance with Porte and McManus's (2019) suggestion to reconsider CALL integration models, we believe that updating the framework can offer more pertinent and actionable insights for both practitioners and researchers. Merely acknowledging the growth of the field is insufficient; we must critically evaluate how well our models capture the current realities of CALL integration and whether they can guide future practice and research. Through this conceptual replication, our goal is to present the CALL community with a model that better mirrors the ongoing changes in language education, ensuring it remains a practical and evidence-based tool for comprehending the complexities of CALL integration in the 21st century.

Data collection

Data collection started with searching for published journal articles in leading CALL research journals. The journals selected for this study were: (1) *CALICO Journal*, (2) *CALL Journal*, (3) *CALL-EJ*, (4) *JALTCALL*, (5) *Language Learning & Technology (LL&T)*, (6) *ReCALL*, (7) *Teaching English with Technology (TEwT)*, and (8) *System*. All the above-mentioned journals are indexed in the SCOPUS database's first quartile (Q1). The SCOPUS database is the most widespread

database of scientific literature in various fields, particularly social sciences, offering a systematic way of capturing high-quality empirical literature (SCOPUS, 2020).

The rationale behind limiting our search to Q1 journals that focus on CALL is to include only rigorous, peer-reviewed studies that adhere to the highest academic standards. This decision is intended to reduce the risk of including lower-quality studies or those with insufficient methodological rigor. However, we acknowledge that this narrow focus may result in a loss of scope and breadth, potentially excluding relevant studies from lower-ranked journals. This trade-off reflects our commitment to prioritising methodological transparency and study quality over a wide range of sources. We also focused exclusively on CALL journals, as opposed to mixed applied linguistics journals, to ensure the focus on CALL itself was prominent enough in the studies. For many publications in applied linguistics, CALL may be a secondary consideration in the study and so we decided to focus on exclusively CALL journals as opposed to studies and journals which blended a sub-focus on CALL with that of technical linguistics study. Furthermore, the limitations section discusses the exclusion of grey literature and non-Q1 studies in more detail.

The search was performed with the Boolean keywords of ‘CALL integration,’ ‘teacher education,’ and ‘professional development (PD).’ As the main scope of the selected journals is CALL, we ignored searching for the keywords and their combinations (e.g., teacher education AND CALL, or teacher education AND technology), but we did modify ‘CALL’ in ‘CALL integration’ to include synonyms such as TELL and technology; this was to ensure we comprehensively captured the literature, but also to ensure we aligned with Hong’s (2010) repeated use of the phrase ‘technology integration’ and helped capture relevant papers. The search returned 941 documents.

Inclusion and exclusion criteria. To adhere to the focus of our study, the next step was developing inclusion and exclusion criteria.

Inclusion criteria:

- ▶ The publication date must be between 2010 and 2022. This period was chosen based on the progressive nature of technology use in language education and the emergence of new technologies and challenges in CALL. This time period also matched with the publication of Hong’s original model meaning we could accurately capture changes since its publication.
- ▶ Full-length articles with abstracts must be accessible in the journal’s archive.
- ▶ Studies must be based on qualitative, quantitative, or mixed-methods research designs.
- ▶ Papers should be written in English.

We focused on general CALL studies, not limited to L2 English, to capture a broad, representative understanding of technology integration across multiple



languages and educational settings. Studies that did not meet these inclusion criteria were excluded from the final study count.

Exclusion criteria:

- ▶ We focused on including only rigorous, empirical research; therefore, non-peer-reviewed sources such as conference proceedings, editorials, and opinion pieces were excluded.
- ▶ To ensure the consideration of high-impact, high-quality research, studies published in non-Q1 journals or those not indexed in SCOPUS were excluded. While this may introduce some publication bias, it aligns with our goal of focusing on studies that have undergone stringent peer-review processes.
- ▶ Grey literature, including unpublished theses, reports, and dissertations, was excluded due to potential methodological inconsistencies and lack of peer review.
- ▶ To maintain linguistic consistency across the review and avoid issues with translation accuracy, non-English studies were excluded, not because they lack value.
- ▶ Studies without clear, replicable methodological frameworks were excluded to ensure the inclusion of only systematically conducted research.
- ▶ Redundant studies were filtered to ensure each study contributes unique insights to the analysis.

Data evaluation

In this stage, three screening processes were employed to accept eligible papers based on the inclusion criteria. These are shown in Figure 2. In the first step, the first author eliminated duplicate and inappropriate documents by reading the titles and keywords. A total of 941 papers were initially identified through journal searching. Several identified papers were removed by reading the abstracts in the second step, and 192 papers remained for further consideration. Finally, in the third step, all the remaining articles were read entirely to determine which were in line with the inclusion and exclusion criteria. To increase reliability and to determine discrepancies in the selection, another round of checks was undertaken by the second author. Following this process, we obtained a final study set of 138 papers.



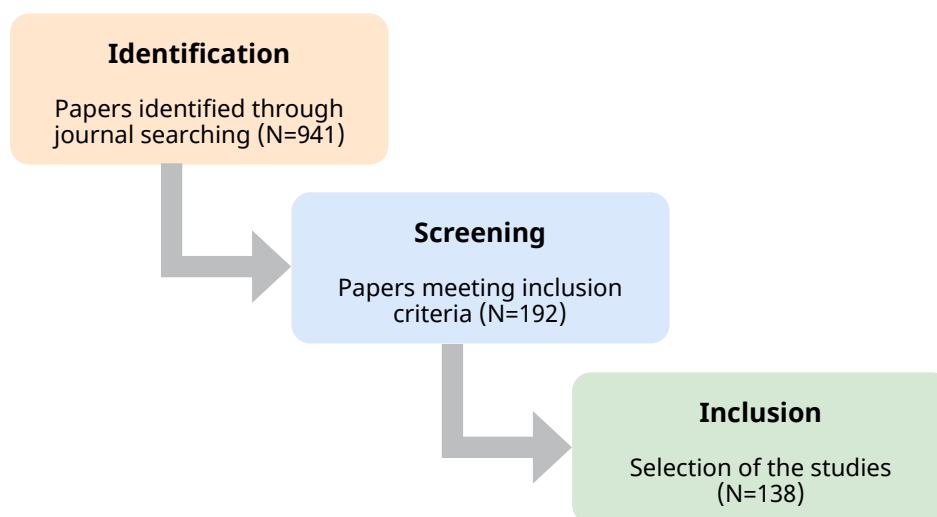


Figure 2. Flowchart of the paper selection process

Data analysis

To ensure a systematic and transparent approach to our review, we devised a categorisation template. Since the influencing factors on teachers' CALL integration were the main focus of the current study, the categorisation template contained: (1) aim of the study, (2) research questions, (3) technology used, (4) research design, (5) data collection methods, (6) context of the study (participants, educational level, and country), and (7) findings and complexities. The categorisation template is provided in Appendix A.

After completing the categorisation templates for each paper, we thematised the findings of each category based on thematic content analysis. In other words, the specified codes were categorised based on their most similar description, which leads to fully developed individual categories. In this way, the first researcher started by reading and rereading the eligible published articles individually to establish the initial codes. After that, the second researcher rechecked the initial codes to reach an agreement on the final emerging themes. Alongside the qualitative coding of the studies using the categorisation template, we also quantitatively recorded the number of studies which mentioned a particular factor. This approach allowed us to summarise the salience of the factors as well as give qualitative details about the specific nature of the factors we found.

To maintain a consistent interpretation of each of Hong's (2010) three spheres: (i) CALL teacher education factors, (ii) individual teacher factors, and (iii) contextual factors, we worked off the basis of the following factor operationalisations. CALL teacher education factors were defined as directly related to teacher training, development, and education, where teachers could individually take responsibility for. For example, professional development programs or workshops aimed at improving teachers' ability to integrate CALL. Individual teacher factors refer to barriers or obstacles that teachers themselves recognised in their own practice or development, such as the need for

further understanding of online safety and ethical issues. Contextual factors were considered to be external challenges, often beyond the control of individual teachers, which required action at the institutional or policy level. This meant we coded factors such as class size and a lack of management support as institutional-level factors, but we coded lack of internet connectivity and electricity as country-level factors.

While these operational definitions provided clarity in distinguishing between the spheres, we acknowledge that certain factors may overlap or interact, particularly true where institutional or policy-level shortcomings intersect with teacher education initiatives. For instance, issues such as access to resources, including legally compliant materials and ethical considerations, can involve both teacher education (through awareness and training) and broader contextual support from institutions. This overlap does not undermine the integrity of the model but rather reflects the complex, interconnected nature of factors influencing CALL integration. Our definitions also expand on the simplistic definitions offered by Hong (2010). The teasing apart of individual, institutional, and country-wide factors allows readers to understand the complexities involved in CALL implementation. Through this conceptual replication of Hong's model, we were able to provide readers with a more nuanced, systematic, evidence-led understanding of CALL integration factors, allowing readers to better understand the evidence base underpinning our claims.

Presentation and discussion of results

In the next section, we report the results from the included articles, focusing on both the existing and emerging factors influencing CALL integration. We present the results systematically and broadly, allowing readers to grasp the overarching literature base. We discuss several exemplar studies to appreciate some of the contextual nuances within the literature base. Our presentation of results includes a principled selection of representative studies which were chosen to highlight that many factors appeared across study geographical locations and irrespective of sample size and research methodology. The studies we illuminate, therefore, allow readers to gain a sense of the literature base as a whole as opposed to grasping a single group of studies, which may misrepresent the prominence of particular factors. We finally narrow and synthesise our findings to answer our single overarching research question: To what extent does Hong's (2010) spherical model remain valid in its original shape and emphasis when the literature base is documented, updated and systematically analysed.

Results

The 138 studies in our review from 2010 to 2022 comprised studies from all our target journals. The full study list is provided in [Supplementary Material 1](#). Over time, the focus on CALL integration and its possible factors fluctuated, as

can be seen in Figure 3. Figure 3 confirms that CALL integration factors remain a popular research focus in the CALL community.

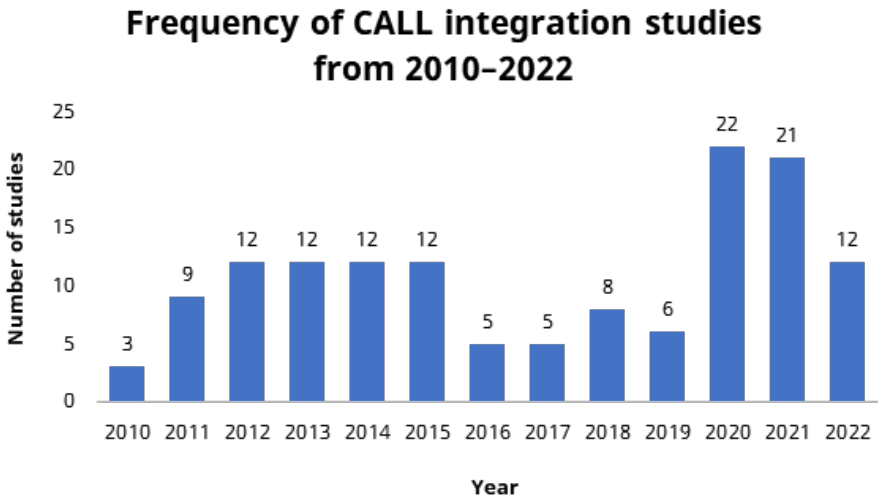


Figure 3. Frequency of CALL integration studies from 2010 to 2022

Figure 4 shows that most studies (n=52) were published in CALL Journal, with the fewest studies in System (n=4). The full study collection highlighted the diverse nature of CALL teacher education/professional development as a research field with studies spanning multiple different countries. Figure 5 shows the top 10 countries of study.

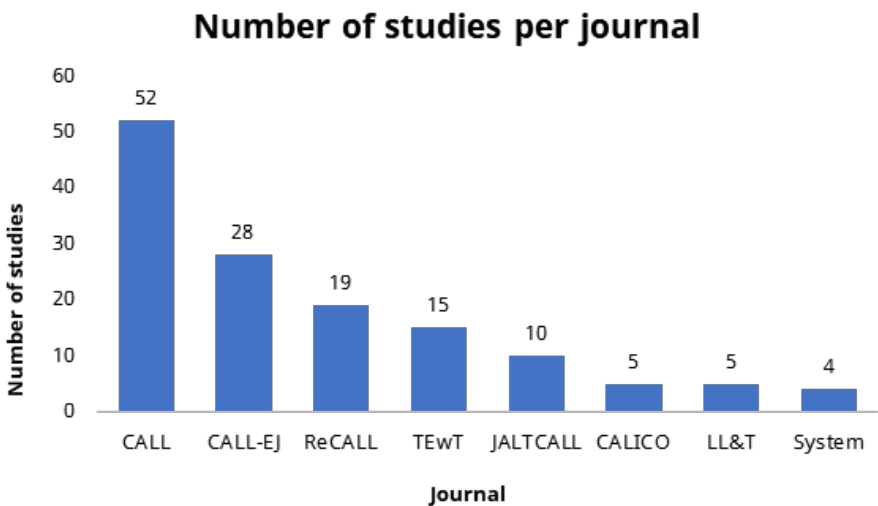


Figure 4. Frequency of reviewed papers in CALL-related journals from 2010 to 2022

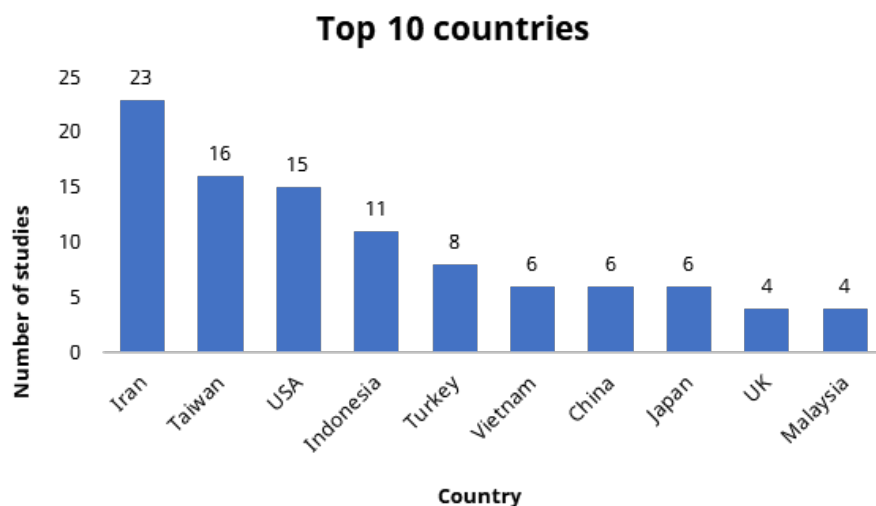


Figure 5. Top 10 countries of study from 2010 to 2022

As shown in Figure 5, Iran was the most popular geographical focus ($n=23$), followed by Taiwan ($n=16$). At the opposite end of popularity, there was little focus on Germany, Columbia, Ethiopia, Jordan, and Saudi Arabia, with these countries accounting for only one study each in our review. A smaller pool of studies in the review focused on technological collaborations across countries with projects between the UK and Spain ($n=1$), the USA and Spain ($n=2$), the USA and Russia ($n=1$), multiple European countries ($n=1$) and multiple Arab league countries ($n=1$). In terms of education level, higher education-based studies were the most common ($n=86$). A smaller pool of studies focused on primary, middle, and secondary education collectively ($n=9$) (e.g., Kissau & Algozzine, 2015) or only one of these education levels (e.g., Pham et al., 2019 focused on primary level education, while Boonmoh et al., 2021, focused on secondary level education). There was less focus on language schools ($n=5$) (e.g., see Dashtestani, 2012).

Collectively, studies involved more than 8,000 teachers and the teaching of more than 2,000 students. Although the overwhelming majority of studies involved multiple teachers and students, some studies only captured the views of a single teacher (e.g., Xue & Churchill, 2020). This demographic picture helps remind our readers that the type and level of inferences we can collectively draw about CALL integration factors need to be considered cautiously and with respect for these different research contexts.

In terms of technological focus, several studies did not explicitly state the types of technology being studied. Instead, studies mentioned simply ‘technology,’ ‘ICT,’ or ‘CALL’ ($n=50$) as the focus (e.g., Kissau & Algozzine, 2015; Prasojo et al., 2018). This is a finding which should be considered when making inferences about potential CALL factors and CALL integration on the whole. Of the 89 studies which did mention specific technology, a nuanced picture of technological choice emerges. This level of nuance is also an aspect that is missing from the opaque representation that Hong’s (2010) narrative presents alongside the study’s broad model. Many of the studies focused on different specific

applications or tools (n=5). For example, a few studies focused on Facebook (e.g., Börekci & Aydin, 2020), and there were single studies on Twitter (e.g., Drewelow, 2012), WeChat (e.g., Xue & Churchill, 2020) and WhatsApp (e.g., Budianto & Arifani, 2021).

This varied picture of CALL integration meant that while our review encountered factors which aligned with Hong's (2010) original review, we also found factors and layers of complexity which were absent in Hong's (2010) review. A comprehensive overview of factors which align with Hong's model is detailed in the next section. Later, we complete our study by providing a comprehensive overview of factors which emerge from our analysis.

What CALL integration factors align with Hong's (2010) findings and model?

We begin by presenting a broad overview of the factors that our review identified. We present this broad narrative first to allow readers to appreciate the diverse nature of CALL integration in classrooms. We then discuss a number of factors and the contexts where they occurred in greater detail to build a comprehensive picture of CALL factors across classrooms and across the contexts we uncovered in our review.

Our review identified 56 individual factors to CALL integration in the language classroom. From these 56 factors, 11 were traced to Hong's (2010) original spherical model. Broadly, we found that these 11 factors mapped neatly onto Hong's (2010) three orbital spheres: (i) CALL teacher education factors, (ii) individual teacher factors, and (iii) contextual factors. These 11 factors are presented in Tables 1–3, alongside a frequency count which shows their overall prevalence in the literature base.

Table 1. CALL teacher education factors which align with Hong (2010)

Sub-factor	n	Representative study
Training (self and provided)	34	Toffoli & Sockett (2015)
Teachers' low level of digital literacy	6	Taghizadeh & Hasani Yourdshahi (2020)

There were two factors which were classified under Hong's (2010) CALL teacher education factors. These were (i) training and (ii) teachers' low level of digital literacy, in the former, training referred to both self-training and externally or internally provided training. From our review, many studies mentioned the need for training. Simpson's (2012) study of a single teacher's use of Facebook in their EFL classroom is one such example where the teacher noted the need for self-training in technological applications. Many other studies mentioned the need for training at an institutional level (e.g., see Toffoli & Sockett, 2015).

Teachers' low level of digital literacy, although somewhat related to training needs, was also identified in our review as a factor that played a role in CALL integration across different types of studies. Low levels of digital literacy were found to be factors in integration in Iranian contexts. For example, Taghizadeh

and Hasani Yourdshahi (2020) found, via a survey of 95 language schoolteachers, that low levels of teachers' digital literacy had an impact on CALL integration and its success.

We also found seven factors which aligned with Hong's (2010) individual teachers' factors. These are presented in Table 2. Many of these factors are related broadly to teacher attitude. We found that teachers' motivation had an influence on CALL integration and its success (e.g., Jiang et al., 2022), as did a general mistrust of technology (e.g., Caldwell, 2020) and a lack of confidence from teachers or 'technophobia' (e.g., see Boonmoh et al., 2021).

Table 2. Individual teacher factors which align with Hong (2010)

Sub-factor	n	Representative study
Mistrust of technology/confidence issues (attitude)	9	Caldwell (2020)
Lack of motivation	8	Jiang et al. (2022)
Insufficient confidence	7	Boonmoh et al. (2021)
Lack of 'buy in' from teachers (attitude)	2	Poole (2022)
Teacher demographics (age, gender)	2	Raygan & Moradkhani (2022)
Relationships between teacher and technology-mediated environment	1	Wang et al. (2010)
Psychological factors	1	Wang et al. (2010)

Our review also aligned with Hong's (2010) findings in relation to the importance of teacher demographics. Our review underlined the importance of age as a potential factor. In Raygan and Moradkhani's (2022) large-scale study of Iranian language schoolteachers, quantitative questionnaire data revealed that age was a notable variable in predicting teachers' Technological Pedagogical and Content Knowledge (TPACK), and therefore, this would influence CALL integration.

Wang et al. (2010) is one final study which underlines the importance of psychological factors as well as the relationship between the teacher and the technology-mediated environment. In their small-scale study of eight university-based teachers in Australia, Wang et al. (2010) used a special LMS (Learning Management System) to train teachers and then report their experiences using multimodal materials (e.g., self-reflection journals, discussion forums and video recordings). They clarify that in CALL, it is not enough to only consider the relationship between teacher and student, but also to consider the relationship the teacher has with the technology-mediated environment. Wang et al. (2010) state that this relationship must be considered carefully because it also impacts teachers' personal growth.

Table 3. Contextual factors which align with Hong (2010)

Sub-factor	n	Representative study
Low level of CALL resources	13	Shin (2015)
School culture	2	Prasojo et al. (2018)

In agreement with Hong (2010), Shin's (2015) dual study of 25 and 35 pre-service teachers in South Korea found that the low level of CALL resources in the teaching context was a factor which affected CALL integration in university classrooms; while Prasojo et al.'s (2018) study of Indonesian teachers in high schools pointed more generically at the school culture as being a factor which affected CALL integration. This section shows that the factors identified by Hong's (2010) review more than a decade ago persist in the current CALL climate.

What CALL integration sub-factors were absent from Hong's (2010) findings and model?

We found 45 factors which were absent from Hong's (2010) model. From these 45 factors, we found many could be classified under the same three orbital spheres: (i) CALL teacher education factors, (ii) individual teacher factors, and (iii) contextual factors but the level of sub-factors in our review is more nuanced.

CALL teacher education factors. We found nine factors which related to CALL teacher education. These nine factors are shown in Table 4. Table 4 also highlights the nuanced picture of this factor level by drawing attention to the fact that these nine factors occur across multiple studies. This reinforces that CALL integration can be broadly similar across contexts yet have a degree of individualisation.

Table 4. CALL teacher education factors in our study

Sub-factor	n	Representative study
Access to materials (sometimes linked to legal use/copyright)	16	Shin (2015)
Knowledge of how to integrate technology	5	DelliCarpini (2012)
Online safety and ethical issues	4	Shin (2015)
Lack of awareness of materials' copyright	3	Shin (2015)
Lack of choice awareness for materials and tools	2	Ernest et al. (2013)
Training students remotely	2	Kessler & Bikowski (2011)
Awareness of/ability to recognise that different technological environments will display materials differently	2	Kessler & Bikowski (2011)
Time period of use	2	Jiang et al. (2022)
Adequately guiding trainers	2	Wang et al. (2010)

It is noteworthy that many factors in Table 4 relate to digital literacy deficiencies. Factors such as choice literacy (Ernest et al., 2013) and literacy surrounding copyright and ethics (Shin, 2015) is absent from the types of factors Hong (2010) has highlighted. This might signal a change in the teacher's role in CALL integration in the classroom. It might also signal that those teachers are being

tasked with making more independent choices regarding teaching materials than in the past, where material choice may have been more top-down and led by management. The same can be said for the awareness of how certain applications will be displayed on different technological devices. This compatibility seems to be a teacher-fronted issue, while in the past, it might have perhaps been a management-fronted issue that needed to be resolved. The final two factors relate more broadly to the relationship between the time spent using technology and its future integration. Jiang et al. (2022) found that the longer teachers are introduced to technology, the more likely they are to integrate that technology into their teaching; while Wang et al. (2010) remind us that trainers need to be adequately guided to provide the best experience for their trainees.

Our review also identified several clearly teacher-led factors relating to classroom management and practices. In line with our categorisations in Table 5, we felt these issues signalled a lack of training or CALL teacher education, and so these factors were classified as such.

Table 5. Teaching-related CALL training factors in our study

Sub-factor	n	Representative study
Lack of online teaching skills	18	Dashtestani (2020)
Time (effective use of resources)	16	DelliCarpini (2012)
The provision of feedback	15	Chen (2011)
Matching the multimedia found online to the language point being practised	2	Kessler & Bikowski (2011)
Ability to judge if learning was taking place	1	Hazaea et al. (2021)
Maintaining presence so activities prosper	1	Mathews-Aydinli & Elaziz (2010)

As Table 5 indicates, these factors are related to aspects of classroom practice and/or management. Table 5 highlights that in some contexts, CALL integration is influenced by a lack of online teaching skills and adopting appropriate online methodologies (e.g., see Dashtestani, 2020). A related point to this recognises the lack of literacy in matching multimedia with the language point being practised (Kessler & Bikowski, 2011). In a sobering realisation, the teachers from Arab league countries in Hazaea et al. (2021) recognised that they had trouble confidently determining if learning was actually taking place online.

The issue of time was frequently mentioned. For example, in a study of 53 TESOL pre- and in-service teachers, DelliCarpini (2012) found that teachers felt the amount of time given for implementing technology was insufficient. In their study of Turkish students learning Italian, Mathews-Aydinli and Elaziz (2010) noted that the long-term success of blogging would require the teacher to maintain a presence to ensure debates continued both in class and online via the blogs.

Finally, the provision of feedback was also found to potentially influence the success of CALL integration. For example, with 25 Taiwanese students and 35 teachers, Chen (2011) explored how an automatic speech recognition (ASR)

website created via the Microsoft Speech Application Software Development Kit could be used to improve oral skills with students. Questionnaire data revealed that the failure to provide adequate feedback was a drawback of the technology, while aspects such as intonation and stress were not covered by the application. This indicates the need to bridge tool shortcomings with adequate teacher training in ‘filling in gaps’ left by the technology’s limitations.

Individual teacher factors. Table 6 represents an overview of individual teacher factors. We found six factors in this category.

Table 6. Individual teacher factors in our study

Sub-factor	n	Representative study
Time/effort required to learn	7	Canals & Al-Rawashdeh (2019)
Difficulty motivating students	4	Mulyono et al. (2021)
Low self-efficacy	2	Sun & Mei (2020)
Management of computers	1	DelliCarpini (2012)
Opportunities to use resources	1	Lan et al. (2013)
Class management	1	Tafazoli (2021)

In terms of individual teacher factors, attitude again appears to be a noted influence on CALL integration and its success. For example, Canals and Al-Rawashdeh (2019) found that their small sample of 6 teachers in a Jordanian university felt that the time needed to learn different applications was not worth it because of the low reward to students.

While the classification of managing computers from DelliCarpini (2012) and the use of inflexible teaching methods may signal a training need or a contextual barrier, it is equally possible that they relate to specific individual teacher preferences. Therefore, we have decided to classify them as such.

It is interesting that factors relating to the day-to-day management and running of the classroom seem to be present for individual teachers in our review. In Lan et al. (2013), teachers pointed to a lack of opportunities to use technological resources in the classroom, while there were general impressions of individual failings in Tafazoli (2021) in Iran because some teachers expressed difficulty in controlling students’ activities online.

Contextual factors. The sphere of contextual factors represented the most complex sphere in our review. Rather than classify all 23 contextual factors as simply ‘contextual,’ we opted for a more fine-grained classification. This was because the factors originated from different levels of independent and mixed responsibility. We identified 12 factors which appeared to fall under the responsibility of the institutions where the studies took place and so classified these as ‘institutional’ factors. The range of institutional factors is shown in Table 7, alongside a sample of representative studies where they appeared.

We also identified five factors which appeared to fall under the responsibility

of individual countries' administrations at the government level. We classified these as 'country' factors. These factors are shown in Table 8. Finally, we identified six factors which had mixed levels of responsibility. These factors are shown in Table 9. These mixed factors could have responsibility at institutional and/or country levels. We believe that this more fine-grained picture of CALL factors is helpful for the CALL community to understand the complexities involved in attempting to mitigate these factors when integrating CALL into language classrooms.

Table 7. Institutional factors to CALL integration and its success

Sub-factor	n	Representative study
Technology less important than other curriculum goals	5	Lan et al. (2013)
Lack of appropriate software	4	Xiaobin et al. (2014)
Lack of clear policy/ understanding of any existing policy	3	Novita et al. (2022)
Oversized classes	2	Pham et al. (2019)
Contact with course designers	2	Nissen & Tea (2012)
Reluctance of managers to invest in new technology	1	Shahrokni & Sadeqjoola (2015)
Financial reward and recognition	1	Borthwick & Gallagher-Brett (2014)
School culture	1	Prasojo et al. (2018)
Top-down message from departmental leadership	1	Gruba & Chau Nguyen (2019)
School censorship	1	Ware & Kessler (2016)
Individual teachers using different tools	1	Nguyen & Nguyen (2021)
Limited server space	1	Espinoza & Medina (2021)

Factors in Table 7 are directly related to the day-to-day management of the language classroom. The first four factors in Table 7 are likely to be factors which have quite a direct and easily relatable influence on the integration and success of CALL in the language classroom. These are likely to be factors which resonate heavily with the average language educator on a daily basis. It was notable that the issue of technology competing for space alongside other curriculum goals was quite common. For example, in Lan et al.'s (2013) study of Taiwanese university teachers, the teachers explained that they did not make use of tools such as YouTube and Microsoft Office Word and PowerPoint because they felt it competed with the time needed for grammar mastery. This means that students do not fully experience the benefits of CALL integration in the language classroom.

Our review also highlighted other institutional factors, including large class sizes and a lack of appropriate software for students. In the case of the former barrier, when Pham et al. (2019) studied Vietnamese primary schools, their 20 teachers reported via reflective journals and questionnaires that large class sizes were a recurring barrier to properly integrating ICT into their classrooms. A different factor which also has the potential to impact the day-to-day

integration of CALL is the lack of appropriate software for students. This emerged in Xiaobin et al.'s (2014) study of primary and middle school teachers. It is interesting to note that these factors are mentioned across educational levels.

One final factor was the lack of contact teachers had with course designers. This was felt in contexts where teachers may have been handed down resources from course designers. Nissen and Tea's (2012) study of French university teachers implementing blended learning drew attention to this barrier. During interviews, teachers reported that since they had not designed the course, they felt distanced from it and felt that this distance meant they were not as invested in it as much as they wanted to be. This distance also had an impact on their confidence levels.

Other factors in Table 7 relate to school or management-level factors. The use of funding by managers to finance technology was a source of tension in Shahrokni and Sadeqjoola's (2015) school-based study in Iran, while in Borthwick and Gallagher-Brett's (2014) UK higher education study of language tutors, tutors reported that there was a lack of financial reward in developing technological resources and that time needed for this development was absent.

The majority of other factors in Table 7 relate to top-down institutional policies and practices. Table 7 highlights how policies and practices have an influence the school culture (e.g., Prasojo et al., 2018) and the level of school censorship (e.g., Ware & Kessler, 2016).

Other studies also presented a lack of clear policy as a barrier to CALL integration and its success. For example, this was found to be problematic in Novita et al.'s (2022) mixed methods study of 125 Indonesian high school teachers found via questionnaires and focus groups that teachers had a poor understanding of any existing policy on technology. A consequence of an unclear policy was that teachers would use different technological applications without clear standardisation. This confused students in Nguyen and Nguyen's (2021) study of Vietnamese university lecturers and administrators.

The next sections elaborate on the country and mixed-level factors our review uncovered. As Table 8 highlights, culture was a prominent factor. Culture was found to be a barrier in Iranian contexts. For example, in their case study of five in-service teachers, Nami et al. (2016) found that the culture of individual nature of lesson planning in the Iranian context was a barrier to technology implementation.

Table 8. Country-level factors to CALL integration and its success

Sub-factor	n	Representative study
Cultural resistance	5	Nami et al. (2016)
Parents' lack of awareness	2	Dashtestani & Hojatpanah (2022)
Electricity stability; internet connectivity	2	Prasojo et al. (2018)
Socio-economic problems relating to access	1	Atai & Dashtestani (2013)
Status of educational establishment	1	Jiang et al. (2022)

In Iran, a lack of awareness about technology from parents was also felt to be a barrier in Dashtestani and Hojatpanah's (2022) large-scale survey and interview of junior high school teachers. This is an interesting acknowledgement because it suggests that the integration of CALL and its success is not only dependent on the everyday activities of institutions and may, in fact, point to a deeper level of education being needed with parents who have some responsibility for supporting their children's education. Similarly, we see country-level factors appearing in Atai and Dashtestani's (2013) Iranian study of university students and teachers. They found socio-economic factors at university to be a factor in CALL integration as students had socio-economic reasons for lacking internet access.

Sharing similar types of problems to the Iranian context, Prasojo et al. (2018) found electricity stability and internet connectivity to be a factor to CALL integration and success in Indonesian Higher Education.

A final factor which helped highlight the uneven distribution of resources which could be used to boost CALL integration and success in contexts was the ranking system used to rank institutions in some countries. For example, Jiang et al. (2022) found that 'better' or higher-ranked institutions had better access to resources, and so on the flip side, institutions which were lower ranked would lack access to resources in Chinese universities.

Table 9 highlights the complexity of contextual factors by highlighting that with these six factors, responsibility might cut across institutional and country boundaries.

At a simple level, Dashtestani's (2014b) study of 39 teacher trainers in Iran reminds us that Iranian teachers may hold ingrained preferences and views on traditional teaching methods which impede the integration and success of CALL in their language classrooms. In Dashtestani's (2014a) study across different levels of education, Iranian teachers also note that there is a lack of appropriate teaching materials for CALL. A barrier which may interact with the lack and quality of resources is that of funding. Funding was identified as a barrier in Dashtestani (2014b) and Xiaobin et al. (2014).

Other factors in Table 9 relate to internet connectivity which may be a country or institutional-level deficit, as found in Boersma and Getu (2016). When studying Indonesian university CALL integration, Silviyanti and Yusuf (2015)'s teachers reported that insufficient government and institutional support was a recognised barrier. Chien's (2013) study of e-portfolios in a Chinese context highlights another mixed-level factor. The 16 pre-service teachers reported that when they relied on external resources, resources were not user-friendly.

Table 9. Mixed-level contextual factors to CALL integration and its success

Sub-factor	n	Representative study
Internet connectivity	14	Boersma & Getu (2016)
Inflexible teaching methods	3	Dashtestani (2014b)
Lack of appropriate teaching materials	2	Dashtestani (2014a)
Funding	2	Xiaobin et al. (2014)
Lack of user-friendly external resources	2	Chien (2013)
Insufficient government and institutional support	1	Silviyanti & Yusuf (2015)

Overall, Tables 7–9 reinforce that factors in CALL integration are complex and multifaceted. In summary, the three spheres of Hong’s (2010) model were found in our review. Factors relating to all three spheres were found in individual studies indicating that the spheres interact and contribute to understanding that factors to CALL integration are complex.

Discussion

This study aimed to conceptually replicate the literature review and subsequent spherical model produced by Hong (2010). We set out to evaluate the current validity of Hong’s (2010) spherical model of barriers to CALL implementation by answering one central research question: To what extent does Hong’s (2010) spherical model remain valid in its original shape and emphasis when the literature base is documented, updated and systematically analysed?

Our results confirm that Hong’s (2010) original model holds some validity from its original conception. Our analysis continued to find evidence that all three spheres were still present in a larger, more comprehensive, updated literature base.

Our review provided a more nuanced picture of CALL integration factors that the CALL community should consider when implementing new interventions in their classrooms. In total, we identified 56 integration factors in the literature. Our findings partially support Hong’s (2010) model across three spheres: CALL teacher education, individual teacher factors, and contextual factors. Specifically, we found 11 factors that aligned with those in Hong’s (2010) narrative and spherical model. These 11 factors were distributed across the three spheres as follows: (i) two CALL teacher education factors, (ii) seven individual teacher factors, and (iii) two contextual factors. While this agreement lends some validity to Hong’s model – given that our review of more recent literature identified some of the same factors – there were many sub-factors that were not afforded attention or found in Hong’s model and study narrative.

A total of 45 factors did not appear in Hong’s model, comprising 16 factors related to CALL teacher education, six individual teacher factors, and 23 contextual factors. Importantly, this volume of individual teacher and contextual

factors calls into question the emphasis placed on CALL teacher education factors from Hong's (2010) model.

Consequently, we believe there is a need for a more comprehensive and systematically developed model. Figure 6 illustrates our response to this need. This 3D model highlights the prominence of contextual factors while still retaining CALL teacher education and individual teacher factors. This model effectively captures the diversity we uncovered in our review and serves as a reminder to the CALL community of the complexities involved in integrating technology into language classrooms. Taken together with our narrative above, the CALL community is better placed to grasp integration complexities and work towards action plans to mitigate the impact of these complexities.

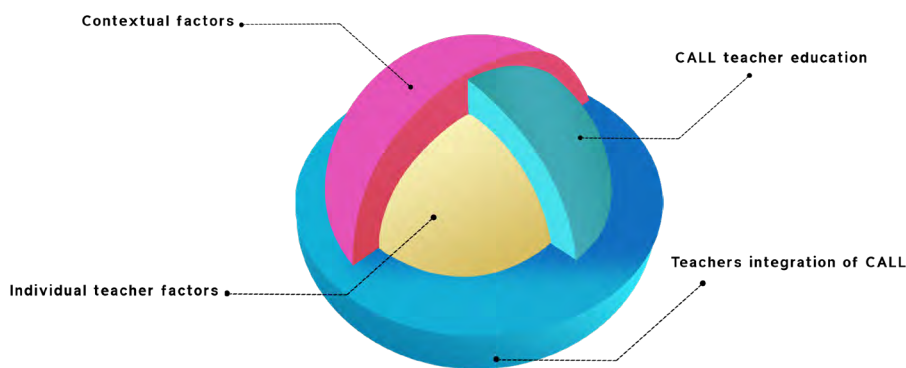


Figure 6. 3D-model representation of CALL integration factors

The main aim of our paper was to uncover whether Hong's (2010) model of CALL implementation barriers still holds validity a decade after its conception. While our findings suggest that it retains some relevance, we have identified a broader range of factors and complexities in more recent literature. Thus, several CALL stakeholders will benefit from our review and remodelling. All CALL stakeholders, from students to school/university management, can gain insights into the complexities involved in CALL integration. This aids in greater appreciation and respect among stakeholders who may only recognise the relevance of their particular set of circumstances.

The primary group of beneficiaries from this study is teachers. They can better understand the integration complexities and gauge how their views on CALL are being voiced in the literature. Our findings point out ongoing concerns with CALL integration and normalisation under the lens of Bax's work (2003, 2013), particularly considering continuing barriers such as teacher resistance and inadequate or insufficient teacher training. Our findings suggest that for many teachers in the reviewed studies, technology (of varying degrees and types) has not found its rightful or proper place in their everyday practice. Indeed, the views of the teachers in these studies suggest that instead of becoming normal to the point of not being consciously aware of its use, technology use is very much still a prominent issue in their classrooms. Our analysis of

relevant factors continues to highlight this fact and in doing so, we hope to validate teacher views. Our findings also have relevance to wider teacher-focused discussions taking place in CALL at the present time. Recently, Kern (2024) and González-Lloret (2024) have placed emphasis on teachers leading the way for students hoping to integrate new technologies such as generative AI (e.g., ChatGPT) into their learning journeys. Both scholars acknowledge that teachers could lead the way in helping students use these technologies to critique and support their language learning. However, along with the sobering realities expressed by González-Lloret (2024), we feel our findings in the current study serve as a timely reminder of the complexities involved in CALL integration. It is clear from our analysis that even the integration of ‘past’ technologies has taken place against a backdrop of struggle for teachers. There is little to suggest in the current literature that the integration of newer technology will be any different and that teachers will continue to experience struggles as key CALL stakeholders and often CALL messengers in their classrooms.

Another pertinent group of beneficiaries is curriculum developers. By recognising these factors, curriculum developers can enhance their awareness of essential considerations for effective design. Understanding these factors may also pave the way for informed macro-level decision-making. It is the responsibility of decision-makers to support teachers in embracing technology integration, as it increases their technological, pedagogical, and content knowledge. Course designers also stand to benefit from our findings. They can gain insights into creating effective courses informed by the factors we identified. For example, they can take account of materials provision and development, which has been an area of restriction in CALL over the last two decades (see Kessler & Plakans, 2001). Finally, in line with Hong (2010), we agree that the factors influencing CALL integration should be respected as a complex and multidimensional issue. We hope our study sheds light on this issue and encourages the CALL community to further expand our understanding of integration in the future.

Conclusion

The purpose of this study was to replicate the literature review and validate the subsequent spherical model proposed by Hong (2010), as well as to extend the understanding of the range of factors influencing CALL integration documented in the literature. Our findings revealed that teachers encountered 56 factors affecting CALL integration. Of these, Hong’s (2010) model addressed 11, indicating that many of the factors identified over a decade ago remain to prevail in the current CALL environment. Based on our extensive sampling and thorough literature coding, we can confidently assert that Hong’s (2010) original model still retains some validity today. However, 45 additional factors emerged in our study that were not identified by Hong (2010), many of which can be classified within the three spheres of his original model. Although our study shows that numerous factors are consistently highlighted across different studies, successful integration is still, to some extent, context-dependent.

Although this study provides a more comprehensive and systematic review of the potential factors affecting CALL integration, there are still limitations to our study. We focused solely on the eight highest-ranked Q1 CALL journals, which limits our ability to generalise the results to the entire body of CALL integration literature. Nevertheless, we are confident that our findings present a model of CALL integration that aligns with the literature base in our selected journals. Another limitation is that we focused exclusively on studies involving teachers, meaning our understanding of the factors is constrained to teacher voices. Future research should aim to expand this model by incorporating the views of other CALL stakeholders (e.g., students, school/university management, and policy makers). This broader approach would provide an enhanced picture of integration, particularly regarding the nuanced contextual factors we have uncovered.

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Appendix A

Example of a categorisation template

Dashtestani, R., & Hojatpanah, S. (2022). Digital literacy of EFL students in a junior high school in Iran: voices of teachers, students and Ministry Directors. *Computer Assisted Language Learning*, 35(4), 635–665.
<https://doi.org/10.1080/09588221.2020.1744664>

Aim	The current study is an attempt to unravel the perspectives of three groups of junior high school stakeholders on the challenges of promoting Iranian junior high school students’ levels of digital literacy.
RQs	1. What are Iranian junior high school teachers’ and students’ perspectives on students’ levels of digital literacy for learning English as a foreign language? Is there a significant difference between teachers’ and students’ perspectives? 2. What software tools and applications are commonly used by Iranian junior high school students based on the perspectives of teachers and students? Is there a significant difference between teachers’ and students’ perspectives? 3. What are Iranian junior high school teachers’ and students’ perspectives on present challenges and future strategies to be taken to promote students’ levels of digital literacy for learning English as a foreign language? 4. What are the perspectives of Directors of the Ministry of Education on the challenges and benefits of promoting Iranian junior high school students’ digital literacy?
Technology used	CALL in general
Data collection	Questionnaire and interviews
Research design	Mixed
Context	64 junior high school students, 20 junior high school teachers, and 3 Directors of the Ministry of Education (Iran)
Findings and complexities	students used technologies for non-educational purposes; parents’ lack of awareness about technology use for educational purposes can be a potential impediment to technology use and the promotion of digital literacies of students; lack of access to digital devices at schools