# Evaluation Report

## *Writing for all: Studying the development of handwriting and keyboarding skills in the Early Years*

December 2024

Writing & Reading For All

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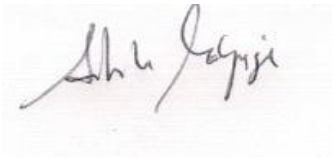
Report by Dr Anabela Malpique, Chief Investigator of the project, on behalf of the *Writing for All* team



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# Executive Summary

Writing is a critical skill for life in the 21st century. In the last two decades, with digital writing replacing paper-based writing in many of our professional and personal written interactions, we find ourselves constantly writing texts, emails, and sending written text messages to each other. In today's digitalized world, children are also expected to produce paper and computer-generated work across subjects and school years. Considering the continuing digital revolution in education and learning, the *Writing for All* project was designed to investigate Year 2 students' abilities and motivation to write handwritten and keyboard-based texts, as well as classroom-level factors promoting effective writing development. In the current evaluation report, we describe key findings from this large-scale study involving a total of 593 children enrolled in 50 classrooms from 19 primary schools in Western Australia. We offer evidence-based recommendations to guide educational practices to support children's writing acquisition and development in the early years. We further describe and evaluate the approach we followed for knowledge dissemination in academia, outside academia, and directly to schools and teachers, providing a comprehensive evaluation of the project's current research impact at the national and international levels. We also share testimonials from teachers and participating children about teaching and learning paper and keyboard-based writing in early education. We finish the current evaluation report offering recommendations for future research aiming to provide a comprehensive understanding of student and contextual-level factors explaining primary students' paper and computer-based writing acquisition and development.

"*Writing is a craft before it is an art; writing may appear magic, but it is our responsibility to take our students backstage to watch the pigeons being tucked up the magician's sleeve*".

Donald M. Murray (2004, p.4)

## Key Findings

**Finding 1.** Early primary students write longer and higher-quality texts using paper and pen(cil) compared to keyboard-based writing.

**Finding 2.** Automaticity of handwriting and keyboarding skills is the strongest predictor of children's paper and computer-based writing performance.

**Finding 3.** Positive associations between children's paper-based writing skills and performance and children's computer-based writing skills and performance.

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**Finding 8.** Many teachers find they did not receive adequate preparation to teach writing in primary classrooms.

**Finding 9.** Teachers do not feel adequately prepared to teach computer-based writing, spending little time supporting the development of computer-based writing in Australian primary classrooms.

**Finding 10:** Parents/Carers are valuable assets in promoting children's positive attitudes towards writing.

## Key Recommendations

**Recommendation 1.** Develop communities in which writing and the teaching of writing are valued.

**Recommendation 2.** Prepare students to become “hybrid” writers with expertise in both handwriting and keyboarding.

**Recommendation 3.** Support the automaticity of handwriting and keyboarding skills.

**Recommendation 4.** Follow an integrative approach to support the development of psychomotor, cognitive, and affective aspects of writing.

**Recommendation 5.** Tailor writing instruction to respond to the gender gap in writing.

**Recommendation 6.** Develop opportunities for teacher training and development on evidence-based practices for teaching writing.

**Recommendation 7:** Develop home-school connections to support writing development.

# 1. Introduction

**Writing is a critical tool for communication, knowledge creation, dissemination, and curation in the digital age**. With the vast expansion of digitalisation in the last two decades, writing has expanded its reach as a communication tool and is today part of personal, professional, and educational environments across the globe. Skilful writing is essential for students since it empowers them to communicate, acquire knowledge, critically engage with information, and produce text-based original thoughts. Hence, developing writing skills is a central part of curricula worldwide [1,2]. Traditionally, paper-based writing has been the main mode for learning, instruction, and assessment in schools, and still is in most primary schools. The digital age, however, has brought changes to the teaching and learning of writing, and in several educational contexts today **children are expected to start developing computer-based writing skills as soon as they start formal education** [3].

**Little is known about children's ability to write by hand and by keyboard in Australia**. This gap is worrisome in a time when digital writing devices have been replacing writing by hand and in a context where high-stakes testing assesses students' literacy skills via keyboarding as early as in Year 3 [4]. Importantly, it is not clear that students have the keyboarding skills necessary to demonstrate their skill development in any academic areas, particularly in writing [5]. **The impact of digitalisation on writing development is still unknown** and researchers are stressing the urgency of understanding the development of both paper and computer-based writing skills to inform evidence-based practices for writing instruction in the digital age [6,7].

It's critical to emphasise that, historically, learning and teaching writing have received much less attention from literacy researchers and educational policies globally. It is widely recognised that **writing has been, for decades, the neglected R in educational research agendas globally compared to the substantial attention that reading acquisition and development has received** [1, 8]. Reading is a fundamental skill that all students need to master, but so is writing. Writing is one of the most pervasive means of communication and knowledge dissemination and it is a primary way through which humans express their

creativity and critical thinking. Writing is used as a communication and assessment tool across subjects and learning areas, and young children who face challenges in learning to write are at a disadvantage and face increased challenges as they progress through schooling [9]. **Preparing proficient writers is more important than ever given the sudden propagation of generative Artificial Intelligence (AI) tools available to the public**. Emerging research points out that generative AI should not replace human writers [10]. Instead, human-AI constructive collaborations should be fostered, with effective writers using their literacy knowledge and critical skills to assess the credibility and enhance the quality of AI generated texts [11]. Overall, this project aimed at **expanding knowledge about writing development in early education to inform writing assessment and instruction** that empower all children to communicate their ideas in written language in the digital world.

## Project Overview

Considering the continuing digital revolution in education and learning, the *Writing for All* project was designed to investigate Year 2 students' handwriting and keyboarding abilities and motivational factors, as well as teaching practices promoting effective writing development. The *Writing for All* project was planned to be developed in two phases, as per Figure 1.

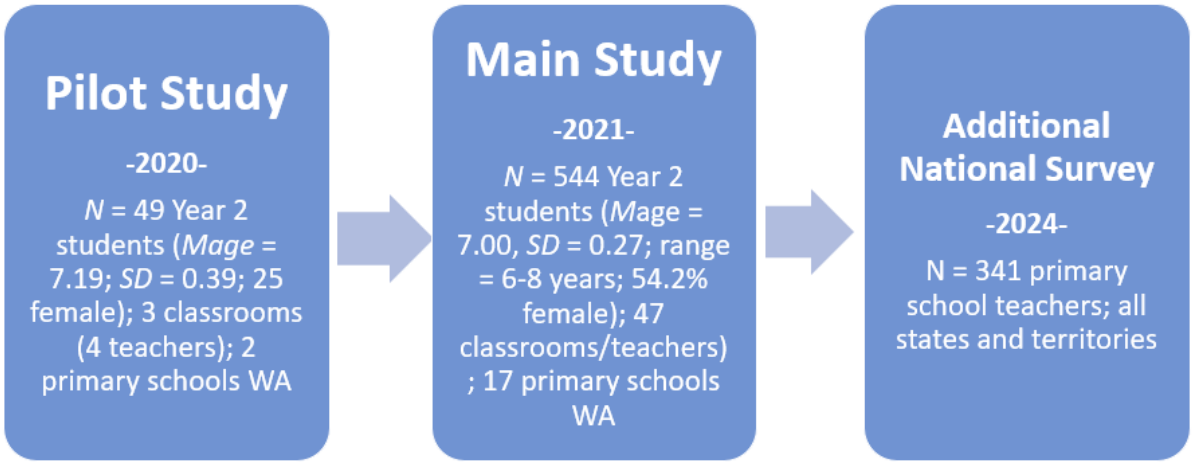


Figure 1 – Project Phases

In a first phase, **a pilot study** was conducted to assess data collection procedures and assessment measures. A sample of three Year 2 classrooms, 49 children and four teachers

participated in the pilot phase of the project (Malpique et al., 2023a; 2024a). In the **main study** phase of the project, data was collected in 17 primary schools in Western Australia involving 544 Year 2 children and 47 primary school teachers (Malpique et al., 2023c; 2024bc). Handwriting and keyboarding outcomes were assessed (i.e., letter writing automaticity; spelling; writing quality and productivity), as well as reading outcomes (i.e., word reading and reading comprehension). Children's self-efficacy and attitudes towards writing across modalities were also assessed, as well as their executive functioning skills. Finally, Year 2 teachers were surveyed on the frequency and nature of the writing instruction provided in their classrooms (as per Figure 2). A final study was included in the current project to examine primary teachers' preparation, beliefs, and instructional practices for teaching computer-based writing (a national survey, involving 341 teachers). A PhD project was also developed with a subsample of participants from the main study phase to examine Parents/Carers' involvement in children's writing (159 parent/child dyads; Kelso-Marsh, under review 1,2,3).

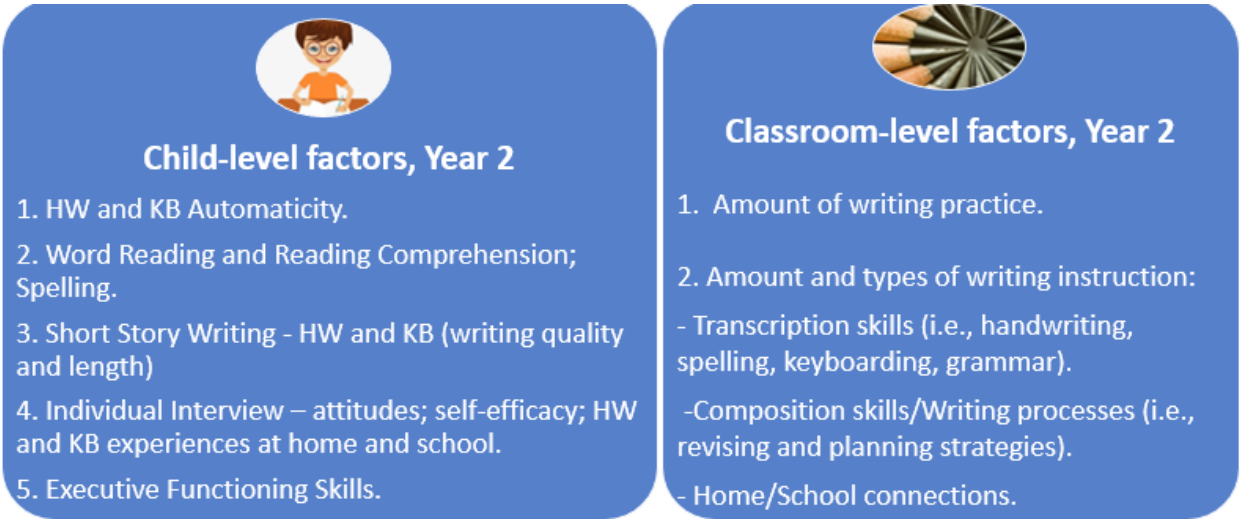


Figure 2 – Project Variables

## 2. Project Key Findings

### Finding 1. Early primary students write longer and higher-quality texts using paper and pen(cil) compared to keyboard-based writing.

We conduct a meta-analysis of studies comparing the effects of handwriting and keyboarding on the writing and reading performance of primary-aged students (aged 3-12 years) (Malpique et al., 2023b). We examined international studies published between 2000-2022, a time of unprecedented technological growth impacting literacy learning. Our findings indicated that on average K-6 students produce higher quality writing via paper and pen(cil) than via keyboard. A key finding from this meta-analysis was also the limited number of national and international research comparing the role of writing tools to explain children's writing performance across modalities, with only five studies comparing the quality of paper and computer-based texts children composed. In many educational contexts today, students are asked to understand and compose paper and computer-based texts in the first year of schooling [e.g., 3]. In Australia, supporting the development of computer-based writing skills is included in curriculum guidelines as early as in Pre-Primary [12]. In the last decade, high-stakes assessments of students' literacy skills, including in writing, have moved to online assessment formats in many countries [e.g., 3, 13], including in Australia [4]. Less attention has been placed, however, on understanding the impact of digitalisation on students' writing acquisition and development, with researchers emphasizing the need to examine factors contributing to students' proficiency in writing across writing modalities [14, 15]. The current *Writing for All* project was the first research study, to our knowledge, comparing young children's paper and computer-based writing performance in Australia. Results from the pilot study and the larger-scale main study, aligned with findings from our meta-analysis of studies in the field, showed that Year 2 children write longer and higher quality texts using paper and pencil.

**Finding 2. The automaticity of handwriting and keyboarding skills is the strongest predictor of children's paper and computer-based writing performance,** above other student-level factors said to contribute to writing

performance in the early years (spelling, word reading, reading comprehension, and executive functioning).

In the pilot and main phases of the current project, we examined the unique contributions of handwriting and keyboarding automaticity in explaining children's paper and computer-based writing performance (compositional quality and productivity). Multilevel modelling analyses, which enabled us to comprehensively examine the contributions of specific children-level variables - HW and KB automaticity; spelling; word-reading; reading comprehension; executive functioning; gender - to explain children's paper and computer-based writing, showed HW and KB automaticity play a critical role in predicting children's writing performance across modalities. Aligned with previous research in the field and extending findings regarding computer-based text composing in the early years, findings from the current project showed that Year 2 students with higher levels of handwriting and keyboarding automaticity wrote longer and higher-quality texts in both writing modalities (pilot study, Malpique et al., 2023b, 2024a; main study, Malpique et al., 2023c, 2024bc). These findings provide additional support to theoretical models of writing [16; 17] arguing that transcription skills constrain young writer's processing capacity to focus on higher-order skills of text composing and extend findings from the few empirical studies examining computer-based writing in early primary [18].

## Finding 3. There are positive associations between children's paper-based writing skills and performance and children's computer-based writing skills and performance.

One major finding from this project was moderate to strong relationships between children-level factors predicting paper-based and computer-based writing, suggesting relationships between writing modalities that are yet to be investigated. More specifically, results from the pilot and main phases of this project showed that children with higher handwriting automaticity also showed higher keyboarding automaticity; children who wrote longer and higher quality paper-based texts also wrote longer and higher quality computer-based texts; children with higher spelling, word reading and reading comprehension skills wrote longer

and higher quality paper and computer-based texts (Malpique et al., 2024ac). This is, to our knowledge, the first project examining these relationships.

## Finding 4. Reading-writing connections contribute to explaining children's paper and computer-based writing performance.

Results from our multilevel analyses (Malpique et al., 2024c) show that, apart from the unique role of transcription skills, other children-level variables may have a significant impact on writing performance across writing modalities in the early years. Research shows that reading and writing are developmental skills that influence each other throughout schooling [19]. In a meta-analysis examining reading-writing relations, it was found that these relations were moderated by developmental stages and that they varied depending on reading and writing subskills [20]. In the current project, children with better reading scores, especially in word-reading, wrote longer and higher quality texts across writing modalities (Malpique et al. 2024ac). In both the pilot and main phases of the project, word-reading skills were found to have a consistently significant positive effect in all the models tested and for both paper-based and computer-based compositional quality and productivity.

## Finding 5. Gender gap in writing performance in favour of female students evident across modalities and as early as in Year 2.

Given the recurrent national and international reports signalling a gender gap in writing typically favouring female students across years of schooling [21, 22, 23], we set to expand knowledge about factors potentially explaining this gender gap in writing across writing modalities. In the pilot phase of the current project, gender differences in writing soon become apparent when assessing children's paper and computer-based writing performance and when interviewing children about their attitudes, preferences, and self-efficacy in writing paper and computer-based texts (Malpique et al., 2023a, 2024a). In the subsequent main phase of this project, and with a much larger sample of children, multilevel analysis revealed a worrisome gender gap in writing across modalities as early as in Year 2. More specifically, girls were found to outperform boys in all writing (handwriting and

keyboarding automaticity, spelling) and reading-related variables (word-reading and reading comprehension), and on executive functioning skills. Consistently, findings from the pilot study and the main study phases of this project showed that girls wrote longer and higher quality paper and computer-generated texts, holding more favourable general attitudes towards writing and more favourable attitudes towards writing paper and keyboard-based texts (Malpique et al., under review1). Using more complex statistical analyses (i.e., multilevel modelling) we examined the contributions of student-level cognitive variables (handwriting and keyboarding automaticity, spelling, word reading, reading comprehension, and executive functioning) and motivational variables (general attitudes and specific attitudes towards writing paper and computer-based texts) in explaining gender differences across modalities after controlling for variance due to classroom. Our multilevel analyses revealed significant differences between boys and girls in both compositional quality and productivity across writing modalities. Specifically, boys consistently exhibited lower scores in both compositional quality and productivity compared to girls. Gender differences were notably influenced by various student-level factors such as handwriting automaticity, spelling ability (more impactful for boys), and reading skills, which demonstrated differential associations with compositional outcomes between genders. Our comprehensive models allowed us to develop nuanced gender profiles for both paper and computer-based compositional quality and productivity, suggesting distinct pathways through which student-level variables contribute to compositional skills based on gender. Overall, our study contributes to the understanding of how gender and student-level variables interact to shape early years students' abilities in both traditional and digital writing contexts.

## Finding 6. Children's attitudes towards writing contribute to their performance across writing modalities.

Understanding the motivational factors of beginning writers is critical because success builds upon individuals' beliefs about their own competence to complete a task [24], implying that children's self-beliefs are particularly malleable and dynamic in the first years of schooling [25, 26]. Literacy research, however, has emphasised the study of cognitive factors explaining writing development, with a scarcity of studies investigating relations between the writing attitudes of beginning writers and their writing achievement [25]. In

this project, and following an embedded mixed methods design [27], we examined the contributions of children's writing attitudes in explaining their writing performance across modalities. For that, we conducted semi-structured interviews in which children were asked to complete a survey including questions about their general attitudes towards writing and their attitudes towards writing paper and keyboard-based texts (Malpique et al., under review1). When analysing children's survey responses and examining the unique contributions of Year 2 students' writing attitudes to explain their paper and computer-based writing performance, we found that children's positive attitudes made a statistically significant unique contribution in explaining their writing outcomes. Children expressed highly positive general writing attitudes (average score of 3.95 on a 5-point scale) as well as highly positive specific paper and keyboard-based writing attitudes (average score of 4.02 and 3.91 on a 5-point scale, respectively). Hence, our findings reinforce the criticality of supporting the development of children's positive attitudes towards writing. To gain a more comprehensive understanding of children's motivation for writing across modalities, our interviews prompted children to explain their answers and provide reasons for their responses ("Why so?" prompt). A qualitative analysis of responses from a representative sample of participating children (*n* = 54 students; 26 girls and 28 boys) offered further information about children's motivational beliefs in writing. Our analysis revealed that between a quarter to a third of the children interviewed expressed negative attitudes and lack of abilities to write, with 64% of them expressing a lack of ability to competently type using keyboards (Malpique et al., under review1).

## Findings 7 and 8. The average time for writing practice and for teaching writing in Year 2 classrooms is below evidence-based recommendations. A large percentage of teachers find they did not receive adequate preparation to teach writing in primary classrooms.

In the current project, we aimed at examining classroom-level factors potentially explaining children's handwriting and keyboarding skills and their paper and computer-based writing performance. For that, in both pilot and main study phases of the project we asked teachers to complete a self-report instrument about the writing practices and instruction being provided in participating Year 2 classrooms. More specifically, teachers were asked to report

on their preparation to teach writing; on the weekly time children spent writing in their classrooms; on the weekly time teachers spent teaching foundational writing skills (handwriting, spelling, keyboarding, and grammar), and teaching text composing strategies (planning and revising); and the frequency with which they implement evidence-based practices for teaching writing in their classrooms.

International research investigating writing instruction typically reports little time allocated for writing practice and for teaching writing in primary school settings across the globe [16]. Evidence-based recommendations for writing development and instruction suggest that teachers should provide daily time for writing in their classrooms, with a minimum of one hour per day devoted to having children engaged in writing activities and to the explicit teaching of foundational and text composing skills [1, 28]. In the pilot study, participating teachers (n = 4) reported allocating less than 1.5 hours on average for weekly writing practice in their classrooms (Malpique et al., 2023a). In the main study phase, teachers (n = 47) reported allocating about 3 hours on average for weekly writing practice in their classrooms (Malpique et al., 2023c). Importantly, in both the pilot and main phases, there was a large variability in the time allocated for writing practices across classrooms, ranging from 60 minutes to 100 minutes per week in pilot classrooms and from 60 minutes to 660 minutes per week in main study classrooms. Pilot and main study results further showed that the focus of writing instructional practices was placed on teaching spelling (average of 120 minutes in pilot and main studies) over and above any other writing skill assessed, with limited time spent on teaching handwriting (average of 60 minutes in pilot study; 42 minutes in main study) and keyboarding (average of 15 minutes in pilot study; 28 minutes in main study) on a weekly basis. Pilot and main study results further showed that teaching strategies to extend writing to the home environment were the least frequently implemented strategies from the instructional practices assessed. Importantly, about 47.5% of main study teachers believed their undergraduate preparation was poor (34.8%) or inadequate (13%). Teachers seemed more positive about their in-service preparation to teach writing. A higher percentage of teachers reported they had received a very good in-service training to teach writing (60.9%), with another 6.5% reporting it as exceptional and 17.5% as adequate. Only 10.9% of teachers reported having received poor (8.7%) and inadequate (2.2%) in-service preparation for teaching writing.

## Finding 9. Primary teachers don't feel adequately prepared to teach computer-based writing in their classrooms in Australia, spending little time supporting the development of computer-based writing in their classrooms.

After conducting the pilot and main phases of the current project and considering the criticality of gaining further insights about instructional practices provided to support children's computer-based writing, a final national study was conducted to investigate primary teachers' preparation, beliefs, and instructional practices to teach computer-based writing in Australian primary classroom. Preliminary analysis from this national survey involving 341 Grades 1-6 teachers suggested that teachers don't feel adequately prepared to teach computer-based writing in their primary classrooms, having received little or no pre-service and in-service preparation to teach computer-based writing skills. Preliminary results further suggest teachers spend little time teaching keyboarding and word-processing skills and that they feel little confidence in teaching these skills in their primary classrooms. Final analyses are planned to be completed by April 31, 2025, for dissemination of findings in 2025-2026.

## Finding 10. Parents/Carers serve as valuable assets in promoting children's positive attitudes towards writing.

Supporting children in becoming skilful writers in the digital world "places greater responsibility on schools and families to help [them] become more efficient at accessing, transmitting, and using information" [28 p. 243]. Findings from the current project suggest that teachers may not be capitalising on the home context to encourage writing. Replicating findings from a national survey that our team conducted to gain insights into teachers' instructional practices in Australian primary classrooms [40], participating Year 2 teachers from the pilot and main phases of this project reported that they developed activities to extend writing to the home environment very sparingly (Malpique et al., 2023a). However, children's responses to our semi-structured interviews suggest that they engage in a variety of home-based writing activities, including writing lists, cards, and short stories. Children's responses were also indicative that support for writing is a family affair, with parents,

siblings, grandparents, and meaningful others scaffolding their writing efforts. We further asked children about their experiences with writing at home using paper and pen(cil) and computers/laptops. Findings were indicative that 76.5% of participating children used paper-pen(cil) for their writings, with only 20% of children confirming that they used computers for writing at home, and only 26.5% of children reporting that they had a personal computer/laptop at home. Overall, these findings reinforced the need to learn more about the role of contextual-factors, including home-level variables, in explaining the writing performance of beginning writers.

With that purpose, a PhD project was also developed with a subsample of participants from the main phase of the current *Writing for All* project to examine Parents/Careers involvement in children's writing (159 parent/child dyads; Kelso-Marsh, under review 1,2, 3). A fundamental tenet of theories explaining skilful writing is that children develop different writing practices, skills, and motivation for writing by interacting with more skilled adults and peers, who via scaffolding and modelling help children accomplish writing related tasks that they could not undertake independently. Parents are often children's first educators and the first to provide them with instruments and opportunities to translate their ideas into written language. However, parental involvement in children's writing is still under-studied despite research suggesting benefits to children's writing performance [30]. The PhD project developed within the main study phase of our *Writing for All* project was designed to examine relations between parental involvement and Year 2 children's paper-based writing performance (Kelso-Marsh, under review 1,2,3). More specifically, it examined the influence of parental motivational variables (i.e., autonomous and controlled motivation, perceived responsibility, self-efficacy beliefs) in explaining parental involvement in writing activities at home. Another aim of this PhD project was to examine the potential contributions of parental involvement in explaining children's writing outcomes, namely children's attitudes toward writing and the quality of their handwritten texts. Findings from the PhD project showed parents/carers who are autonomously motivated in supporting their child's writing development engage more often in home-led writing activities. Such parental involvement in home-led writing activities strengthens children's positive attitudes towards writing, resulting in higher quality texts children produce at school.

# 3. Evidence-Based Recommendations

## Recommendation 1. Develop communities in which writing and the teaching of writing are valued.

Writing is a social activity shaped and constrained by the communities in which it takes place [16]. Learning to become a skilful writer is a challenging process and requires decades of learning [31]. Indeed, writing does "not simply unfold automatically and effortlessly in the manner of a well learned motor skill" [31 p.17]. To become skillful writers, children need to learn and develop foundational writing skills, such as handwriting, keyboarding, grammar usage, and spelling; learn and develop sentence and text-level skills as well as strategies to compose texts, such as goal setting, planning, and revision; learn and develop content knowledge, specialized knowledge, and knowledge about the target audience; learn to monitor and regulate multiple aspects of writing (e.g., emotions, behaviors, beliefs, attention, problem solving); and develop motivation for writing and confidence about their writing competence. Hence, developing communities in which writing development and the teaching of writing are valued and supported is paramount. More often, and aligned with educational policies and agendas, school communities prioritize the learning and development of reading skills over the learning and development of writing skills [1]. It is critical to remember, however, that both reading and writing are life skills that all students need to master. In our digital and global world, writing has become a critical life skill, with text communications being an integral part of our personal and professional lives. Importantly, and as confirmed in this project's findings, reading and writing are related skills, explaining children's paper and computer-generated texts. Hence, as recently argued by other researchers in the field, the science of reading is incomplete without the science of writing [32]. As such, school leaders should develop a comprehensive vision and strategic plan for teaching literacy in the early years aiming to promote a community in which writing is valued by all community members, including students, teachers, staff, families, and the larger community. Research reports more often schools and teachers don't view writing development and instruction as a priority, with many schools holding on to a non-progressive view about the teaching of writing, placing a more recurrent focus on form and correctness, especially concerned with expectations for writing imposed by standardized

writing assessments [33]. It is time for change. School communities must find ways to include opportunities for writing and teaching writing every day for longer periods of time, with opportunities for students to develop different writing skills and to share their writing voices and ideas in paper and computer-based texts. It's a question of revitalising school communities as a whole to empower all students to become skilful writers in the digital world.

## Recommendation 2. Prepare students to become "hybrid" writers with expertise in both handwriting and keyboarding.

In the last decades, the way we use written tools to communicate our thoughts and ideas with other people changed dramatically. In our digitalised world, children's first experiences with writing are often on smartphones and iPads, so we assumed that because children are 'digital natives' they are 'naturally' able to write texts using digital devices [34]. Findings from the current *Writing for All* project question that assumption. More specifically, results from our meta-analysis (Malpique et al., 2023b) of international studies published between 2000-2022 comparing the effects of writing by hand or keyboarding on primary students' writing performance showed that primary students produce higher quality texts using paper and pen(cil) than when using a keyboard. Subsequent findings from our pilot and main study with Year 2 children in WA replicated these findings, with children writing longer and higher-quality handwritten texts. It's important to note that in most educational systems, including in Australia, children are introduced to writing by hand, and digital writing is only added as an extra skill once handwriting has been mastered [7]. Current findings offer evidence on the importance of developing handwriting skills to support paper-based writing in early primary education. Research does show that teaching handwriting in the first years of schooling is connected to improved spelling and a greater capacity to write fast and accurately [35]. Brain research comparing paper and keyboard-based writing also found advantages of taking handwritten notes, showing that the motor activity of coordinating the complex hand movements when shaping letters using a pen causes "different underlying neurological processes that provide the brain with optimal conditions for learning and remembering "[36 p.2]. Hence, there's compelling evidence for the importance of developing handwriting skills and for teaching handwriting in the digital age.

Interestingly, a major novel finding from our project was the moderate to strong relationships between writing modalities. Our findings suggest that there are relations between children's handwriting and keyboarding abilities and attitudes, and that potentially supporting children in developing paper-based text composing skills may contribute to developing children's keyboard-based text composing skills. Longitudinal research is clearly needed to understand developmental pathways explaining these connections and to address unanswered questions about the order in which handwriting and keyboarding should be taught or whether teaching these skills simultaneously is beneficial for children. The fact is that digital tools are now an integral part of most communities across the globe. Hence, an important recommendation from the current project is to prepare students to become "hybrid" writers, able to produce paper and computer-generated texts with a similar level of proficiency.

## Recommendation 3. Support the automaticity of handwriting and keyboarding skills.

If we are to prepare children to master paper and computer-based writing to become active and successful digital citizens, the focus must be placed on understanding factors explaining writing acquisition and development across writing modalities. Findings from this project reinforce previous research showing that children's capacity to automatize handwriting and keyboarding predicts their writing performance across modalities. Automaticity refers to being able to write or type letters and words effortlessly. Whether by pen(cil) or keyboard, proficient automatic writing enables writers to focus on idea generation, maximising text quality. It's like driving a car. We need to first learn car controls and features, traffic, and road rules. Once these initial skills are automatised, we can actually focus on driving and on enjoying the ride! Mastering transcription skills also impacts children's motivation to write. When children face difficulties in handwriting and keyboarding, they may avoid writing altogether and develop a negative mindset towards writing. Developing keyboarding skills, much like handwriting, is a complex process involving cognitive, visual, and motor processes, requiring teaching and frequent practice. Explicit teaching of handwriting and keyboarding is important, and teachers should allocate time to support the automaticity of transcription skills in the early years. Along with the explicit teaching of handwriting skills

promoting legibility (posture, pencil grip, and paper position), it's critical to focus on supporting handwriting and keyboarding speed (e.g., timed-writing exercises) to promote automaticity of these inscription skills. Children cannot translate their ideas into written text when their thinking is mostly focused on forming legible letters or on findings the right letter on the keyboard.

## Recommendation 4. Follow an integrative approach to support the development of psychomotor, cognitive, and affective aspects of writing.

One of the most recurrent points made about skilful writing relates to its complexity. Indeed, effective writing involves the acquisition and development of skills across the psychomotor, cognitive, and affective learning domains. As highlighted in Recommendation 3, supporting the development of psychomotor skills related to handwriting and keyboarding automaticity is paramount. In the current project, we also found positive contributions of reading-writing connections in explaining children's paper and computer-based writing performance. Hence, early primary teachers should include in their literacy blocks opportunities for the development and practice of handwriting and keyboarding skills to support automaticity. Given reading-writing connections, writing instruction should systematically incorporate reading activities and practices, and vice-versa. While the focus of the current project was not placed on examining the contributions of self-regulatory strategies for writing, there's a wealth of knowledge confirming the criticality of explicitly teaching planning and revising strategies for text composing, including in the early years [32]. An important recommendation for writing instruction in primary education is to follow an integrative approach. More specifically, primary teachers should plan to devote time to the teaching and practice of foundational writing skills and to the teaching and practice of sentence and text-level composing skills in the same instructional protocol [28]. Traditionally, writing research and educational practices place a stronger focus on understanding and developing the psychomotor and cognitive aspects of writing (Malpique et al., under review 1,3). In the last decade, researchers have thought to learn more about the role of motivational factors in explaining writing performance. However, less attention has been placed on investigating motivational aspects of writing across modalities in the early years. We do know that students typically start school with positive attitudes toward

writing and feeling confident about their writing abilities. However, some studies found that developing writers become less positive and less confident about their writing over time [37]. It's critical to understand children's motivation and self-efficacy for writing across modalities and to determine if they have long-lasting effects on their writing performance. Indeed, findings from the current project confirm that motivational factors play an important role in explaining children's writing performance across modalities. Unquestionably, teachers should invest time and attention on supporting psychomotor and cognitive aspects of learning to write in the early years. However, attention must also be placed on creating engaging writing activities where children are moved to write and share their voices as authors. Overall, teachers should invest time and attention to creating a positive and enthusiastic writing community where "children and teachers write together every single day (…) for many different purposes, and for a variety of audiences (…) and are moved to write about what they are most knowledgeable and passionate about" [38 p. 3].

## Recommendation 5. Tailor writing instruction to respond to the gender gap in writing.

The gender gap in writing has received strong interest from literacy education and research, with recurrent gender differences in writing typically favouring female students. In today's digitalised world, skilful writing involves the development of paper and computer-based text composing skills, setting the criticality of understanding gender differences across writing modalities. Recent reports from the National Assessment Program Literacy and Numeracy (NAPLAN) in Australia reinforce the gender gap in writing in Australian primary and secondary education, with findings showing a consistent gender gap favouring female students in Grades 3, 5, 7 and 9 [21]. While biological factors were found to explain gender differences in writing, with females showing a more advanced development in language and fine motor skills compared to males [39], studies also suggest that there are societal expectations explaining the gender gap in writing, with female students more recurrently described as better writers and as having better handwriting abilities when compared to their male counterparts [16, 26]. While research informing evidence-based recommendations to respond to gender differences in writing is scarce, female students show a higher level of handwriting automaticity compared to male students across primary

and secondary school grades [2]. Considering findings from the current project showing that automaticity plays a critical role in predicting students' writing performance across writing modalities, teachers should reinforce opportunities for male students to develop legibility and automaticity aspects of their writing. Female students showed more favourable attitudes toward paper and computer-based texts in our study, writing longer and higher-quality texts across modalities. Hence, teachers should include strategies for improving male students' writing by making writing activities attractive, enjoyable, and engaging, with real purposes, to increase male students' positive attitudes toward writing.

## Recommendation 6. Develop opportunities for teacher training and development on evidence-based practices for teaching writing.

As one of the most complex human skills, writing must be explicitly taught. Unquestionably, teaching writing is a very complex job since it involves teaching and supporting the development of distinct and rather complex skills and processes across psychomotor, cognitive, and affective domains of learning. A large percentage of the Year 2 teachers who participated in the pilot and main study stages of this *Writing for All* project felt, however, ill-prepared to teach writing in their classrooms, reporting they applied evidence-based recommendations to teach writing quite sparingly (on a monthly basis or less). Preliminary analysis from our national survey examining primary teachers' preparation to teach computer-based writing suggests an even more worrisome picture, with the majority of teachers finding their pre-service and in-service preparation inadequate and poor. We know that teachers who are better prepared to teach writing are more likely to engage children in writing activities in their classrooms; dedicate more time to implement evidence-based recommendations and practices for writing instruction in their literacy blocks; feel more confident in teaching writing; and value writing as a critical learning and communication tool [40]. National and international research has consistently reported that many teachers do not feel adequately prepared to teach writing when completing their college degrees and that teachers' preparation and self-confidence for teaching writing are the strongest predictors of teachers' instructional practices for writing [40, for a review]. This must change, and educational institutions, including researchers, must do a better job of bridging the gap between literacy science and education. Our findings offer additional evidence of a

systemic issue [41], and call for a re-evaluation of teacher training programs to upskill teachers (with a variety of experience) with the knowledge, skills and understanding of teaching writing in early primary education.

## Recommendation 7: Develop home-school connections to support writing development.

There is a wealth of research and educational policies substantiating the importance of developing home-school connections to support children's learning [42]. Less attention, however, has been placed on investigating parents/carers involvement in home-based writing activities with their children and the affordances of extending writing practices to the home environment. Children's first experiences with writing are often at home and these experiences may shape writing development. Findings from the current project provide preliminary evidence about the role that parents/carers may play in supporting children's writing development. Indeed, it was found that when parents are interested in and find it meaningful to get involved in home-based writing activities with their children, their engagement in these activities has a positive effect on children's attitudes towards writing. As such, teachers should aim at developing more opportunities to extend writing to the home-environment and develop home-school partnerships for writing, including encouraging parents/carers to get children involved in fun, meaningful and enjoyable writing activities at home (as elaborated by Malpique et al., 2022, 2024, *The Conversation*).

# 4. Dissemination of New Knowledge

Considering the lack of national and international research examining and comparing children's paper and computer-based text composing skills, a major goal of the current project was to offer empirical evidence to substantiate evidence-based recommendations to support the development of children's writing performance in the digital age. The *Writing for All* team followed a comprehensive dissemination approach to share research findings with and outside academia at the national and international levels, as described below.

## A. Professional Development Opportunities for Schools/Teachers

A major goal of this project was to disseminate research findings directly to the schools and teachers participating in the project. Participating schools were offered in-site Professional Learning (PL) sessions in which we shared evidence-based recommendations for teaching writing, evidence-based practices for teaching handwriting and keyboarding, and for teaching text composing skills. A total of 11 PL sessions were delivered in-site to participating schools in 2022 and 2023. Two PL sessions were also delivered at the State Library of Western Australia in 2023, with an additional 48 attendees. A total of 326 teaching staff attended the PL sessions in WA. Results collected via Professional Development feedback surveys showcase the success of the sessions, with the overall quality of the PD sessions reaching an average score above 4.5 in a 5-point scale.

To increase the dissemination of findings to teachers at the national level, we delivered a whole-day Professional Learning session at the University of Canberra, Faculty of Education (November 2024). The PL session attracted the attention of ACT in-service and pre-service teachers and educational leaders from the ACT Education Directorate, enabling us to share evidence-based recommendations for teaching writing in primary education as well as findings from the current *Writing for All* project that inform the teaching of handwriting and keyboarding in early primary education.

## B. Dissemination in Academia

Dissemination of findings from the pilot and the main phases of the project were undertaken by the research team at the national and international levels as per Figure 3.

In the pilot phase, we successfully published two peer-reviewed publications, including one publication in a prestigious journal in the field of digital technology and education (*Computers and Composition*). Conference dissemination of findings from the pilot phase of the project was also achieved in two presentations in national conferences - Australian Association for Research in Education (AARE), 2022, 2023 - and one presentation in an international conference - European Association for Research on Learning and Instruction (EARLI). In the main phase of the project, we successfully published four peer-reviewed papers, including two publications in one of the most prestigious journals in education (*Contemporary Educational Psychology*). The team was further able to disseminate findings from the main phase of the project presenting our work in one national conference (AARE) and two international conferences (EARLI). International dissemination of findings also included the organisation of a leading symposium for the EARLI Special Interest Group (SIG) in Writing, involving the collaboration of esteemed international researchers from Europe and Asia in the first symposium examining the role of the writing tools for writing in the digital age. Considering the novelty of our findings and the criticality of project dissemination to inform research and educational practices, we have an additional six papers under review for publication and one conference presentation accepted to continue project dissemination at the international level (for a full list of peer-reviewed publication and conference presentations, see reference list, pp. 38-40).

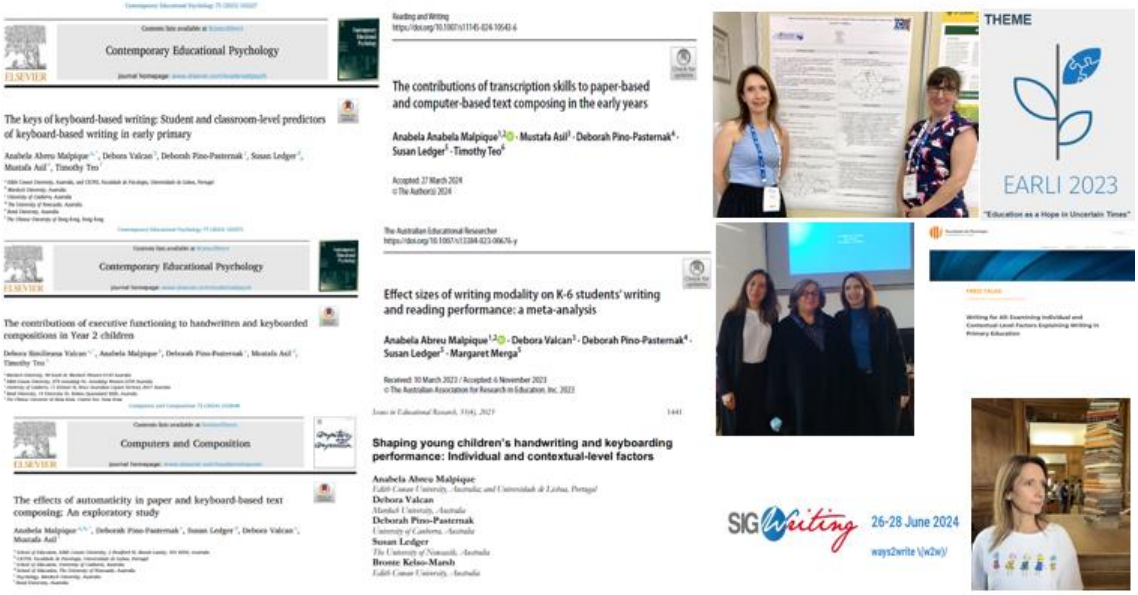


Figure 3 – Dissemination in academia

## C. Dissemination outside academia

Considering the criticality of generating and informing public conversations on writing acquisition and development in the digital world to inform educational policies and practices, our research team followed a comprehensive approach to share findings outside academia, as illustrated in Figure 4.

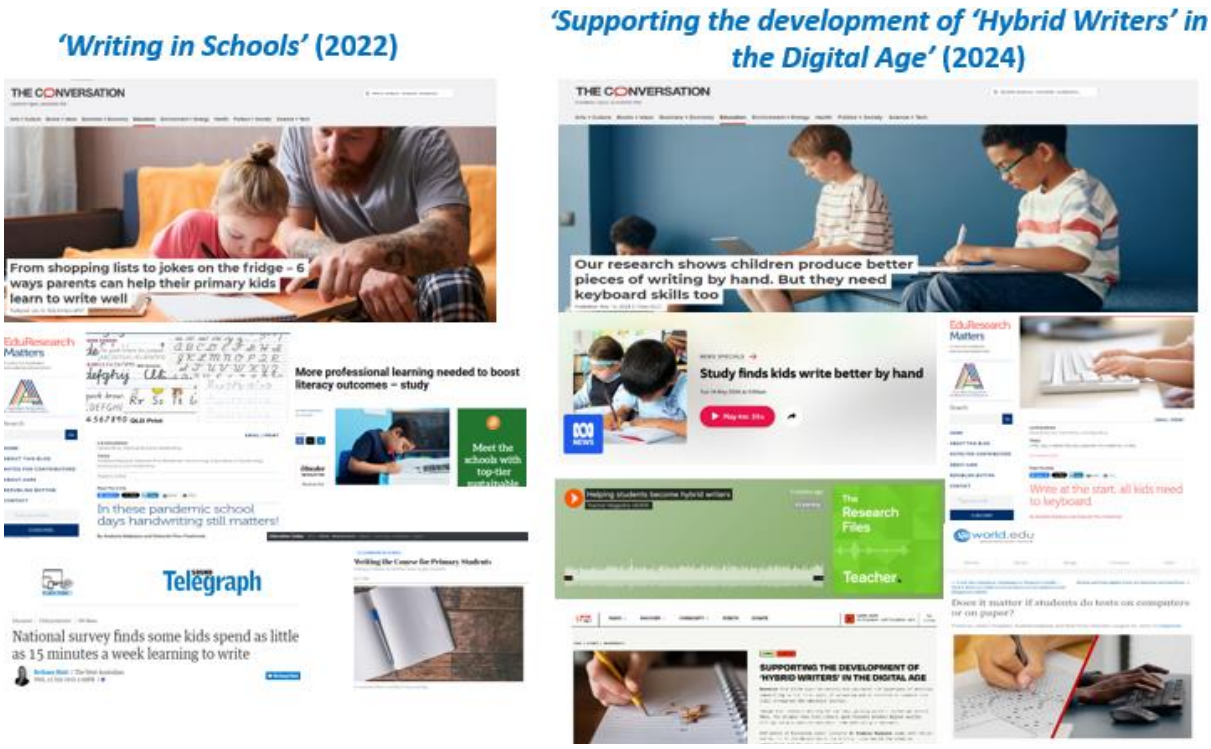


Figure 4 – Dissemination outside academia

Two main media research campaigns were developed to share research findings with a broader non-expert audience and maximize the accessibility of research publications:

**1. *'Writing in Schools'* Research Campaign (2022)** - This campaign received widespread media attention nationally, including articles in tier one media such as The Conversation, The Australian, The Herald Sun, Courier Mail and The West Australian. It secured 74 media mentions, reaching an audience of 11,120,521 people, worth an estimated advertising value of $102,864.

**2. *'Supporting the development of 'Hybrid Writers' in the Digital Age'* Research Campaign (2024)** – This media campaign resulted in two articles in The Conversation, articles in other

tier one media such as Education HQ, The Educator , radio interviews, one live TV interview on ABC News, and a podcast interview for The Australian Council for Educational Research. It secured 37 individual media mentions, reaching a global audience of almost 65 million, with estimated average advertising spend of $575,017.

To secure further dissemination of the *Writing for All* projects and the team's peer-reviewed publications, conference presentations, and media dissemination, we developed and created the *Writing and Reading for All* website, https://www.ecu.edu.au/schools/education/research-activity/teacher-education/writing-and-reading-for-all.

# 5. Research Impact

## International and National Academic Impact

**A. Organisation of the symposium "The role of writing tools: Predictors and outcomes of paper and computer-based writing".** This leading symposium was delivered at the 20th SIG Writing Biennial Conference (2024), European Association for Research on Learning and Instruction (EARLI) "Ways2write \(w2w)/", Paris, France. The innovative work presented in this symposium cut across several domains (individual and classroom-level factors) and study designs (cross-sectional and longitudinal) and brought forward insights on the role of writing tools in promoting writing acquisition and development in the digital age. The inclusion of European, Asian, and Australian studies strengthened the international relevance of the symposium.

**B. International Recognition.** CI Malpique was invited as **a Founding member of the European Literacy Network (ELN)**, representing Australia, and including the most esteemed international literacy researchers. CI Malpique was also invited to act as the **Editor for the first ELN journal**. A major aim of the ELN is to bridge the gap between literacy science and education. The creation of a new journal for the ELN will support the dissemination of findings from ELN members and practitioners to a broader, non-expert audience to help maximize the accessibility of research publications.

**C. Organization of a Special Issue for *Reading and Writing* on "The Contributions of Writing Tools".** CI Malpique and A/Professor Rui Alves act as Guest Editors for this Special Issue for one of the leading journals in literacy research. The main goal of this special issue is to collect worldwide expertise on the pivotal role that the mastery of writing tools plays in enabling skillful writing. We invited researchers worldwide, who are conducting research in this topic area, with both typical and atypical developing writers, to submit their recently achieved research for this special issue. This included researchers in Australia, Israel, United States, Portugal, Spain, and France. Collectively, the papers invited are the most recent research focusing on the contributions of writing tools to the development of writing skills.

**D. Development of an international network to inform and collaborate in future research under the *Writing for All* initiative**. An International Advisory Panel (IDP) will support the *Writing for All* team in upcoming research projects to expand knowledge on paper and computer-based writing in early primary education. The IDP will comprise leading international researchers on writing development and instruction including Professor Steve Graham (USA), A/Professor Rui Alves (Portugal), Professor Naomi Weintraub (Israel), and A/Professor Vibeke Rønneberg (Norway) who have already confirmed their collaborations.

**E. Participation in the University of Canberra's Research Festival (November 2024).** The participation included a day-long Professional Learning session with ACT in-service and pre-service teachers, and educational leaders from the ACT Education Directorate, about evidence-based practices to support handwriting, keyboarding, and text composing in primary education. The participation also included the development of the "Write from the Start" interactive family space featured in two different locations across Canberra as part of the University of Canberra's Research Festival. The "Write from the Start" stand, located at Canberra Centre, provided families and community members access to pre-writing and writing activities suitable for children aged birth to 8 (as per Figure 5). Children were also able to engage in different handwriting activities and in creating multimodal texts (as per Figure 6).


Figure 5. Flyers for Families


Figure 6. Children's Writings

## Educational Impact

**A. Impact on the Western Australian Curriculum (P-10)**. In 2021, CI Malpique provided consultancy for the School Curriculum and Standards Authority (SCSA) responsible for the school curriculum, assessment, and standards in WA. The result of this consultancy was the publication of the *Handwriting Continuum* in 2022 providing observable phases of handwriting development to support WA teachers in the teaching and monitoring of students' handwriting from Pre-primary through Year 10. The continued sharing of findings from the *Writing for All* initiative and from the current project with SCSA and with the Department of Education WA supported the inclusion of curriculum standards for the development of handwriting from P-10 in WA in the revised SCSA English Curriculum planned to be implemented in 2025.

This continued consultancy also **supported the development of one Professional Learning (PL) module for high-school teachers** providing guidance on the importance of supporting the consolidation of a personal handwriting style beyond the primary years of schooling. The PL module is available on SCSA English Handwriting Articulate module, and it includes citations and references of research we developed in the current *Writing for All* project. This module aims to reinforce the continued need to support the development of paper and computer-based writing beyond the primary years of schooling and it will be made available to all high-school teachers in WA. This partnership with SCSA provides unquestionable impact of the current project.

This continued consultancy with SCSA for teaching handwriting in primary and secondary education will impact more than 203,000 primary school children, more than 292,000 secondary school students, and approximately 10,000 primary and 6,700 secondary school teachers [47].

**B. Increased interest from Principals and School leaders on Professional Learning (PL) initiatives in WA to support evidence-based writing instruction in primary education**. Following the delivery of in-house PL sessions to the schools which participated in the current project, we received several invitations to share our findings in other primary and

secondary schools in WA. These invitations and subsequent visits enabled us to further disseminate research findings to educational providers in WA, reinforcing research impact.

**C. Informing the "Inquiry into Literacy and Numeracy in ACT public schools" [45].** Findings from the current project informed the "*Literacy and Numeracy Education Expert Panel*" Final Report, including references to two publications disseminating findings from our project to reinforce the criticality of supporting the automaticity of handwriting and keyboarding skills in primary education (Malpique et al., 2023bc). The Report offers the ACT Government evidence-based recommendations to strengthen literacy outcomes for all ACT public school students. The recommendations of the review will impact more than 26,000 primary school children and approximately 3,500 teachers at the ACT [46].

# 6. Project Testimonials

### A. Teachers Reports from Professional Learning Sessions and National Survey on Instructional Practices for Computer-Based Writing.

**Feedback from Teachers from Professional Learning Sessions**

- *"The task you have in front of you is not simple. I'm thrilled that you are querying the efficacy of handwriting practices. Handwriting is not a simple task (nor is teaching)".*
- *"The content was very interesting and helped with putting this into the bigger picture of teaching writing".*
- *"Really informative PL and promoted a lot of self-reflection. Very informative and practical".*
- *"Very interesting. It was good to hear about the research and high need to explicitly teach handwriting and keyboarding skills through school. Will definitely be trying the alphabet rockets in my classroom".*

**Feedback on Teaching Computer-Based Writing**

- *"I think it's important that students become fluent in computer-based writing (…). However, it's not consistent in my school and most instruction is ad hoc/entirely up to the teacher. "*
- *"I never had any PL on teaching computer-based writing, so I did have to learn by myself. There's a clear need to have PLs on this for primary teachers".*
- *"Having had different experiences across schools, the teaching of computer-based writing is always dependent on each school's approach to technologies. I've worked in non-tech schools, in little availability of computers and IPads, we can hardly teach computer-based writing in these schools (…). Thank you for bring this up".*
- *"Personally, I find it very challenging to keep up with new tec and new demands. I did not receive any training for teaching computer-based writing at college, and it's very hard to find PDs covering it".*

### B. Children's Personal Views on Writing Paper and Keyboard-Based Texts.

*"I kind of … use your whole body for the whole thing. Like the computers like three quarters when you write a story, but your body is full when you write a story with the paper and pencil".*

You can access the full audio-recording here.

*"Because using both would be better because then, like, you can write a note down and you're also chatting to somebody else, because you're writing notes down and then you can type it up on your computer and then print it out. Sometimes you have to use a computer. Sometimes you have to use both".*

You can access the full audio-recording here.

*"I can write neat, but yeah, I can do it neat and probably not that much at keyboards because I might get the wrong letters".*

You can access the full audio-recording here.

*"Typing a story on a keyboard takes a really long time because you've gotta, like, find the letters on it. Um, and also, when you're a kid, it's hard to use one because, um, it's … you have to find all the letters and stuff and then it's hard".*

You can access the full audio-recording here.

# 7. Future Research and Conclusion

The current project is one of the first large-scale projects investigating student and contextual-level factors explaining young children's paper and computer-based writing. There is, however, an unquestionable need for further research to examine writing development in the digital age, and we offer below four main recommendations for research in the primary years of schooling.

**Recommendation 1. Longitudinal research to examine developmental growth patterns in paper and computer-based writing performance in the early years.** As highlighted by the most prominent researchers in the field, knowledge about writing development "is fragmented along lines of theory, method, age range, or populations studies, with little done to create an integrated picture of writing development as a multidimensional process that continues across the lifespan" [44 p. 352]. In most educational systems, including in Australia, children are introduced to writing by hand, but also expected to gradually understand and compose texts using digital devices, including in national exams. Longitudinal research is needed to understand the merits and demerits of emphasising paper or computer-based writing in primary education. We are also yet to identify how processes of writing acquisition via keyboarding, touch typing, and stylus use differ. Investigating the factors that explain the acquisition of handwriting and keyboarding skills is paramount to inform educational standards for writing instruction in the digital age.

**Recommendation 2. Longitudinal and cross-sectional studies to examine the contributions of both student-level and contextual-level variables explaining students' writing performance.** Skilful writing is shaped by the individual writer's capabilities (biological, neurological, and physical) but also by the environment where writing development takes place [16]. More recurrently, research places attention on studying either the contributions of cognitive and or affective aspects of writing in the early years, placing less attention on understanding contextual-level factors impacting writing development, including school, classroom, and family-level factors. Studying the interaction between student and context-level factors shaping writing development in the early years

will provide essential information to gain a comprehensive understanding of how writing development operates in the digital age.

**Recommendation 3. Expand knowledge about the nature of effective classroom-level practices supporting writing development in the digital age.** Effective writing is typically developed in classroom contexts. In the last two decades, there's been a cumulative interest in understanding teachers' preparedness, beliefs, and instructional practices for writing. Results from several national surveys from across the globe [2], including here in Australia [40, 41], show teachers recurrently reporting not feeling adequality prepared to teach writing and not allocating much time for writing practices and to teach writing in their classrooms. Simultaneously, intervention research has provided robust empirical evidence to inform evidence-based recommendations for teaching writing. Less attention, however, has been placed on directly observing teachers' writing practices to complement self-reports in the examination of writing instruction and their contributions to students' writing achievement over time. If we fail to understand what teachers value, need, and do to support children's writing development, educational policies informing writing instruction will be inevitably flawed. There is also little information about specific instructional practices to support children in developing computer-based text composing skills, which is of critical importance to support writing development in the digital world.

**Recommendation 4. Examine family-level factors predicting children's performance in both paper and computer-based writing.** Typically, children's first literacy experiences take place in interactions with parents/carers and family members in daily family activities. Research investigating associations between home writing practices and writing achievement is scarce, but findings, including ours, suggest that high levels of parental involvement have a positive effect on children's paper-based writing performance. Parents/Carers have the unique opportunity to engage their children in day-to-day paper and computer-based writing activities. From the limited research in the field, it is suggested that cultivating a warm environment at home where writing attempts are praised and valued has positive effects on children's writing outcomes [43]. At the time of writing this report, we were not able to locate any study examining family-level factors predicting

children's computer-based writing. Hence, we argue for the importance of studying the role of home-environments in supporting the development of psychomotor, cognitive, and affective aspects of writing to inform educational practices and policies for writing instruction.

**Writing is a life skill and a vital communication tool that all students should be empowered to master**. It was an incredibly rewarding learning experience for our *Writing for All* team to discover, write about, and share children's writing outcomes as well as their very personal views about writing, the importance they attribute to it, and their perceptions as writers. In every visit to each participating school, during Professional Learning sessions, and in informal conversations with teachers and school leaders, we learned about their challenges, needs, and achievements as they do their best to shape the next generation of writers and digital citizens. We will continue disseminating findings from this project at the national and international levels, firmly committed to providing evidence-based information to substantiate educational practices and policies for teaching writing for all in the digital age.

# 8. References

## Project Publications

**A. Peer-Reviewed publications:**

**Pilot Study:**


Malpique, A., Valcan, D., Pino-Pasternak, D., Ledger, S, & Kelso-Marsh, B. (2023a). Shaping children's handwriting and keyboarding performance: Individual and contextual-level factors. *Issues in Educational Research. https://www.iier.org.au/iier33/malpique.pdf*

Malpique, A., Pino-Pasternak, D., Ledger, S., Valcan, D., & Asil, M. (2024a). The effects of automaticity in paper and keyboard-based text composing: An exploratory study. *Computers and Composition*. https://authors.elsevier.com/sd/article/S8755-4615(24)00024-0.


**Main Study:**


Malpique, A., Diaz, R., Valcan, D., Pino-Pasternak, D. & Ledger, S. (under review1, Special Issue). Examining early primary students' attitudes towards paper and computer-based writing: A mixed-methods study. *Reading and Writing, Special Issue- Writing Tools.*

Malpique, A., Pino-Pasternak, D., Valcan, D., & Asil, M. (under review2). The gender gap in writing paper and computer-based texts: The contributions of cognitive and affective factors in early primary. *Contemporary Educational Psychology.*

Malpique, A., Pino-Pasternak, D., Valcan, D., & Asil, M. (under review3). The contributions of cognitive, affective, and classroom-level factors for writing achievement in early primary. *Written Communication*.

Kelso-Marsh, B., Malpique, A., & Davis, H. (under review1). Involvement helps: a systematic review of parental involvement in primary-school-aged children's writing. *Journal of Writing Research.*

Kelso-Marsh, B., Malpique, A. A., & Davis, H. (under review2). 'My mum sometimes helps me with my writing': Parents' and children's perspectives of home-led writing. *Journal of Educational Research.*

Kelso-Marsh, B., Malpique, A. & Davis, H. (under review3). A systematic review of parental involvement in primary-school-aged children's writing. *Cambridge Journal of Education*.

Malpique, A., Valcan, D., Pino-Pasternak, D., Ledger, S., & Merga, M. (2023b). Effects of writing modality on K-6 students' writing and reading performance: A meta-analysis. *The Australian Educational Researcher.* https://doi.org/10.1007/s13384-023-00676-y

Valcan, D., Malpique, A, Pino-Pasternak, D., Teo, T. & Asil, M. (2024b). The contributions of executive functioning to handwritten and keyboarded compositions in Year 2. *Contemporary Educational Psychology.* https://doi.org/10.1016/j.cedpsych.2024.102272

Malpique, A, Valcan, D., Pino-Pasternak, D., Ledger, S., Asil, M., & Teo, T. (2023c). The keys of keyboard-based writing: Student and classroom-level predictors of keyboard-based writing in early primary school. *Contemporary Educational Psychology.* https://doi.org/10.1016/j.cedpsych.2023.102227

Malpique, A., Asil, M., Pino-Pasternak, D., Ledger, S. & Teo, T. (2024c). The contributions of transcription skills to paper-based and computer-based text composing in the early years. *Reading and Writing*. https://doi.org/10.1007/s11145-024-10543-6

**B. Peer-Reviewed conference presentations:**

**Pilot Study:**

Pino-Pasternak, D., Malpique, A., Valcan, D., Ledger, S., Asil, M. (November, 2023). The effects of automaticity in paper and keyboard-based text composing. Paper presented at the Australian Association for Research in Education (AARE) 2023 Conference, Melbourne, Australia.

Malpique, A., Valcan, D, Pino-Pasternak, D., Ledger, S. (November, 2022). Studying the Development of Handwriting and Keyboarding Skills in Early Education: A Pilot Study. Paper presented at Australian Association for Research in Education (AARE) 2022 Conference, Adelaide.

Malpique, A., Merga, M., Pino-Pasternak, D., Ledger, S., & Valcan, D. (August, 2021). Writing for all: Studying the development of handwriting and keyboarding skills in early education. Paper presented at the 19th Biennial European Association for Research on Learning and Instruction (EARLI) Conference, online.

**Main Study:**

Malpique, A., Diaz, R., Valcan, D., Pino-Pasternak, D. & Ledger, S. (March, 2025). Early primary students' attitudes towards paper and computer-based writing: A mixed-methods study. Paper accepted for presentation at the European Literacy Network, 2nd Summit, Cologne, Germany.

Malpique, A., Asil, M., Pino-Pasternak, D., Ledger, S. & Teo, T. (June, 2024). The role of writing tools: Predictors and outcomes of paper and computer-based writing. Symposium organised and presented at the 20th SIG Writing Biennial Conference, European Association for Research on Learning and Instruction (EARLI) "Ways2write \(w2w)/", Paris, France.

Malpique, A., Valcan, D., Pino-Pasternak, D., Ledger S., Mustafa, A., & Teo, T. (November, 2023). The keys of keyboard-based writing: Student and classroom-level predictors of keyboard-based writing in early primary. Paper presented at the Australian Association for Research in Education (AARE) 2023 Conference, Melbourne, Australia.

Malpique, A., Valcan, D., Pino-Pasternak, D., Ledger S., Mustafa, A., & Teo, T. (August, 2023). The keys of keyboard-based writing: Student and classroom-level predictors of keyboard-based writing in early primary. Paper presented at the 20th Biennial European Association for Research on Learning and Instruction (EARLI), Thessaloniki, Greece.

Pino-Pasternak, D., Valcan, D., Malpique, A., Asil, M., & Teo, T. (August, 2023). The contributions of executive functioning to handwritten and keyboarded compositions in Year 2. Poster presented at the 20th Biennial European Association for Research on Learning and Instruction (EARLI), Thessaloniki, Greece.

Malpique, A. (January, 2023). Writing for All: Examining Individual and Contextual Level Factors Explaining Writing in Primary Education. Paper presented at Fred Talks, Conferences in Psychological Science, University of Lisbon, Faculty of Psychology, invited keynote speaker.

Malpique, A., Valcan, D, Pino-Pasternak, D., & Ledger S. (June, 2022). Effect sizes of handwriting and keyboarding on the writing and reading performance of K-6 students: A meta-analysis of the last 20 years. Paper presented at SIG Writing Biennial Conference, European Association for Research on Learning and Instruction (EARLI), online.

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