September 2026

PerseResearch

Typing vs. Writing



The Perse Journal

Edited by Hazel Knight

THE PERSE SCHOOL CAMBRIDGE

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FOREWORD

Honest self-reflection, engagement with wider research, and a commitment to continuous improvement are some of the hallmarks of a great school. All can be found in this latest edition of Perse Research where teachers critically evaluate the pros and cons of typing and writing.

Debates about the digitisation of education can become heated, especially when those involved adopt 'all good' or 'all bad' positions. 1 or 0 discussions might generate press headlines and social media followers but they rarely reflect the complexities and nuances of reality. As my grandmother used to say, "the answer is rarely 1 or 0, but most often somewhere in between" – and in between will often vary depending on individuals and contexts.

In recent years, there has been a growth in personalised medicine which customises healthcare – including disease prevention, diagnosis and treatment to an individual's unique genetic profile, lifestyle, and environment. Personalised medicine recognises that identical prescriptions for the same medical conditions can have different efficacies in different patients. Put simply, drug X may be 25% more effective in patient A than patient B, even though they both have the same underlying condition.

We are now starting to appreciate the need for personalised education. Different students respond differently to the same pedagogy or method of communication. What works well for student A may work less well for student B. The variance may explain why researchers struggle to identify clearly positive or clearly negative group effects when they investigate which is better – typing or writing? It may well be there is no coherent group effect, just lots of individual effects – some positive and some negative, which cancel each other out.

This, of course, creates practical challenges for schools. It is much easier to run digital or analogue only workflows. Mixing the two or allowing students to select which one works best for them, creates complexity which adds to workloads and costs. However, if our aim is to maximise learning, then we need flexibility over the form of learning to ensure that individual students can select approaches that work best for them. In an ideal education world, staff and students would select the "best tool for the job" and not be limited by school policies that dictate all paper or all screen approaches.

We must also remember that schools are not just about learning, they are also about preparing students for what comes next. Whilst I draft this foreword using pen and paper, I recognise that it is digital workflows that dominate higher education and employment. Even if it could be shown that analogue methods delivered the greatest learning gains, we would still need to teach digital workflows, as part of a blended approach to ensure students are well prepared for what comes next.

Ed Elliott (Head)
September 2026

03

A review of the literature

Hazel Knight
Head of Research



Over the past ten years, one-to-one devices have become ubiquitous in secondary school classrooms, with digital input commonly replacing handwriting (Kiefer et al., 2015). However, this transition has been heavily criticised by some, who point to research such as correlative data from a very large study in Finland, which suggested that frequency of ICT use in school was negatively associated with various educational outcomes including problem-solving, reading, maths and science (Saarinen et al., 2021). This was most impactful on those who self-reported having particularly strong IT skills (Saarinen et al., 2021), suggesting that any negative association cannot be explained solely by difficulties accessing or using digital materials.

These findings raise difficult questions about the most appropriate use of devices within the classroom and how schools can safeguard learning and development whilst also preparing students for the digital world ahead. While some concerns relate to device use itself, irrespective of activity, a more focused question is whether the act of typing differs from handwriting in ways that affect learning and performance.

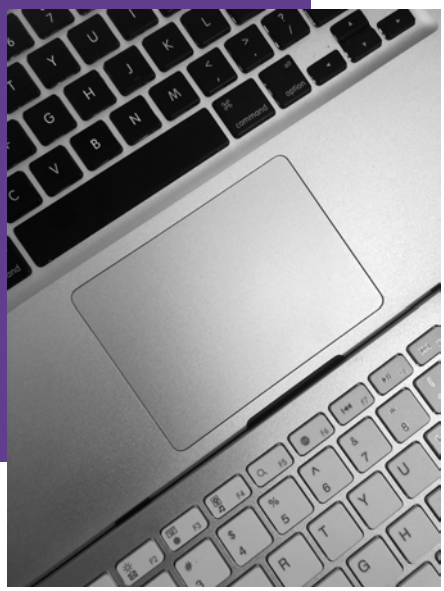
Since the publication of 'The pen is mightier than the keyboard' (Mueller & Oppenheimer, 2014) there has been increasing debate about the specific impact, on both learning and performance, of typing rather than writing longhand. At The Perse, post-lockdown, we shifted to 'digital workflow' for Y9 and above, meaning almost all schoolwork is completed digitally. In the last two years we have rolled out individual devices for Y7 and Y8, which are used when directed by the teacher. As assessments are now also commonly digital (Backes & Cowan, 2019), it is also important to understand the consequences of these choices in order to put in place any necessary support or guidance.

As Mueller and Oppenheimer point out, teachers tend to hold the opinion that writing longhand is more valuable than typing (Yamamoto, 2007) which opposes the typical student view that laptops are better (Barak et al., 2006) and that the benefits outweigh any costs (Kay & Lauricella, 2011). One reason that devices may reduce educational attainment is through simple distraction. Studies have found that students are frequently off-task when working on devices and that this impacts not only their own performance but that of classmates nearby (Dontre 2021; Hall et al. 2020; Kraushaar and Novak 2010; Sovern 2011). Even casual browsing impairs performance (Hembrooke & Gay, 2003) presumably due to the cognitive load required, as shown by task-switching research (Rubinstein et al., 2001).

As a result, some educational institutions have trialled banning laptops in specific courses (Elliott-Dorans, 2018), but find no positive impact, and indeed sometimes this can cause an increase in anxiety (Cheever et al., 2014). Given that many of today's teachers were educated in classrooms equipped with, at most, a single shared computer, it is possible that teachers are resistant to change rather than making objective decisions about the value of technology.

Literacy development

The importance of early development of fundamental literacy skills of reading and writing means that understanding the impact of increased typing in younger years is vital. Neuroscientists have looked at brain activity during typing and writing tasks and have found that circuits known to be active during reading tasks were activated when preliterate children saw letters after a handwriting task but not after tracing or typing tasks (James & Engelhardt, 2012). While it is tremendously difficult to interpret patterns of brain activity conclusively, particularly in young children, these findings do suggest that handwriting and typing engage different cognitive processes and may therefore have implications for subsequent brain development.



The evidence about the impact of early typing is, however, somewhat conflicting. One study of 147 reception children found that those who practised handwriting with a pencil were better at recognising letters and had better visuo-spatial skills but that those who had typed were better at reading and writing whole words (Mayer et al., 2019). The importance of handwriting with pencil and paper in the development of early reading skills has also been supported by research showing that even physically tracing letters and words leads to better recognition than typing does (Ibaibarriaga et al., 2025). However some studies have disputed this and found no difference between improvements made in novice readers after handwriting practice and typing practice (Duiser et al., 2022). The impact of typing may depend on the measure: in a large study of KS2 age students, spelling was unaffected by writing modality in a creative task but was better in handwritten work when copying (Broc et al., 2025), although it should be noted that this study was in French and spelling and grammatical complexity may interact with modality in ways we do not yet understand.

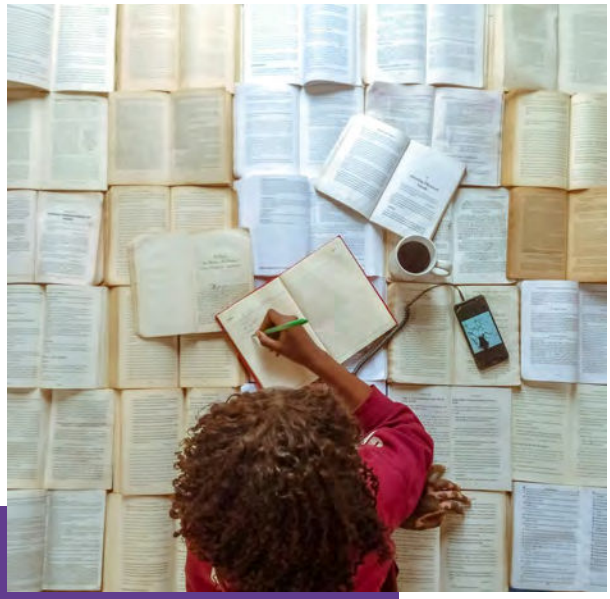
Research can potentially explain the variation in results; one study found that, for children with good typing skills, typing practice was as good for word learning as handwriting practice but that this was not true for poor typists (Ouellette & Tims, 2014). This may explain why some studies find a significant impact of handwriting (if the participants are mainly novice typists) but others do not (if the participants are more competent with a keyboard). Indeed one intervention study found that simply practising typing skills without any additional instruction improved the length and quality of typed text for students who had been identified as struggling with typing (Christensen, 2004).

One key study to consider here, however, is Cerni et al; while the sample is small and the language is Italian, this study found that dyslexic students' spelling improved more after typing practice than handwriting (Cerni et al., 2025). The authors speculated that this was due to the cognitive load caused by increased graphomotor demands for dyslexic students. Taken

with the findings about typing proficiency, this suggests that spelling practice should be completed in the least demanding modality to free up cognitive capacity for retaining patterns.

When looking at the development of broader writing skills, including syntactic accuracy and complexity, as well as narrative sophistication, a real-world comparison of different classes in their first year of school Norway found no difference in the development of children who had typed or written by hand (Spilling et al., 2023). Interestingly, handwriting intervention has been found to improve narrative writing in KS1 students more than typing skills (Alves et al., 2016), suggesting again that it is the physical demands of writing and/or typing that hamper young students' ability to record their ideas.

As students move through the school, the ability to record information becomes more important as they take more responsibility for processing, organising and recalling lesson content. This leads naturally to the question of whether handwriting and typing affect learning differently when used as tools for note-taking.



Note-taking

One popular view is that handwriting notes during lessons or lectures improves retention of content, perhaps because it keeps the mind focused on the task, preventing mind-wandering (Wong & Lim, 2023). Another theory is that the speed of typing allows learners to record what the teacher is saying verbatim, whereas taking notes by hand involves processing and summarising information, which is then better for learning (Mueller & Oppenheimer, 2014). An alternative view is proposed by Allen, who suggested that

The act of using a laptop migrates student focus away from participation and discussion surrounding the classroom content. Therefore, the learner begins to view classroom activities as something passive and the discussion background noise to the central focus of what is occurring on the laptop screen. The laptop computer or mobile phone may simply increase the perception of psychological distance from the discussion and reduce the sense of immediacy and involvement on the part of the student(s).

This provides a third explanation for the impact of typing: the shifting of attention from the external input to the laptop itself (Allen et al., 2020).

While teachers at The Perse usually share lesson content or notes with students via Microsoft OneNote, students may also be expected to take notes alongside class materials, particularly in Sixth Form. There has been plentiful research into the impact of digital note-taking, usually focused on college students. While the results from this kind of academically selected and age-constrained sample cannot be generalised widely, applying findings to the oldest students of an academically selected independent school is more appropriate.

The well-publicised research by Mueller and Oppenheimer found that typing notes results in students performing less well in conceptual questions while factual recall remains similar (Mueller & Oppenheimer, 2014), which has also been found in Y6 students (Horbury & Edmonds, 2020). This finding, however, has not replicated reliably (Kirkland, 2016; Luo et al., 2018; Mitchell & Zheng, 2017; Morehead et al., 2019). Meta-analyses, which pull together results from multiple studies, find either no significant difference between typing and handwriting (Voyer et al., 2022), or only a slight advantage for longhand (Lau, 2022).

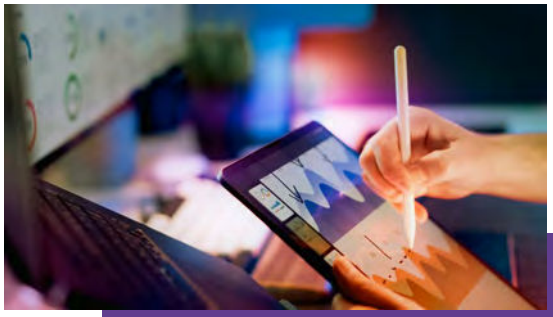
One typical response to identification of problems in device usage is to suggest that students need further instruction on how to use laptops effectively. However, studies find repeatedly that students do not follow instructions given about laptop use, even in experimental conditions where they know their output will be viewed. For example, students told not to transcribe notes verbatim did so anyway (Mueller & Oppenheimer, 2014)

and students told to pay particular attention to diagrams and supplementary material ignored them (Latini et al., 2020).

It is important to note that the methodology utilised in these experiments does not reflect real-life learning in classrooms, so these findings may not be directly applicable to schools. Firstly, the studies ask students to take notes about material such as TED talks, which they have little motivation to learn about, compared to classwork leading to grades or qualifications. Secondly, students are not given time to review their notes before being tested for recall and understanding, which is completely different to the purpose of typical classroom note-taking. However, a small meta-analysis of studies measuring more meaningful outcomes, such as correlation between note taking medium and exam grades, also found that handwriting notes was advantageous, across multiple subjects (Allen et al., 2020).

One problem, though, with some of the real-world research included in this meta-analysis, is that it does not employ random allocation to digital or handwritten notes; the choice to use a laptop is not random. It has been suggested that students who are more likely to become distracted – and are perhaps therefore less likely to do well anyway – are those most likely to choose to type (Kirschner & Karpinski, 2010). By using a repeated measures design to investigate – comparing the same student taking notes by hand or typing – it has been shown that there is little impact of switching modality for individual students, suggesting that earlier findings may be correlative rather than causal (Artz et al., 2020), with stronger students choosing longhand independently.

Another aspect to consider is that students' beliefs about the purpose of notes seem to be changing. It is now commonplace for university students to rewatch lectures, with the explicit aim of capturing notes verbatim (Arden et al., 2024). Some even view the act of note-taking as performative, demonstrating that they are paying attention, rather than being a tool for learning (Marin & Sturm, 2021). For some students, having a set of complete and well-presented notes is seen as the outcome, and a proxy for success (Arden et al., 2024), rather than being a learning activity. This shows that the early research into retention after note-taking where students have no chance to revise is particularly limited as, for many current students, making notes appears to be the creation of a tool to use for revision. This is supported by an unpublished study by Gong and Rodd, who found that the advantage seen in retention following handwriting notes compared to typed notes completely disappeared when participants were warned in advance that they would not have time to review their notes before being tested. This suggests that students are voluntarily engaging in 'cognitive offloading'



while typing notes but that they can override this when the situation requires it (Gong & Rodd, 2020).

Even if modality does matter, 'digital note-taking' as seen in classrooms is not a single activity and may encompass photography, typed notes, and the use of a stylus to write, annotate, highlight or draw diagrams. Research suggests that taking photos of slides is akin to taking no notes at all (Wong & Lim, 2023) but again hints at students' urge to record everything rather than process information. Typing on software keyboards (on screen, such as on tablets) has been found to be significantly worse for retention than typing on a physical keyboard (Arif & Stuerzlinger, 2009; MacKenzie & Soukoreff, 2002). Writing with a stylus appears to increase retention slightly compared to typing (Ihara et al., 2021), and handwriting with either a pen or stylus is associated with a more positive mood than typing (Ihara et al., 2021). Correlative research suggests that longhand note-taking is associated with higher cognitive scores across a range of tests compared to using a stylus but the causal direction is not clear here (Al-Sharman et al., 2025). Experimental research which compared factual and conceptual recall and compared handwriting, stylus and typed notes found no significant differences (Wiechmann et al., 2022). Neuroscience research has, however, shown some difference in brain response, which implies that students who are familiar with digital pens may find some advantage to their use compared to writing by hand (Osugi et al., 2019). There is comparatively little research comparing the use of a stylus to typing as yet and this is worthy of further investigation.

A significant weakness of the literature, presumably due to the focus on university students as participants, is the exclusive focus on note-taking. In schools, of course, work in the classroom may involve note-taking but also includes answering questions, completing practice tasks, organisation of ideas into tables or similar structures, drawing diagrams, annotation of text, and a multitude of other activities, which are sometimes subject-dependent. Would retention or understanding be affected by completing this kind of general classwork by hand/typing? Janet Symonds, from our Computer Science department,

explores this in her action research comparing revision activity modality on page 22. Victoria Lipp, Head of Geography, also completed a comparative study of the effectiveness of online or paper worksheets in Year 9 classwork (p18). Both these studies look at outcomes in terms of retention and performance in curricular tasks.

There are also other possible indirect impacts of laptop use; for example, if laptop use reduces participation in discussion – perhaps due to the attentional shift proposed by Allen (2020), this may have a resulting effect on engagement, retention, understanding, or fluency. Marta D'Asaro investigated this in her project which involved recording the contributions of students during group work when using devices compared to paper-based tasks. Read about her findings on p27.



Output

While much of the literature focuses on learning and retention, a separate body of research examines the consequences of typing for the creation of written work.

Quantity

The advantage given by laptop use in terms of speed will clearly vary with typing proficiency. Early studies found that handwriting was faster than typing for students about to start secondary school (Connelly et al., 2007) and more recent work suggests that the turning point, when typing becomes faster than handwriting, is in Y7/8 (Broc et al., 2025). In secondary school, there is plentiful evidence that suggests that typing leads to longer essays (Robinson-Staveley & Cooper, 1990; Schaumburg, 2006), particularly for those working in their second language (Barkaoui & Knouzi, 2018). This effect, however, reduces with age and appears to be mostly absent by the first year in university (Mogey et al., 2010). Another study found that, in a sample of 'gifted' adolescents, boys wrote more when using devices but girls were unaffected (Dixon et al., 2005). Some researchers have suggested that length is just more variable when typing (Endres, 2012).

Quality

Again, early research found that the content of written work was significantly better in handwritten work of students at the age when they move to secondary school – with keyboard scripts lagging by up to two years in developmental quality (Connelly et al., 2007). However, for secondary and university students, the relationship between modality and quality is less clear. Typed work is more often organised into paragraphs (Russell & Haney, 1997) and more formal in tone (Wolfe et al., 1996), including longer sentences (Jin & Yan, 2017) and more lexical variations (Chambers, 2008). Meta-analyses find that devices improve the quantity and quality of essays (Goldberg et al., 2003), with the largest effect for weaker writers (Bangert-Drowns, 1993). However, it should be noted that in these studies students generally have access to spelling and grammar checkers, which is not true for assessed pieces of work such as typing for A-levels. Behavioural analysis sometimes shows that there is more revision when typing which may also account for some improvements (Owston et al, 1992) though this is not found consistently (Bangert-Drowns, 1993; Goldberg et al., 2003).

On p11 Tim Lunn explores this idea; his action research compared the quantity and quality of Year 9 English work when completed by typing or handwriting, as well as gathering views from students.

Marking

It is not just the writing itself that can be affected by modality; the judgements of the reader may also be affected. Here, results are very mixed, with some studies finding that in general handwritten essays score better (Connelly et al., 2007), some finding typed essays score better (Russell & Haney, 1997) and some finding no effect (Barkaoui & Knouzi, 2018; Charman, 2014; MacCann et al., 2002; Mogey et al., 2010). The difference is greatest for those hampered by lack of familiarity with IT or with weak skills in English (Wolfe et al., 1996); for others marks tend to be fairly similar across modalities (Wolfe & Manalo, 2004).

Experimental research that compares handwritten essays with identical, but typed, essays finds more reliably that handwritten essays score better (MacCann et al., 2002; Powers et al., 1994), and that this is not just an impact of spacing (Michael & Tao, 2004). This appears to be caused by expectation; markers expect typed essays to be more professional and spot errors more easily (Michael & Tao, 2004) as well as a perception of more personal effort from hand-writers (Michael & Tao, 2004). Interestingly, this impact seems most problematic for the best essays (Sweedler-Brown, 1991). There is greater inter-marker reliability for typed essays (Sweedler-Brown, 1991) suggesting any bias introduced by handwriting varies by marker. This may be something for Perse students to consider when approaching examinations.

A key limitation of the existing research is that many studies do not adequately account or control for students' familiarity with technology or differences in typing proficiency, both of which may influence performance independently of the assessment medium. Another issue is that studies into typed output do not clearly distinguish between timed and untimed writing conditions, despite the possibility that the advantages and disadvantages of handwriting and typing may vary considerably depending on time constraints. A further problem is that research into written output has predominantly examined extended essay writing, which is only really relevant for older students. Far less is known about the effects of medium on other forms of assessment, such as mathematics, short-answer responses, or translation tasks.

Conclusion

Taken together, the evidence comparing typing to handwriting remains inconclusive and suggests complex interactions between task, typing proficiency, age, purpose and context. Furthermore, much of the evidence is also relatively dated, and rapid changes in technology, digital literacy, and marking practices mean that findings may not fully reflect current educational contexts. Together, these limitations suggest that existing findings should be interpreted cautiously and hence need to be tested in our own specific context.

For note-taking, it should be noted that while some evidence finds handwriting is advantageous and some finds little difference, there is comparatively little evidence suggesting a consistent learning advantage for typing (apart from spelling for dyslexic students) so it is perhaps wise to take a cautious path to use in the classroom, particularly with younger students. The evidence for the use of typing in assessments is more encouraging and suggests that gains in quantity and quality are possible outcomes, if not inevitable ones. The interaction between student profile and the choice to type perhaps needs further scrutiny so that students can benefit from personalised advice about the best course of action.



09

REFERENCES

Allen, M., LeFebvre, L., LeFebvre, L., & Bourhis, J. (2020). Is the Pencil Mightier than the Keyboard? A Meta-Analysis Comparing the Method of Notetaking Outcomes. *Southern Communication Journal*, *85*(3), 143–154. https://doi.org/10.1080/1041794X.2020.1764613

Al-Sharman, A., Shalash, R. J., Omran, T. A. M., Elsayed, R. M., Warfa, I. A., Adawi, W. S. E. A., Aljaberi, A. O., Alabdooli, A. A., Arumugam, A., Ramakrishnan, S., Saad, N., Ahbouch, A., Bani issa, W., Hijazi, H., Kim, M., Hegazy, F., & Nashwan, A. (2025). Exploring the impact of note taking methods on cognitive function among university students. *BMC Medical Education*, *25*(1), 1218. https://doi.org/10.1186/s12909-025-07593-x

Alves, R. A., Limpo, T., Fidalgo, R., Carvalhais, L., Pereira, L. Á., & Castro, S. L. (2016). The impact of promoting transcription on early text production: Effects on bursts and pauses, levels of written language, and writing performance. *Journal of Educational Psychology*, *108*(5), 665–679. https://doi.org/10.1037/edu0000089

Arden, B., Norris, J., Cole, S., & Gamble, S. C. (2024). Digital notetaking in lectures: How students adapt to a multi-faceted university learning environment. *Cogent Education*, *11*(1), 2373552. https://doi.org/10.1080/2331186X.2024.2373552

Arif, A., & Stuerzlinger, W. (2009). *Analysis of text entry performance metrics*. 100–105. https://doi.org/10.1109/TIC-STH.2009.5444533

Artz, B., Johnson, M., Robson, D., & Taengnoi, S. (2020). Taking notes in the digital age: Evidence from classroom random control trials. *The Journal of Economic Education*, *51*, 1–13. https://doi.org/10.1080/00220485.2020.1731386

Backes, B., & Cowan, J. (2019). Is the pen mightier than the keyboard? The effect of online testing on measured student achievement. *Economics of Education Review*, *68*(C), 89–103.

Bangert-Drowns, R. L. (1993). The Word Processor as an Instructional Tool: A Meta-Analysis of Word Processing in Writing Instruction. *Review of Educational Research*, *63*(1), 69–93. https://doi.org/10.3102/00346543063001069

Barak, M., Lipson, A., & Lerman, S. (2006). Wireless Laptops as Means For Promoting Active Learning In Large Lecture Halls. *Journal of Research on Technology in Education*, *38*(3), 245–263. https://doi.org/10.1080/15391523.2006.10782459

Barkaoui, K., & Knouzi, I. (2018). The effects of writing mode and computer ability on L2 test-takers' essay characteristics and scores. *Assessing Writing, Special Issue: The Comparability of Paper-Based and Computer-Based Writing: Process and Performance*, *36*, 19–31. https://doi.org/10.1016/j.asw.2018.02.005

Broc, L., Goudeau, S., & Colliot, T. (2025). Comparing the effects of typing and handwriting on spelling performance in school. *Scientific Reports*, *15* (1), 17985. https://doi.org/10.1038/s41598-025-03369-x

Cerni, T., Lonciari, I., & Job, R. (2025). Learning by writing: The influence of handwriting and typing on novel word learning in typically developing readers and readers with dyslexia. *Learning and Instruction*, *98*, 102119. https://doi.org/10.1016/j.learninstruc.2025.102119

Chambers, L. (2008). Computer-based and paper-based writing assessment: a comparative text analysis. *Research Notes, 34,* 9-15.

Charman, M. (2014). Linguistic analysis of extended examination answers: Differences between on-screen and paper-based, high- and low-scoring answers. *British Journal of Educational Technology*, *45*(5), 834–843. https://doi.org/10.1111/bjet.12100

Cheever, N. A., Rosen, L. D., Carrier, L. M., & Chavez, A. (2014). Out of sight is not out of mind: The impact of restricting wireless mobile device use on anxiety levels among low, moderate and high users. *Computers in Human Behavior*, *37*, 290–297. https://doi.org/10.1016/j.chb.2014.05.002

Christensen, C. A. (2004). Relationship between orthographic-motor integration and computer use for the production of creative and well-structured written text. *British Journal of Educational Psychology*, *74*(4), 551–564. https://doi.org/10.1348/0007099042376373

Connelly, V., Gee, D., & Walsh, E. (2007). A comparison of keyboarded and handwritten compositions and the relationship with transcription speed. *The British Journal of Educational Psychology*, *77*(Pt 2), 479–492. https://doi.org/10.1348/000709906X116768

Dixon, F., Cassady, J., Cross, T., & Williams, D. (2005). Effects of Technology on Critical Thinking and Essay Writing Among Gifted Adolescents. *Journal of Secondary Gifted Education*, *16*(4), 180–189. https://doi.org/10.4219/jsge-2005-482

Duiser, I. H. F., Ledebt, A., van der Kamp, J., & Savelsbergh, G. J. P. (2022). Does learning to write and type make a difference in letter recognition and discrimination in primary school children? *Journal of Cognitive Psychology*, *34*(6), 691–702. https://doi.org/10.1080/20445911.2022.2060240

Elliott-Dorans, L. R. (2018). To ban or not to ban? The effect of permissive versus restrictive laptop policies on student outcomes and teaching evaluations. *Computers & Education*, *126*, 183–200. https://doi.org/10.1016/j.compedu.2018.07.008

Endres, H. (2012). A comparability study of computer-based and paper-based Writing tests. *Research Notes*, *49*, 26-33 https://www.cambridgeenglish.org/Images/23166-research-notes-49.pdf)

Goldberg, A. L., Russell, M., & Cook, A. (2003). *The Effect of Computers on Student Writing: A Meta-analysis of Studies from 1992 to 2002*. https://www.semanticscholar.org/paper/The-Effect-of-Computers-on-Student-Writing%3A-A-of-to-Goldberg-Russell/c5b5d8911d7870c40142f325c79d0e5301a84057

Gong, C., & Rodd, J. (2020). *A cognitive offloading perspective on the modality effect in note-taking*. https://doi.org/10.31234/osf.io/qwdpf

Hembrooke, H., & Gay, G. (2003). The laptop and the lecture: The effects of multitasking in learning environments. *Journal of Computing in Higher Education*, *15*(1), 46–64. https://doi.org/10.1007/BF02940852

Horbury, S., & Edmonds, C. (2020). Taking Class Notes by Hand Compared to Typing: Effects on Children's Recall and Understanding. *Journal of Research in Childhood Education*, *35*, 1–13. https://doi.org/10.1080/02568543.2020.1781307

Ibaibarriaga, G., Acha, J., & Perea, M. (2025). The impact of handwriting and typing practice in children's letter and word learning: Implications for literacy development. *Journal of Experimental Child Psychology*, *253*, 106195. https://doi.org/10.1016/j.jecp.2025.106195

Ihara, A. S., Nakajima, K., Kake, A., Ishimaru, K., Osugi, K., & Naruse, Y. (2021). Advantage of Handwriting Over Typing on Learning Words: Evidence From an N400 Event-Related Potential Index. *Frontiers in Human Neuroscience*, *15*. https://doi.org/10.3389/fnhum.2021.679191

James, K. H., & Engelhardt, L. (2012). The effects of handwriting experience on functional brain development in pre-literate children. *Trends in Neuroscience and Education*, *1*(1), 32–42. https://doi.org/10.1016/j.tine.2012.08.001

Jin, Y., & Yan, M. (2017). Computer Literacy and the Construct Validity of a High-Stakes Computer-Based Writing Assessment. *Language Assessment Quarterly*, *14*(2), 101–119. https://doi.org/10.1080/15434303.2016.1261293

Kay, R. H., & Lauricella, S. (2011). Exploring the Benefits and Challenges of Using Laptop Computers in Higher Education Classrooms: A Formative Analysis. *Canadian Journal of Learning and Technology*, 37(1). https://doi.org/10.21432/T2S598

Kiefer, M., Schuler, S., Mayer, C., Trumpp, N. M., Hille, K., & Sachse, S. (2015). Handwriting or Typewriting? The Influence of Pen- or Keyboard-Based Writing Training on Reading and Writing Performance in Preschool Children. *Advances in Cognitive Psychology*, *11*(4), 136–146. https://doi.org/10.5709/acp-0178-7

Kirkland, K. M. (2016). The Effect of Note Taking Media and Preference on the Cognitive Processes Involved in Learning. https://www.semanticscholar.org/paper/The-Effect-of-Note-Taking-Media-and-Preference-on-Kirkland/57fc8b0dcd664cd67ef1846af708b8c545e36ffd

Kirschner, P. A., & Karpinski, A. C. (2010). Facebook® and academic performance. *Computers in Human Behavior, Online Interactivity: Role of Technology in Behavior Change*, *26*(6), 1237–1245. https://doi.org/10.1016/j.chb.2010.03.024

Latini, N., Bråten, I., & Salmerón, L. (2020). Does reading medium affect processing and integration of textual and pictorial information? A multimedia eye-tracking study. *Contemporary Educational Psychology*, *62*, 101870. https://doi.org/10.1016/j.cedpsych.2020.101870

Lau, T. (2022). *The effect of typewriting vs. handwriting lecture notes on learning: A systematic review and meta-analysis.* [University of Louisville]. https://doi.org/10.18297/etd/3982

Luo, L., Kiewra, K. A., Flanigan, A. E., & Peteranetz, M. S. (2018). Laptop versus longhand note taking: Effects on lecture notes and achievement. *Instructional Science*, *46*(6), 947–971. https://doi.org/10.1007/s11251-018-9458-0

MacCann, R., Eastment, B., & Pickering, S. (2002). Responding to free response examination questions: Computer versus pen and paper. *British Journal of Educational Technology*, *33*(2), 173–188. https://doi.org/10.1111/1467-8535.00251

MacKenzie, I., & Soukoreff, R. (2002). Text Entry for Mobile Computing: Models and Methods, Theory and Practice. *Copyright*, *17*, 147–198. https://doi.org/10.1207/S15327051HCI172&3_2

Marin, L., & Sturm, S. (2021). 'Why Aren't You Taking Any Notes?' On Note-Taking as a Collective Gesture. *Educational Philosophy and Theory*, *53*(13), 1399–1406. https://doi.org/10.1080/00131857.2020.1744131

Mayer, C., Wallner, S., Budde-Spengler, N., Braunert, S., Arndt, P. A., & Kiefer, M. (2019). Literacy Training of Kindergarten Children With Pencil, Keyboard or Tablet Stylus: The Influence of the Writing Tool on Reading and Writing Performance at the Letter and Word Level. *Frontiers in Psychology*, *10*, 3054. https://doi.org/10.3389/fpsyg.2019.03054

Michael, R., & Tao, W. (2004). Effects of Handwriting and Computer-Print on Composition Scores: A Follow-up to Powers, Fowles, Farnum, & Ramsey. *Practical Assessment, Research, and Evaluation*, *9*(1). https://doi.org/10.7275/9g7k-yr32

Mitchell, A., & Zheng, L. (2017). Examining Longhand vs. Laptop Debate: Evidence from a Replication. *AMCIS 2017 Proceedings*. https://aisel.aisnet.org/amcis2017/Replication/Presentations/2

Mogey, N., Paterson, J., Burk, J., & Purcell, M. (2010). Typing compared with handwriting for essay examinations at university: Letting the students choose. *Research in Learning Technology*, *18*(1). https://journal.alt.ac.uk/index.php/rlt/article/view/873

Morehead, K., Dunlosky, J., & Rawson, K. (2019). How Much Mightier Is the Pen than the Keyboard for Note-Taking? A Replication and Extension of Mueller and Oppenheimer (2014). *Educational Psychology Review*, *31*. https://doi.org/10.1007/s10648-019-09468-2

Mueller, P. A., & Oppenheimer, D. M. (2014). The Pen Is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking. *Psychological Science*, *25*(6), 1159–1168. https://doi.org/10.1177/0956797614524581

Osugi, K., Ihara, A. S., Nakajima, K., Kake, A., Ishimaru, K., Yokota, Y., & Naruse, Y. (2019). Differences in Brain Activity After Learning With the Use of a Digital Pen vs. An Ink Pen—An Electroencephalography Study. *Frontiers in Human Neuroscience*, *13*. https://doi.org/10.3389/fnhum.2019.00275

Ouellette, G., & Tims, T. (2014). The write way to spell: Printing vs. Typing effects on orthographic learning. *Frontiers in Psychology*, *5*. https://doi.org/10.3389/fpsyg.2014.00117

Owston, R. D., & Others, A. (1992). The Effects of Word Processing on Students' Writing Quality and Revision Strategies. *Research in the Teaching of English*, *26*(3), 249–276.

Powers, D. E., Fowles, M. E., Farnum, M., & Ramsey, P. (1994). Will they think less of my handwritten essay if others word process theirs? Effects on essay scores of intermingling handwritten and word-processed essays. *Journal of Educational Measurement*, *31*(3), 220–233. https://doi.org/10.1111/j.1745-3984.1994.tb00444.x

Robinson-Staveley, K., & Cooper, J. (1990). The Use of Computers for Writing: Effects on an English Composition Class. *Journal of Educational Computing Research*, *6*(1), 41–48. https://doi.org/10.2190/N3WK-KC2Q-DVGD-7F0B

Rubinstein, J. S., Meyer, D. E., & Evans, J. E. (2001). Executive control of cognitive processes in task switching. *Journal of Experimental Psychology. Human Perception and Performance*, *27*(4), 763–797. https://doi.org/10.1037//0096-1523.27.4.763

Russell, M., & Haney, W. (1997). Testing Writing on Computers: An Experiment Comparing Student Performance on Tests Conducted via Computer and via Paper-and-Pencil. *Education Policy Analysis Archives*, *5*(3). https://www.learntechlib.org/p/85891/

Saarinen, A. I. L., Lipsanen, J., Hintsanen, M., Huotilainen, M., & Keltikangas-Järvinen, L. (2021). The Use of Digital Technologies at School and Cognitive Learning Outcomes: A Population-Based Study in Finland. *International Journal of Educational Psychology*, *10*(1), 1. https://doi.org/10.17583/ijep.2021.4667

Schaumburg, H. (2006). *Elektronische Textverarbeitung und Aufsatzleistung. Empirische Ergebnisse zur Nutzung mobiler Computer als Schreibwerkzeug in der Schule*. https://www.semanticscholar.org/paper/Elektronische-Textverarbeitung-und-Aufsatzleistung.-Schaumburg/b7b5685d843912c72fd8ab65cb02c94391507556

Spilling, E. F., Rønneberg, V., Rogne, W. M., Roeser, J., & Torrance, M. (2023). Writing by hand or digitally in first grade: Effects on rate of learning to compose text. *Computers & Education*, *198*, 104755. https://doi.org/10.1016/j.compedu.2023.104755

Sweedler-Brown, C. O. (1991). Computers and Assessment: The Effect of Typing versus Handwriting on the Holistic Scoring of Essays. *Research and Teaching in Developmental Education*, *8*(1), 5–14.

Voyer, D., Ronis, S. T., & Byers, N. (2022). The effect of notetaking method on academic performance: A systematic review and meta-analysis. *Contemporary Educational Psychology*, *68*, 102025. https://doi.org/10.1016/j.cedpsych.2021.102025

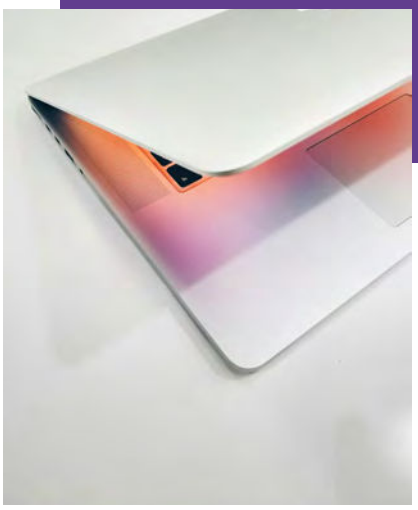
Wiechmann, W., Edwards, R., Low, C., Wray, A., Boysen-Osborn, M., & Toohey, S. (2022). No difference in factual or conceptual recall comprehension for tablet, laptop, and handwritten note-taking by medical students in the United States: A survey-based observational study. *Journal of Educational Evaluation for Health Professions*, *19*, 8. https://doi.org/10.3352/jeehp.2022.19.8

Wolfe, E. W., Bolton, S., Feltovich, B., & Niday, D. M. (1996). The Influence of Student Experience with Word Processors on the Quality of Essays Written for a Direct Writing Assessment. *Assessing Writing*, *3*(2), 123–147.

Wolfe, E. W., & Manalo, J. R. (2004). *Composition Medium Comparability in a Direct Writing Assessment of Non-Native English Speakers*. https://doi.org/10.64152/10125/25229

Wong, S. S. H., & Lim, S. W. H. (2023). Take notes, not photos: Mind-wandering mediates the impact of note-taking strategies on video-recorded lecture learning performance. *Journal of Experimental Psychology. Applied*, *29*(1), 124–135. https://doi.org/10.1037/xap0000375

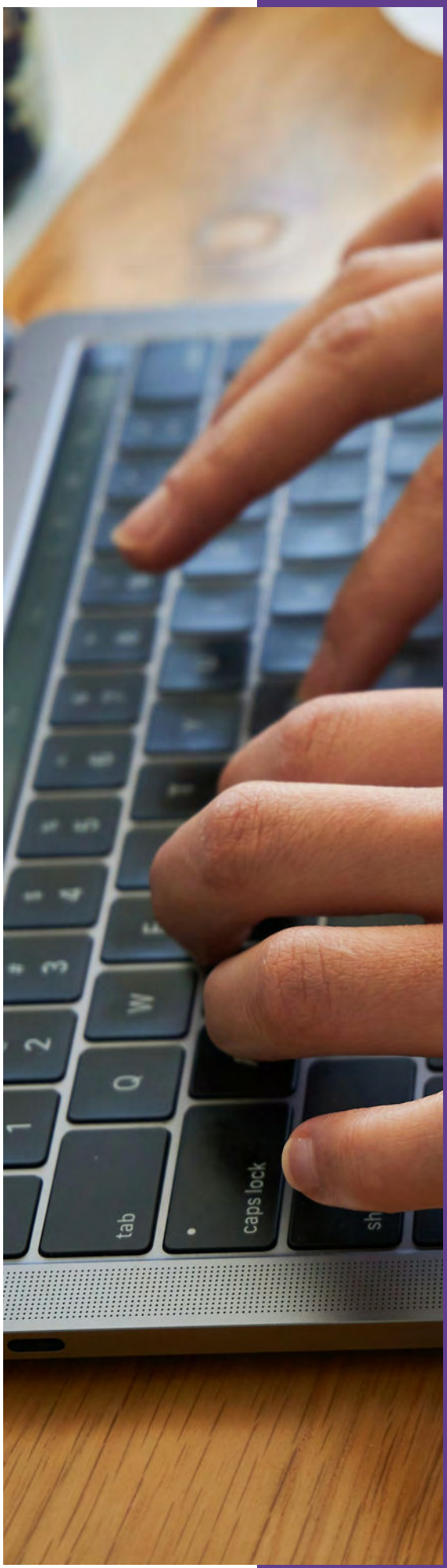
Yamamoto, K. (2007). *Banning Laptops in the Classroom: Is it Worth the Hassles?* (SSRN Scholarly Paper No. 1078740). Social Science Research Network. https://papers.ssrn.com/abstract=1078740



11

Writing in the Digital Age: A Mixed-Methods Action Research Study of Assessment Mode in GCSE English

Tim Lunn



Introduction and Context

The increasing integration of digital technologies into secondary classrooms has significantly altered how students compose written work, particularly in English. Word processing is now the dominant mode of composition in many educational contexts, including A-Level English, where typed responses are permitted, and in the wider workplace, where handwritten extended writing is increasingly rare. Despite this shift, formal assessment in English at KS3 and KS4 often continues to privilege handwritten responses, particularly in timed conditions. This divergence raises important questions about assessment validity, equity, and the extent to which assessment practices reflect both contemporary classroom writing and post-school literacy demands. It also has implications for teacher workload and the sustainability of marking practices.

Research examining the relationship between writing mode and student performance presents mixed and inconclusive findings. Some studies suggest that students achieve higher levels of performance when writing by hand, while others indicate that students perform better when composing using word processing.

Much of the existing research comparing handwritten and word-processed writing dates back to the early 2000s, a period in which access to digital technology was less widespread and typing was not yet the dominant mode of composition for most students. As a result, the applicability of these findings to contemporary classrooms, where students routinely compose digitally both in school and beyond, may be limited. This highlights the need for

more recent, classroom-based research that reflects current writing practices and assessment contexts.

This study is situated within a secondary English department and focuses on a single cohort of twenty five students completing two comparable summative assessments under timed conditions: GCSE English Language Section A assessments, each completed within one hour. The research was designed as a small-scale action research project, enabling the teacher-researcher to investigate questions arising directly from classroom practice while maintaining ethical and methodological rigour. A counterbalanced design was employed to mitigate familiarity effects and strengthen the validity of comparisons between assessment modes.

Two central research questions guided the enquiry. The first asked: To what extent do students produce a greater volume of written work when typing compared with handwriting under timed assessment conditions? The second examined: To what extent does any difference in written output between modes have an impact on students' assessed marks in English? In addressing these questions, the study also considers students' perceptions of assessment mode and reflects on the implications for teacher assessment practices, particularly in relation to marking workload and cognitive demand.

Literature Review

Research examining the impact of writing mode on students' written output and performance presents mixed and sometimes contradictory findings, with variation across age groups, cohorts, and assessment contexts.

In relation to writing volume, early research suggested that handwriting could be faster than typing for younger students. Connelly et al. (2007), for example, found that handwriting was quicker than typing for pupils in Year 5 and Year 6. However, this research is now almost two decades old and reflects a period in which students' familiarity with keyboards and digital composition was more limited.

Other studies have more consistently found that word processing enables students to produce longer responses. Owston (1992) and Robinson-Staveley and Cooper (1990) report increased writing volume when students compose digitally.

Findings related to writing quality are similarly contested. Some studies suggest that handwriting supports higher-quality writing, particularly among younger students. Connelly et al. (2007), in a large sample of approximately 300 Year 5 and Year 6 pupils, found handwritten writing to be significantly stronger in quality, with differences equivalent to approximately two years of development. However, as with findings on writing speed, the age of this research raises questions about its applicability to contemporary cohorts. More recent syntheses, such as Feng et al.'s (2019) meta-analysis, found relatively small differences in writing quality between handwriting and typing, with a slight advantage for digital devices in terms of speed rather than quality.

Conversely, a substantial body of research indicates that word processing can support improved writing quality. Studies by Owston (1992), Schaumburg (2006), and Robinson-Staveley and Cooper (1990) report improvements in overall quality and richness of vocabulary when students write using digital devices. Meta-analyses further support these findings. Goldberg et al. (2003), synthesising research across K–12 contexts, found that word processing significantly improved both the quantity and quality of students' writing. An earlier meta-analysis by Bangert-Drowns (1993) similarly concluded that the positive effects of word processing were most pronounced for weaker writers, suggesting that digital composition may reduce barriers to performance for some students.

Where research examines examination outcomes, results are similarly inconsistent. A substantial body of work reports that handwritten essays score higher than typed essays in certain testing contexts (Breland et al., 2004; Bridgeman and Cooper, 1998; Chen et al., 2011; Connelly et al., 2007; Green and Maycock, 2004; Manalo and Wolfe, 2000a; McGuire, 1995; Yu et al., 2004). By contrast, other studies report a typing advantage, with typed essays scoring higher in particular assessment designs (Lam and Pennington, 1995; Russell and Haney, 1997; Russell and Plati, 2002; Lessien, 2013; Zhu et al., 2016). A third strand of evidence reports no statistically meaningful difference between handwritten and typed responses, suggesting that mode effects may be minimal or context-dependent in many settings (Barkaoui and Knouzi, 2018; Brunfaut et al., 2018; Chan et al., 2018; Charman, 2014; Horkay et al., 2006; Lee, 2002; Lovett et al., 2010; MacCann et al., 2002; Mogey et al., 2010; Yu and Iwashita, 2021).

These findings highlight the complexity of isolating the effects of writing mode from broader factors such as student proficiency, familiarity with technology, and assessment design.

Methodology

Research Design

The study adopted a mixed-methods approach, combining quantitative data on writing volume and assessment outcomes with qualitative data exploring students' perceptions of assessment mode.

Participants and Context

The research was conducted with a single cohort of Year 10 students. Students were studying GCSE English Language and represented a mixed-attainment group within an academically selective context. As part of normal classroom practice, students routinely complete extended written work by hand in English and in other essay-based subjects such as History, Philosophy, Ethics and Religion (PER), and Geography. All students were familiar with both handwriting and word-processing, though extended handwritten essays remained the dominant mode of formal assessment within the school.

Assessment Design and Data Collection

Quantitative data were collected through two comparable summative assessments based on Section A of the AQA GCSE English Language examination. Students completed two Section A assessments under timed conditions of one hour: one handwritten and one word-processed. Tasks were designed to be comparable in structure, demand, and assessment objectives, and were aligned closely with GCSE examination requirements.

A counterbalanced design was employed. Half of the cohort completed the handwritten assessment first, while the remaining students completed the word-processed assessment first.

Data collected included total word count and overall assessment marks for each response, as well as word count and marks awarded for individual questions within Section A.

To reduce the risk of marker bias associated with assessment mode, handwritten scripts were digitised prior to marking. All responses were therefore marked in a uniform digital format, ensuring that assessors were not influenced either positively or negatively by handwriting legibility or presentation. All assessments were marked using identical GCSE AQA English Language mark schemes.

Qualitative data were gathered through two student questionnaires. The first questionnaire was administered prior to students completing either assessment and explored their preliminary views on handwriting and typing in timed English assessments, including expectations about speed, confidence, and performance. The second questionnaire was administered after students had completed both the handwritten and word-processed assessments. This follow-up questionnaire invited students to reflect on their subsequent views, including whether their perceptions had changed after experiencing both modes under examination-style conditions.

Ethical Considerations and Limitations

Ethical approval was obtained in accordance with school guidelines. Participation was voluntary, consent was secured, and students were assured that their assessment outcomes would not be affected by participation in the research. As a practitioner-researcher, the author acknowledges the potential for bias in data interpretation. In addition, the small sample size and single-school context limit the generalisability of the findings. Nevertheless, the study aims to generate contextually meaningful insights into assessment mode that may inform departmental practice and contribute to wider debates around validity and equity in English assessment.

Findings

Although the class consisted of 25 students, data from 20 students were included in the assessment analysis. Only students who completed both the handwritten and word-processed assessments were included, ensuring comparability across assessment modes.

Questionnaire data reflect responses from the full class of 25 students in the pre-assessment questionnaire and 21 students in the post-assessment questionnaire. Findings are organised to address the two research questions in turn: first, whether students produced a greater volume of writing when typing compared with handwriting under timed conditions; and second, whether any difference in writing volume was associated with differences in assessed marks.

Writing Volume: Word Count Across Assessment Modes

Analysis of word count data from the 20 students who completed both assessments revealed a substantial overall increase in writing volume when students typed rather than handwrote their responses. Across the cohort, the mean word count increased from 727 words in the handwritten assessment to 920 words in the word-processed

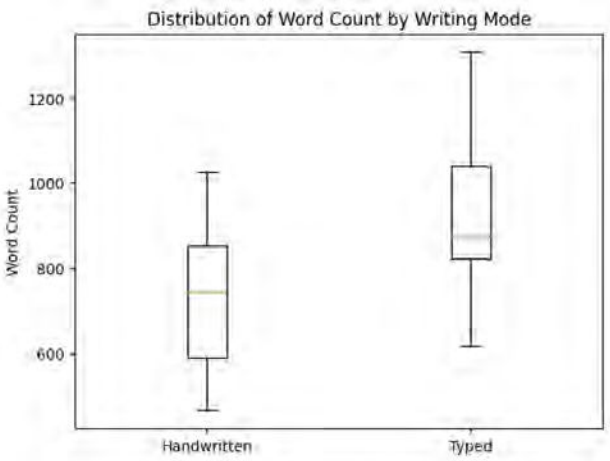


Figure 1: Box plot showing the distribution of word counts for hand written and typed assessments

assessment, representing an average increase of approximately 29% in writing volume under the same one-hour time constraint. This can be seen in figure 1.

19 of the 20 students produced more written work when typing. Percentage increases in word count varied considerably between individuals, ranging from relatively modest increases of between 2% and 9% for some students to increases of over 50% for others. This indicates that for some students, typing enabled a substantially greater level of sustained written output under timed conditions. Only one student produced less written work when typing, with a decrease of approximately 17%, representing a clear exception to the overall pattern.

When the data were disaggregated by gender, further differences became apparent in both the scale and consistency of the increase in writing volume. Among the female students, the mean increase in word count when typing was 143 words, corresponding to an average increase of approximately 19%. By contrast, eight male students showed a markedly larger mean increase of 268 words, equivalent to an average increase of approximately 45%.

Assessment Outcomes: Overall Marks

Analysis of overall assessment marks from the 20 students who completed both assessments revealed a modest overall difference between handwritten and word-processed responses. The mean score for the handwritten assessment was 23.6, compared with a mean score of 25.7 for the word-processed assessment, representing an average increase of 2.1 marks when students typed their responses. Median scores showed a similar pattern, increasing from 24.0 in the handwritten assessment to 25.5 in the word-processed assessment.

At an individual level, variation in outcomes was evident. Fifteen of the twenty students achieved a higher overall score in the word-processed assessment than in the handwritten assessment. Four students achieved lower scores when typing, and one student achieved the same score across both modes. Differences in marks ranged from a decrease of 5 marks in one case to an increase of 9 marks in another, indicating substantial individual variation in how assessment mode related to performance.

Several students demonstrated notable gains when typing. By contrast, a small number of students achieved slightly lower scores in the word-processed assessment. This can be seen in figure 2.

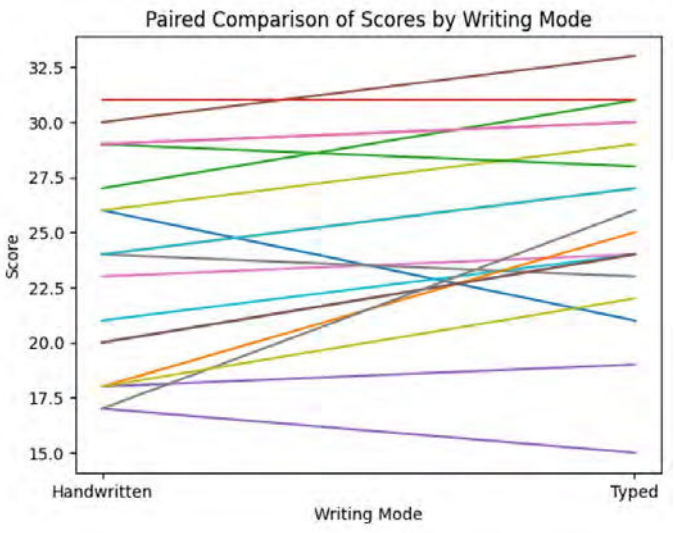


Figure 2: Paired line graph comparing individual students' handwritten and typed assessment scores.

Among the male students, the mean handwritten score was 19.5, increasing to 23.1 when typing, representing an average increase of 3.6 marks. 7 of the 8 boys achieved higher scores in the word-processed assessment, while one scored lower. In contrast, the 12 female students showed a smaller average change: mean scores increased from 26.3 when handwriting to 27.3 when typing, an average increase of 1.1 marks. While most girls achieved slightly higher scores when typing, a greater proportion of female students than male students performed better when handwriting.

Taken together, these findings suggest that although typing was associated with a modest overall increase in marks across the cohort, the magnitude and consistency of this effect were greater for male students than for female students.

Questionnaire findings

The first questionnaire, administered prior to students completing either assessment explored students' preliminary views on handwriting and typing in timed English assessments. Preferences were relatively evenly distributed at this stage: 10 students reported a preference for handwriting, 8 preferred typing, and 7 indicated no preference. A clear gendered pattern emerged: all students who expressed a preference for handwriting were girls, while all students who preferred typing were boys.

The second questionnaire was administered after students had completed both the handwritten and word-processed assessments. 4 students were absent at the time of administration, meaning responses were collected from 21 students. This questionnaire invited students to reflect on their experiences of both assessment modes and to indicate whether their views had changed following direct comparison under timed conditions.

In relation to perceived speed of writing, initially 17 students reported that they believed they worked more quickly when typing, compared with 3 who felt handwriting was quicker and 5 who perceived little difference. This matched well with the the second questionnaire, where 14 students reported feeling more rushed during the handwritten task, compared with only 3 who felt more rushed when typing, and 4 who perceived no difference.

Responses regarding physical effort showed a marked contrast between modes. In the initial questionnaire, 7 students reported that handwriting was tiring and a further 2 described it as very tiring. By comparison, only 1 student reported typing as tiring and 1 as very tiring. In the second questionnaire 4 students described handwriting as very tiring, while only 1 student reported typing as very tiring.

Planning was more commonly associated with handwriting, with 17 students in the first questionnaire reporting that planning was easier when writing by hand, compared with 5 who felt planning was easier when typing and 3 who perceived no difference. However, students' perceptions of organisation shifted following completion of both assessments. 12 students reported that typing helped them organise their ideas more effectively, compared with 4 who felt handwriting supported organisation and 5 who perceived no difference. a majority of students had reported that planning was easier when handwriting.

Editing, however, was strongly associated with typing: 18 students reported that typing made editing easier, compared with 6 who favoured handwriting and 1 who perceived no difference. In the second questionnaire 15 students reported that typing had made it easier to check and improve their work, compared with only 1 who favoured handwriting and 5 who perceived no difference.

When asked whether their views had changed overall, 9 students reported no change. 8 students indicated that they felt more positive about typing after completing both assessments, while 4 reported becoming more positive about handwriting

Despite this, students' perceptions of performance remained mixed: 8 students believed they had performed better in the handwritten assessment, 11 believed they had performed better when typing, and 2 perceived no difference. These judgements were made before students received their marks.

Finally, students were asked to indicate their overall preference after completing both tasks. Preferences remained relatively evenly distributed: 8 students reported no preference between handwriting and typing, 7 preferred typing, and 6 preferred handwriting.

A gender split was apparent again: all students who preferred handwriting were girls, and all students who preferred typing were boys. This repetition suggests that preferences for assessment mode were relatively stable and not substantially altered by direct experience of both modes. Taken together, these findings indicate that while experiences of typing were often viewed positively—particularly in relation to speed, stamina, and ease of editing—direct comparison did not result in a decisive shift towards a single preferred assessment mode across the cohort.





Implications for Practice

The findings of this study suggest several implications for classroom practice and assessment design in English, particularly in light of the increasing prominence of digital writing in education and the wider workplace. While the results should be interpreted cautiously due to the small-scale nature of the study, they offer useful insights for reflective practice.

Given that typing was associated with a substantial increase in writing volume for most students and a modest overall increase in assessed marks, there is a strong case for incorporating typed writing more routinely into classroom-based assessment. For many students, particularly boys, typing appeared to reduce physical fatigue and time pressure, enabling more sustained writing under timed conditions. Allowing some extended writing tasks to be completed digitally may therefore provide a more accurate reflection of students' analytical and compositional abilities, rather than constraining performance through transcription demands.

However, the variability in outcomes indicates that no single assessment mode suits all learners equally. Handwriting appeared to support planning for some students, particularly prior to writing, while typing supported organisation and editing during composition. A balanced approach that incorporates both modes may therefore be pedagogically advantageous.

From a teacher workload perspective, typed responses are quicker and easier to mark, as handwriting does not need to be deciphered. This reduces cognitive load for markers and enables comments and targets to be reused or adapted more efficiently, supporting consistency in feedback. While ease of marking should not drive assessment decisions alone, these practical considerations are significant in contemporary educational contexts.

Conclusion

This classroom-based action research project set out to explore whether students produced a greater volume of writing when typing rather than handwriting under timed conditions, and whether any such difference was associated with differences in assessed performance in GCSE English. The findings indicate that typing enabled almost all students to write more, with a substantial average increase in writing volume and particularly pronounced gains for some individuals, most notably boys. Typing was also associated with a modest overall increase in assessment marks, although this effect was smaller and more variable than the increase in writing volume.

Importantly, the study suggests that increased output does not automatically translate into higher attainment. While typing appeared to reduce physical fatigue and time pressure for many students, writing quality remained dependent on core compositional skills such as organisation, clarity, and analytical control.



REFERENCES

Bangert-Drowns, R.L., Hurley, M.M. and Wilkinson, B. (2004) 'The effects of school-based writing-to-learn interventions on academic achievement: A meta-analysis', Review of Educational Research, 74(1), pp. 29–58. https://doi.org/10.3102/00346543074001029.

Barkaoui, K., & Knouzi, I. (2018) The effects of writing mode and computer ability on L2 test-takers' essay characteristics and scores. Assessing Writing, 36, 19–31.

Breland, H., Lee, Y. W., & Muraki, E. (2004) Comparability of TOEFL CBT writing prompts: Response mode analyses (Research Report, Issue RR-75). Educational Testing Service.

Bridgeman, B., & Cooper, P. (1998, April 13–17) Comparability of scores on word processed and handwritten essays on the Graduate Management Admissions Test [Paper presentation]. The Annual Meeting of the American Educational Research Association, San Diego, CA, United States.'

Brunfaut, T., Harding, L. and Batty, A.O. (2018) 'Going online: The effect of mode of delivery on performances and perceptions on an English L2 writing test suite', Assessing Writing, 36, pp. 3–18. https://doi.org/10.1016/j.asw.2018.02.003.

Chan, S., Bax, S., & Weir, C. (2018) Researching the comparability of paper -based and computer-based delivery in a high-stakes writing test. Assessing Writing, 36, 32–48.

Charman, M. (2014) Linguistic analysis of extended examination answers: Differences between on-screen and paper-based, high- and low-scoring answers. British Journal of Educational Technology, 45(5), 834–843.

Chen, J., White, S., McCloskey, M., Soroui, J., & Chun, Y. (2011) Effects of computer versus paper administration of an adult functional writing assessment. Assessing Writing, 16(1), 49–71.

Connelly, V., Gee, D., & Walsh, E. (2007) A comparison of keyboarded and handwritten compositions and the relationship with transcription speed. British Journal of Educational Psychology, 77(2), 479–492.

Endres, H. (2012) A comparability study of computer-based and paper-based Writing tests. Research Notes, 49, 26–33.

Feng, L., Lindner, A., Ji, X.R. and Joshi, R.M. (2019) 'The roles of handwriting and keyboarding in writing: a meta-analytic review', Reading and Writing: An Interdisciplinary Journal, 32(1), pp. 33–63. https://doi.org/10.1007/s11145-017-9749-x.

Goldberg, A., Russell, M. and Cook, A. (2003) 'The effect of computers on student writing: A meta-analysis of studies from 1992 to 2002', Journal of Technology, Learning and Assessment, 2(1), February 2003. Available at: https://ejournals.bc.edu/index.php/jtla/article/view/1661 (Accessed: [01/01/26]).

Green, T., & Maycock, L. (2004) Computer-based IELTS and paper-based versions of IELTS. Research Notes, 18, 3–6.'

Horkay, N., Bennett, R. E., Allen, N., Kaplan, B., & Yan, F. (2006) Does it matter if I take my writing test on computer? An empirical study of mode effects in NAEP. Journal of Technology, Learning, and Assessment, 5(2), n2.

Lam, F., & Pennington, M. C. (1995) The computer vs. the pen: A comparative study of word processing in a Hong Kong secondary classroom. Computer Assisted Language Learning, 8(1), 75–92.

Lee, Y.-J. (2002) A comparison of composing processes and written products in timed-essay tests across paper-and-pencil and computer modes. Assessing Writing, 8(2), 135–157.

Lessien, E. (2013) The effects of typed versus handwritten essays on students' scores on proficiency tests [Unpublished doctoral dissertation, Michigan State University].

Lovett, B. J., Lewandowski, L. J., Berger, C., & Gathje, R. A. (2010) Effects of response mode and time allotment on college students' writing. Journal of College Reading and Learning, 40(2), 64–79.

MacCann, R., Eastment, B., & Pickering, S. (2002) Responding to free response examination questions: Computer versus pen and paper. British Journal of Educational Technology, 33(2), 173–188.

Manalo, J. R., & Wolfe, E. W. (2000a, April 24–28) A comparison of word-processed and handwritten essays written for the Test of English as a Foreign Language [Paper presentation]. The Annual Meeting of the American Educational Research Association, New Orleans, LA, United States.

Manalo, J. R., & Wolfe, E. W. (2000b, April 24–28) The impact of composition medium on essay raters in foreign language testing [Paper presentation]. The Annual Meeting of the American Educational Research Association, New Orleans, LA, United States.

McGuire, D. W. (1995) A comparison of scores on the Kansas Writing Assessment for word-processed and hand-written papers of eleventh graders [Unpublished doctoral dissertation, Kansas State University].

Mogey, N., Paterson, J., Burk, J., & Purcell, M. (2010) Typing compared with handwriting for essay examinations at university: Letting the students choose. Research in Learning Technology, 18(1), 29–47.

Owston, R.D., Murphy, S. & Wideman, H.H. (1992) 'The effects of word processing on students' writing quality and revision strategies', Research in the Teaching of English, 26(3), pp. 249–276.

Robinson-Staveley, K. and Cooper, J. (1990) 'Mere presence, gender, and reactions to computers: Studying human–computer interaction in the social context', Journal of Experimental Social Psychology, 26(2), pp. 168–183. https://doi.org/10.1016/0022-1031(90)90074-V.

Russell, M., & Haney, W. (1997) Testing writing on computers: An experiment comparing student performance on tests conducted via computer and via paper and-pencil. Education Policy Analysis Archives, 5 (3).

Russell, M., & Plati, T. (2002) Does it matter with what I write? Comparing performance on paper, computer and portable writing devices. Current Issues in Education, 5.

Wolfe, E. W., Bolton, S., Feltovich, B., & Bangert, A. W. (1995, April 18–22) The influence of computers on student performance on a direct writing assessment [Paper presentation]. The Annual Meeting of the American Educational Research Association, San Francisco, CA, United States.

Wolfe, E. W., & Manalo, J. R. (2004) Composition medium comparability in a direct writing assessment of non-native English speakers. Language Learning & Technology, 8(1), 53–65.

Yu, L., Livingston, S. A., Larkin, K. C., & Bonett, J. (2004) Investigating differences in examinee performance between computer-based and handwritten essays (Research Report, Issue RR-04-18). Educational Testing Service.

Yu, W., & Iwashita, N. (2021) Comparison of test performance on paper based testing (PBT) and computer-based testing (CBT) by English-majored undergraduate students in China. Language Testing in Asia, 11(1), 32.

Zhu, Y., Shum, S.-K. M., Tse, S.-K. B., & Liu, J. J. (2016) Word-processor or pencil and-paper? A comparison of students' writing in Chinese as a foreign language. Computer Assisted Language Learning, 29(3), 596–617.

How does the use of digital and paper worksheets impact immediate recall of geographical knowledge in a Year 9 Geography lesson?

Victoria Lipp

This study explores whether the mode of worksheet delivery impacts short term recall of material in a Year 9 Geography classroom. A within-cohort design across 8 Year 9 Geography classes minimises the impact of other factors by standardising the results of two post lesson recall tests delivered using digital and paper worksheets.

Use of digital tools such as Microsoft OneNote allow students to use devices in lessons and use the interface as a worksheet, rather than a traditional paper worksheet. It also allows worksheets to be more organised and was first started to be used more widely at The Perse as part of the Covid19 response to allow more seamless access to resources remotely.

Literature Review

The existing literature body related to digital usage in education explores both the role of the medium of delivery (using screens or paper) and the role of input method (handwriting or typing). There is little literature that specifically explores worksheet medium in a secondary classroom, rather it reflects two separate elements that are connected to this; reading comprehension and handwriting vs typing. It is important to note that this study will not be able to fully explore the difference between typing and handwriting, as students are allowed a choice over whether to type responses onto their digital worksheets or handwrite using a stylus, often choosing the former for organisational reasons or to align with access arrangements in exams. Therefore, a review of these related research areas is key to create context for the study but cannot account for the results see due to the mixture of input methods seen in the digital worksheets and the variety of skills involved in using a worksheet in classroom teaching.

Studies exploring the role of digital technology in college level notetaking do not produce an agreed impact on achievement. Multiple meta-analyses have found that taking handwritten notes can positively influence long term academic performance at college level at varying levels. These papers suggest that the use of digital devices in notetaking increases the potential for distractions away from the content covered in the notes (Allen et al., 2020), alongside being less efficient than handwriting the same equivalent notes and promoting weaker memory processes than handwriting (Flanigan et al., 2020). In contrast, other reviews found only modest differences between handwritten and typed note-taking and instead suggest caution and more detailed consideration of the wider context that is likely to moderate the impact strongly. They also suggest the need for further research at secondary school level in particular (Voyer et al., 2020).

Reading comprehension and its relation to educational outcomes is also important to consider in this study. Meta-analyses by both Delgado et al. (2018) and Clinton (2019) conclude that reading on paper has a positive effect on comprehension and 'reading performance' respectively, compared to reading on screen. Interestingly, readers are found to be better aware of their own reading performance when reading on paper (Clinton, 2019). Further to this, undergraduate students in a study by Singer and Alexander (2017) showed a clear preference for reading digital texts and predicted they would achieve better outcomes from this, but this was not shown in the results. Instead, the finer detail of the texts related to the main ideas were better recalled when read on paper rather than on screen. There is more consensus in the literature about the benefits of reading comprehension on paper rather than on screen, which has some role to play in interpreting the results of this study but will not cover all aspects.

Methodology

Results about the influence of digital vs paper mediums in lessons are inconsistent across the current literature and do not directly cover the practicalities of the classroom environment at The Perse Upper school. Therefore, this study has been designed to replicate an authentic classroom environment as far as possible, in contrast to many of the existing studies that focus on undergraduate level students. Lessons were taught by existing teachers who have a rapport with students and the resources used in the research draw heavily from existing schemes of learning, allowing the results to explore the influence of worksheet medium in our current context more precisely. At the time of the data collection, students were familiar with the use of both paper resources and digital worksheets in their Geography lessons, so neither had a 'novelty value' that may have influenced the results. Students were informed in January 2026 that research was going to be carried out as part of their Geography lessons in the remainder of the year but the specific lessons were not signposted to students at the time of delivery.

The study utilised a crossover design, allowing each student to experience lessons delivered using digital and paper worksheets. This allowed students to act as the control in this experiment and accounts for differences in prior attainment in the outcomes. This also produces a more robust set of data than simply comparing two classes who have completed different tasks as it allows other variables to be controlled as far as possible. There was a post lesson recall test, focussed on knowledge and understanding covered in the lesson in question, which was used at the immediate end of each lesson sequence (some lessons covered more than one 40 minute block). It must be noted that this method does not test long term recall or depth of understanding and this could be an important area to explore in future studies. The post-lesson recall tests comprised of a combination of multiple choice or short answer responses (max 5 words needed) and was administered using another digital tool, Microsoft Forms. This provided identifiers for the test responses which allowed the results to be paired for each student across both worksheet mediums. The study used 8 Year 9 Geography classes and, once accounting for students who

missed one or other lesson (or did not complete the recall test), there were a total of 153 students who completed both lessons and post-lesson recall tests. This data formed the basis of the further analysis. To remove the influence of lesson content and post lesson recall test difficulty, each lesson was delivered to 4 forms on paper worksheets and 4 forms on digital work sheets, in a counter-balanced design.

Results

153 students completed post lesson recall tests of geographical knowledge covered in a lesson taught with either a digital or paper worksheet. The research design outlined above standardises for prior attainment and lesson content as far as is reasonably practicable. The recall tests after the paper worksheet lesson had a mean score of 65% whilst the digital worksheet had a mean score of 64%. However, as the recall tests were different for each lesson as part of the crossover design, standardisation was required to ensure that this was not accounting for the difference seen here. Z scores were calculated for the post lesson recall tests to show performance relative to the distribution of scores in each assessment and showed a marginally higher standardised score after the digital worksheets were used compared to the paper worksheets, with an average standardised score of 0.0385 standard deviations across the 153 students. A paired-samples t test was run, t(152)= 0.37905 p=0.70518 showing that this small difference seen in the standardised score is not significantly significant and therefore the study shows no meaningful evidence that there is a difference in post lesson recall tests after the digital or paper worksheets in Year 9 Geography lessons.



26.1 Starter: key term focus

Instructions: Match the key terms below in to the grid underneath.

gentrification	suburban area	brownfield site	rural area (e.g. village)
commute	deprivation	urban area (e.g. inner city)	greenfield site

	A journey to work
	Sites to build on that have previously been built on

Figure 1: Worksheet extract

Discussion

This study finds no significant difference seen in attainment, measured through immediate post lesson recall, between students using digital and paper mediums. This aligns with some areas of the wider literature, which has found no compelling evidence in a significant difference between digital and paper based learning (Voyer et al., 2022) but is in contrast to other studies such as Allen et al.(2020) and Flanigan et al. (2024) who assert that there is an advantage seen when paper based mediums are used. However, a direct comparison with these studies is challenging as the measures of attainment are different, they cover a range of educational contexts rather than specifically a UK secondary classroom and they focus on note-taking rather than completion of worksheets as is seen in the results here. Therefore it is unlikely that the assertions suggested to justify the results, such as handwriting promoting stronger encoding (Flanigan et al., 2024) and additional distractions on devices (Allen et al., 2020) can be used to definitely explain the trend seen here, alongside the more limited relevance to the research methodology here.

It is likely that the difference in the raw scores across both recall tests is down to the relative difficulty of both the geographical content covered in the lesson and the final recall test. This is an expected pattern across schemes of learning and can also be caused by different levels of familiarity of the content due to different prior coverage.

The advantages of using digital devices to improve recall has been explored in papers such as Çekiç & Bakla (2021), who explore the use of instant feedback formative quiz platforms, which can be integrated into lessons when using devices. These were not integrated into the digital worksheets used here, to keep consistency between worksheets as mentioned above, so these advantages would not have been realised in the outcomes here. However, it is not the case that instant feedback and formative assessment is exclusive to digital mediums and many practitioners successfully use mini whiteboards, hands up and other non-digital techniques to provide the same benefits to students, again lending credence to the conclusion that pedagogical design is more important than the medium of delivery.

In addition, this study simply refers to post lesson recall, but the organisational advantages of using digital workflow can also be significant when it comes to revision of material in the long term, as a digital OneNote notebook stored on the cloud cannot be left on a train in the same way as a paper exercise book. This may influence longer term outcomes for students in a Year 9 Geography class and would be an interesting avenue for further investigation.

Limitations

An important limitation of this study is that students in the digital condition used different input methods. Some students using the digital worksheet completed activities using typed responses, while others used a stylus to handwrite onto the screen. This is a reflection of an authentic classroom, where the expectations for students to be well equipped, digitally, for their lessons is not always the case and additionally some students use typing as a normal way of working for learning support reasons. As previous research suggests that typing and handwriting may influence information processing differently, any observed differences between the paper and digital conditions cannot be fully explained by either handwriting or typing and indeed, this may have impacted recall outcomes in a way that cannot be detected by the study.

Another important limitation here is to consider the differences in pedagogical approach when mainly using digital worksheets on OneNote in contrast to on paper. The research design replicated activities exactly across the paper and digital worksheets in order to keep teaching consistency across classes in the cohort and to reflect wider departmental practice, but this is likely to have some influence. The advantages that can be found through digital learning would not have been fully explored here as the lesson activities needed to be replicated across the paper worksheet design too. There will also be a variation in teacher delivery of content and time passed between the lessons in question, as the lessons were taught by 7 different Geography teachers at different points in the academic year. However, the application of z scores and the crossover design to standardise between tests and the fact that every student sat both paper and digital worksheets hopes to mitigate against this, but is an important consideration when examining short term recall from lessons.

Conclusions

This study shows no significant connection between immediate recall of geographical knowledge after lessons using digital and paper worksheets. This therefore highlights the importance of pedagogical design rather than medium of delivery. Future research could compare three conditions: paper-based worksheets, digital worksheets handwritten using a stylus, and digital worksheets completed through typing. This would help determine whether any differences in recall are attributable to the digital medium itself or to the method students use to interact with it.

REFERENCES

Allen, M., LeFebvre, L., LeFebvre, L. and Bourhis, J. (2020). Is the Pencil Mightier than the Keyboard? A Meta-Analysis Comparing the Method of Notetaking Outcomes. Southern Communication Journal, 85(3), pp.143–154. doi:10.1080/1041794x.2020.1764613.

Çekiç, A., and Bakla, A. (2021). A review of digital formative assessment tools: Features and future directions. International Online Journal of Education and Teaching (IOJET), 8(3), pp. 1459-1485.

Clinton, V. (2019). Reading from paper compared to screens: A systematic review and meta-analysis. Journal of Research in Reading, 42(2), pp.288–325. doi:10.1111/1467-9817.12269.

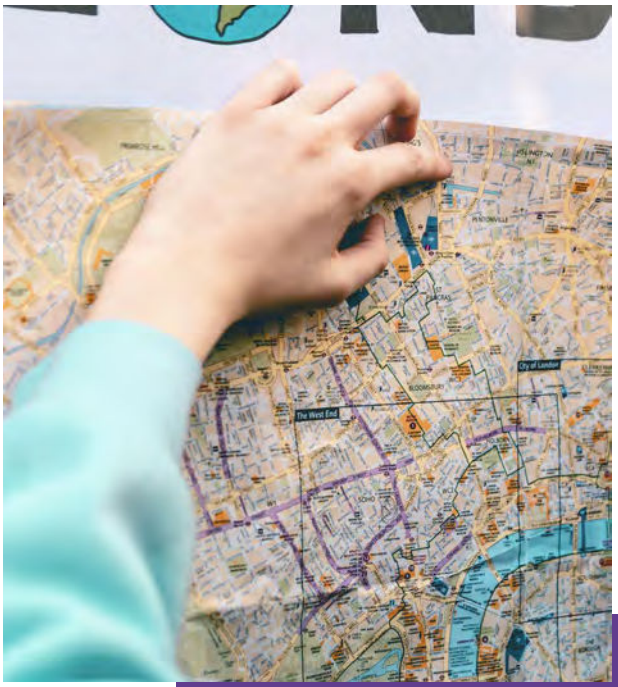
Delgado, P., Vargas, C., Ackerman R. and Salmeron, L. (2018). Don't throw away your printed books: A meta-analysis on the effects of reading media on reading comprehension. Educational Research Review, 25(1). doi: 10.1016/j.edurev.2018.09.003.

Flanigan, A.E. and Titsworth, S. (2020). The impact of digital distraction on lecture note taking and student learning. Instructional Science, 48(5). doi:10.1007/s11251-020-09517-2.

Flanigan, A.E., Wheeler, J., Tiphaine Colliot, Lu, J. and Kiewra, K.A. (2024). Typed Versus Handwritten Lecture Notes and College Student Achievement: A Meta-Analysis. Educational Psychology Review, [online] 36 (3). doi:10.1007/s10648-024-09914-w.

Singer, L. M., and Alexander, P. A. (2017). Reading on Paper and Digitally: What the Past Decades of Empirical Research Reveal. Review of Educational Research, 87(6), pp. 1007-1041. doi.org/10.3102/0034654317722961

Voyer, D., Ronis, S.T. and Byers, N. (2022). The Effect of Notetaking Method on Academic performance: a Systematic Review and meta-analysis. Contemporary Educational Psychology, 68(1). doi:10.1016/j.cedpsych.2021.102025.



A Comparative Study of Digital and Paper-Based Revision Methods within Computer Science

Janet Symonds

Introduction and Literature Review

This research investigates whether collaborative paper-based retrieval activities improve engagement and assessment performance compared with predominantly individual digital revision methods.

The recent introduction of devices for pupils in Years 7 and 8 has increased the proportion of learning completed digitally across the school. Within Computer Science, revision resources are usually distributed as digital question-based activities, and pupils generally work independently on their devices. In my own lessons, I had noticed that pupils often completed digital revision quietly and independently, but did not interact and discuss the concepts behind their answers. Digital technologies can improve accessibility, independent learning and collaborative opportunities within classrooms (Tamim et al., 2011), and digital platforms can support rapid feedback and flexible retrieval practice (Hattie, 2009). However, digital environments may also increase cognitive distraction and task-switching behaviours, which can affect attention and retention (Sana et al., 2013).

Social constructivist theory proposes that learning is strengthened through dialogue and collaborative problem solving, as pupils co-construct understanding through interaction with their peers (Vygotsky, 1978). This suggests that collaborative paper-based activities may promote stronger face-to-face interaction and deeper cognitive engagement than independent digital tasks. Research into cooperative learning further indicates that well-structured collaborative activities can improve academic achievement and interpersonal skills when pupils work towards shared learning goals (Slavin, 1989; Johnson and Johnson, 2009).

This study adopts an action research approach because it allows revision methods to be investigated within classroom environments while maintaining normal teaching practice and informing future classroom decisions (Kemmis and McTaggart, 1988; Cohen et al., 2018).

The literature does not suggest that paper-based methods should be viewed as universally superior to digital learning. Sung et al. (2016) argue that the effectiveness of technology-enhanced learning depends largely on how digital tools are implemented within the classroom. Structured digital activities that promote retrieval practice, immediate feedback and purposeful interaction can still provide substantial learning benefits. Learner preference and familiarity with technology may also influence engagement and motivation, particularly in Computer Science, where digital fluency forms part of the wider curriculum experience. Overall, the effectiveness of revision strategies appears to depend less on the medium itself than on the extent to which activities promote active cognitive engagement.

Methodology

This study adopted a comparative design to investigate the impact of collaborative paper-based revision activities on pupil engagement and assessment performance in Computer Science, compared with the department's established digital revision approach.

Paper-based resources were produced in the run-up to assessments. Where parallel classes were available, one class used the paper-based resources and the other continued with the usual digital revision resources. Parallel classes taught by the same teacher were selected where possible to reduce variability caused by differences in teaching style, classroom routines or behaviour management.

The paper-based resources were designed to target the content of each assessment. Most activities promoted collaborative working in pairs or small groups. This created a more interactive revision environment, with pupils

recalling information, discussing answers and working together to extend their understanding.

The revision resources included Tarsia puzzles, Parsons Problems for coding practice and quick-fire question cards that pupils used to test one another, with answers provided on the reverse. Research into active and collaborative learning suggests that puzzle-based activities can enhance engagement, collaboration and conceptual understanding through peer discussion and problem-solving (Chi and Wylie, 2014; Johnson and Johnson, 2009). Collaborative puzzle-solving activities can also increase motivation and deepen understanding through peer interaction and immediate feedback.

Within Computer Science education, Parsons Problems are increasingly recognised as an effective scaffold for novice programmers. Rather than generating code from scratch, learners reorganise pre-written code segments into the correct sequence, allowing them to focus on program logic and structure without excessive cognitive load (Du et al., 2020). Research suggests that Parsons Problems can improve engagement, reduce frustration and support problem-solving strategies compared with traditional code-writing activities. Weinman et al. (2021) further developed this approach through Faded Parsons Problems, in which learners reorganise code segments and complete missing sections. Their study found that these scaffolded activities supported the learning of programming patterns and were at least as effective as traditional code-writing exercises in developing programming ability. Students also reported positive perceptions of Faded Parsons Problems, often preferring them to more conventional code-tracing and code-writing tasks. This may be because the activities allow learners to focus on underlying programming concepts and logic while reducing the cognitive demands associated with generating code entirely from memory.

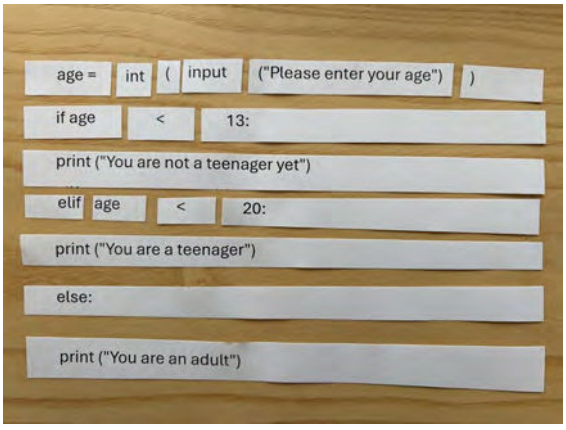


Figure 1: Exemplar Parsons problem

The inclusion of Parsons-style activities in this study was intended to provide structured opportunities for pupils to engage with programming concepts, build confidence and reduce barriers to success. From a Cognitive Load Theory perspective, scaffolded approaches such as Parsons Problems may reduce unnecessary cognitive load by allowing learners to focus on understanding program logic before generating complete solutions independently (Sweller, 1988). This may be particularly beneficial for novice programmers who are still developing foundational programming schemas.

With a focus on revision, the paper-based activities were designed around retrieval practice, whereby learners actively recall previously learned information from memory. Research consistently demonstrates that retrieval practice improves long-term retention more effectively than passive review strategies (Agarwal et al., 2021). The activities were therefore structured to encourage retrieval of key knowledge and concepts before assessment. This approach is supported by evidence of the "testing effect", whereby repeated retrieval results in significantly greater long-term retention than repeated study alone (Roediger and Karpicke, 2006; Agarwal et al., 2021).

Pupil feedback was also collected through a short online questionnaire after the revision activities to gather views on engagement, preferred revision methods and perceived usefulness.

The research took place within normal classroom practice, so no pupils were disadvantaged by participation. Assessment data were anonymised during analysis and used solely for educational research purposes.

Analysis Method

Assessment data were collected for the classes involved in the study after the Lent assessment period. The primary aim of the analysis was to investigate whether classes using collaborative paper-based revision activities demonstrated different levels of attainment from those using the department's established digital revision resources.

Several approaches were used to analyse the data. First, class average scores were calculated and compared across each year group to identify broad differences in performance between classes that experienced the paper-based intervention and those that followed the usual digital revision programme. Because attainment can vary

significantly between classes, comparisons were not based solely on final assessment scores.

To account for prior attainment, Lent assessment performance was compared with the previous Michaelmas assessment. This enabled changes in attainment to be measured over time and provided an indication of whether particular classes demonstrated greater improvement following the revision programme. Examining progress between assessment points also reduced the influence of pre-existing differences in attainment between classes.

Where parallel classes taught by the same teacher were available, these were compared directly. This was valuable because it reduced the influence of variables such as teaching style, classroom routines and teacher expectations. Differences observed between these classes were therefore more likely to be associated with the revision methods used, although they still need to be interpreted cautiously because other classroom-level factors could not be fully controlled.

For Year 10, a more detailed analysis was undertaken because the assessment was organised by topic area. In addition to examining overall assessment performance, individual topic results were analysed separately. This made it possible to identify whether the revision activities appeared to have a greater impact on particular areas of the curriculum, such as programming-based content or theory-based topics. Combining overall and topic-level analyses provided a more detailed understanding of the effectiveness of the different revision approaches.

Results

The results are summarised below to make the main patterns easier to compare across year groups. The figures should be interpreted as indicative rather than conclusive because of the small-scale nature of the study and the differences between classes, topics and prior attainment levels.

Pupil Feedback Summary

Across all four year groups, pupils viewed both digital and paper-based revision positively. The strongest overall preference was for a hybrid approach combining both methods. Year 8 showed a slight preference for digital revision and Year 9 favoured paper-based collaborative activities, but no cohort advocated using a single approach exclusively.

Paper-based activities were consistently praised for increasing engagement, promoting discussion and supporting memory recall through active participation. Collaborative learning was viewed positively across all year groups. Digital revision remained valued for its accessibility, organisation and ease of locating information, with several pupils requesting additional online quizzes and digital resources.

Pupils also emphasised the importance of variety, recommending a combination of quizzes, flashcards, mind maps, summaries, practice papers and interactive games. Several comments suggested that the effectiveness of revision depended more on the quality of the activity than on whether it was delivered digitally or on paper.

Year group	Paper-based revision outcome	Digital revision outcome	Main interpretation
Year 7	Average attainment increased from 64.3% to 76.3%, a gain of 12 percentage points.	Average attainment increased from 61.3% to 70.5%, a gain of 9.2 percentage points.	Both groups improved. Paper-based classes showed a slightly greater overall increase, but the pattern was not consistent across all teacher groups.
Year 8	The paper-based class improved by 6 percentage points.	Digital revision classes collectively showed almost no overall change, although they began from a higher baseline.	The paper-based class improved more, but a ceiling effect and class variation limit the strength of this comparison.
Year 9	The paper-based class decreased slightly from 87% to 86%.	The comparable digital revision class increased slightly from 83% to 84%.	The differences were small and do not provide convincing evidence of a substantial attainment advantage.
Year 10	Outcomes were comparable with digital revision, with greater consistency of performance and fewer low scores in one direct class comparison.	Outcomes were broadly comparable overall.	Topic-level analysis suggested the strongest apparent paper-based advantage in Computational Thinking, with less pronounced differences in programming.

Discussion

Across Years 7-10, the findings did not provide consistent evidence that collaborative paper-based revision activities resulted in substantially higher attainment than the department's established digital revision methods. The Year 7 and Year 8 data showed slightly greater improvements in classes using paper-based resources, the Year 9 results demonstrated little difference between approaches, and the Year 10 data suggested broadly comparable attainment outcomes. Taken together, the results indicate that collaborative paper-based revision can be at least as effective as digital revision in supporting assessment performance, but the evidence is not strong enough to claim a clear attainment advantage.

A notable pattern was that classes using paper-based revision generally performed comparably to, and in some cases slightly better than, those using digital resources despite the relatively small scale of the intervention. However, the variation observed between classes and year groups suggests that prior attainment, class composition, pupil motivation and topic content are also likely to have influenced outcomes.

The pupil feedback provided a clearer and more consistent picture. Pupils responded positively to the collaborative paper-based activities, describing them as engaging, enjoyable and supportive of discussion with peers. Although preferences varied between cohorts, most pupils favoured a blended approach combining interactive paper-based activities with digital resources. Many pupils also reported that paper-based activities supported memory recall, while still valuing digital resources for accessibility, organisation and independent practice. These findings suggest that the two approaches are complementary rather than competing methods of revision.

Overall, the quantitative data provide some support for the use of collaborative paper-based revision activities, but they do not provide conclusive evidence that these activities lead to higher attainment. The qualitative findings indicate that paper-based activities may enhance pupil engagement, collaboration and motivation, all of which are recognised as important contributors to effective learning (Johnson and Johnson, 2009; Chi and Wylie, 2014). The short duration of the intervention may have limited the extent to which these wider educational benefits were reflected in assessment outcomes. The findings therefore suggest that collaborative paper-based revision is best understood as a valuable complement to digital revision, not as a replacement for it.

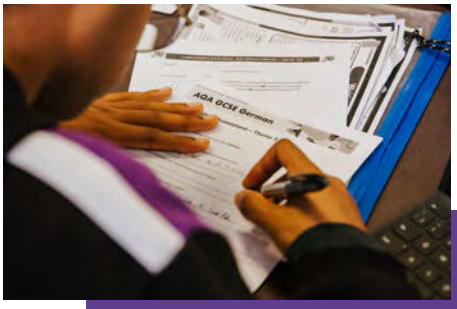
Limitations

Several limitations should be considered when interpreting the findings. First, the sample size was small and restricted to a limited number of Computer Science classes. Efforts were made to reduce potential confounding variables through the use of parallel classes taught by the same teacher, but it was not possible to eliminate all teacher or classroom-level influences. Differences in classroom dynamics, pupil motivation, attendance and prior attainment may therefore have influenced outcomes independently of the revision method.

The intervention was implemented during a single Lent term assessment cycle. Although comparisons were made between Michaelmas and Lent assessment outcomes, a more robust evaluation would require data to be collected across multiple assessment periods and, ideally, over several academic years. This would provide a clearer indication of whether any observed effects were consistent over time rather than reflecting the characteristics of a particular cohort or assessment.

Comparison of assessment data was also complicated by different curriculum topics being assessed at different points in the year. Pupils may naturally perform more strongly in some areas of the Computer Science curriculum than others, meaning changes in attainment cannot necessarily be attributed solely to the revision strategy used. For this reason, comparisons between assessment points should be interpreted cautiously.

Engagement levels may also have been influenced by a novelty effect. Pupils may have responded positively because the revision activities differed from their usual classroom experience, rather than because paper-based activities were inherently more effective. Finally, the relatively short duration of the study makes it difficult to determine whether any improvements represented genuine long-term retention or short-term performance gains immediately before assessment. A longitudinal study would be required to establish whether the benefits of collaborative paper-based revision are sustained over time.



Conclusion

This study investigated whether collaborative paper-based revision activities could improve engagement and assessment performance compared with the predominantly digital revision methods currently used within Computer Science. The findings suggest that paper-based revision can support attainment at a level broadly comparable with digital revision, but they do not provide consistent evidence of a substantial attainment advantage. The clearest benefit was not a dramatic rise in assessment scores, but a visible improvement in the quality of revision lessons: pupils talked more, questioned one another more and appeared more willing to explain their thinking.

These findings align with the wider literature. Digital revision methods offer advantages in terms of accessibility, organisation and flexibility, but digital environments can also introduce distractions that affect concentration and learning (Sana et al., 2013). Conversely, research into retrieval practice and collaborative learning suggests that paper-based activities can promote deeper cognitive processing, discussion and knowledge retention (Mueller and Oppenheimer, 2014; Agarwal et al., 2021; Vygotsky, 1978).

The most appropriate response is therefore a blended revision model. Collaborative paper-based activities such as Tarsia puzzles, Parsons Problems, retrieval-based questioning and blurting can be used within lessons to promote discussion, recall and deeper understanding. Digital question-based homework can then complement this by enabling pupils to consolidate learning independently, access resources efficiently and practise constructing written responses. A hybrid approach combines the accessibility and efficiency of digital technologies with the cognitive benefits of retrieval practice and the social advantages of collaborative learning.

The findings support the argument developed in the literature review: revision is most effective when it engages pupils in meaningful retrieval, explanation and discussion. The medium matters, but it appears to matter less than the quality of the activity and the thinking it requires. For future practice, the department should therefore retain digital revision resources while deliberately incorporating collaborative paper-based revision activities at key points before assessment.

REFERENCES

Agarwal, P.K., Nunes, L.D. and Blunt, J.R. (2021) 'Retrieval practice consistently benefits student learning: a systematic review of applied research in schools and classrooms', Educational Psychology Review, 33, pp. 1409-1453. doi: 10.1007/s10648-021-09595-9.

Chi, M.T.H. and Wylie, R. (2014) 'The ICAP framework: linking cognitive engagement to active learning outcomes', Educational Psychologist, 49(4), pp. 219-243. doi: 10.1080/00461520.2014.965823.

Cohen, L., Manion, L. and Morrison, K. (2018) Research Methods in Education. 8th edn. London: Routledge.

Du, Y., Luxton-Reilly, A. and Denny, P. (2020) 'A review of research on Parsons Problems', in Proceedings of the Twenty-Second Australasian Computing Education Conference (ACE '20). New York: Association for Computing Machinery, pp. 195-202. doi: 10.1145/3373165.3373187.

Hattie, J. (2009) Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement. London: Routledge.

Johnson, D.W. and Johnson, R.T. (2009) 'An educational psychology success story: social interdependence theory and cooperative learning', Educational Researcher, 38(5), pp. 365-379. doi: 10.3102/0013189X09339057.

Kemmis, S. and McTaggart, R. (1988) The Action Research Planner. 3rd edn. Geelong, Victoria: Deakin University Press.

Mueller, P.A. and Oppenheimer, D.M. (2014) 'The pen is mightier than the keyboard: advantages of longhand over laptop note taking', Psychological Science, 25(6), pp. 1159-1168. doi: 10.1177/0956797614524581.

Roediger, H.L. and Karpicke, J.D. (2006) 'Test-enhanced learning: taking memory tests improves long-term retention', Psychological Science, 17(3), pp. 249-255. doi: 10.1111/j.1467-9280.2006.01693.x.

Sana, F., Weston, T. and Cepeda, N.J. (2013) 'Laptop multitasking hinders classroom learning for both users and nearby peers', Computers & Education, 62, pp. 24-31. doi: 10.1016/j.compedu.2012.10.003.

Slavin, R.E. (1989) 'Research on cooperative learning: an international perspective', Scandinavian Journal of Educational Research, 33(4), pp. 231-243.

Sung, Y.-T., Chang, K.-E. and Liu, T.-C. (2016) 'The effects of integrating mobile devices with teaching and learning on students' learning performance: a meta-analysis and research synthesis', Computers & Education, 94, pp. 252-275. doi: 10.1016/j.compedu.2015.11.008.

Sweller, J. (1988) 'Cognitive load during problem solving: effects on learning', Cognitive Science, 12(2), pp. 257-285. doi: 10.1016/0364-0213(88)90023-7.

Tamim, R.M., Bernard, R.M., Borokhovski, E., Abrami, P.C. and Schmid, R.F. (2011) 'What forty years of research says about the impact of technology on learning: a second-order meta-analysis and validation study', Review of Educational Research, 81(1), pp. 4-28. doi: 10.3102/0034654310393361.

Vygotsky, L.S. (1978) Mind in Society: The Development of Higher Psychological Processes. Edited by M. Cole, V. John-Steiner, S. Scribner and E. Souberman. Cambridge, MA: Harvard University Press.

Weinman, N., Fox, A. and Hearst, M.A. (2021) 'Improving instruction of programming patterns with faded Parsons problems', in Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (CHI '21). New York: Association for Computing Machinery. doi: 10.1145/3411764.3445228.

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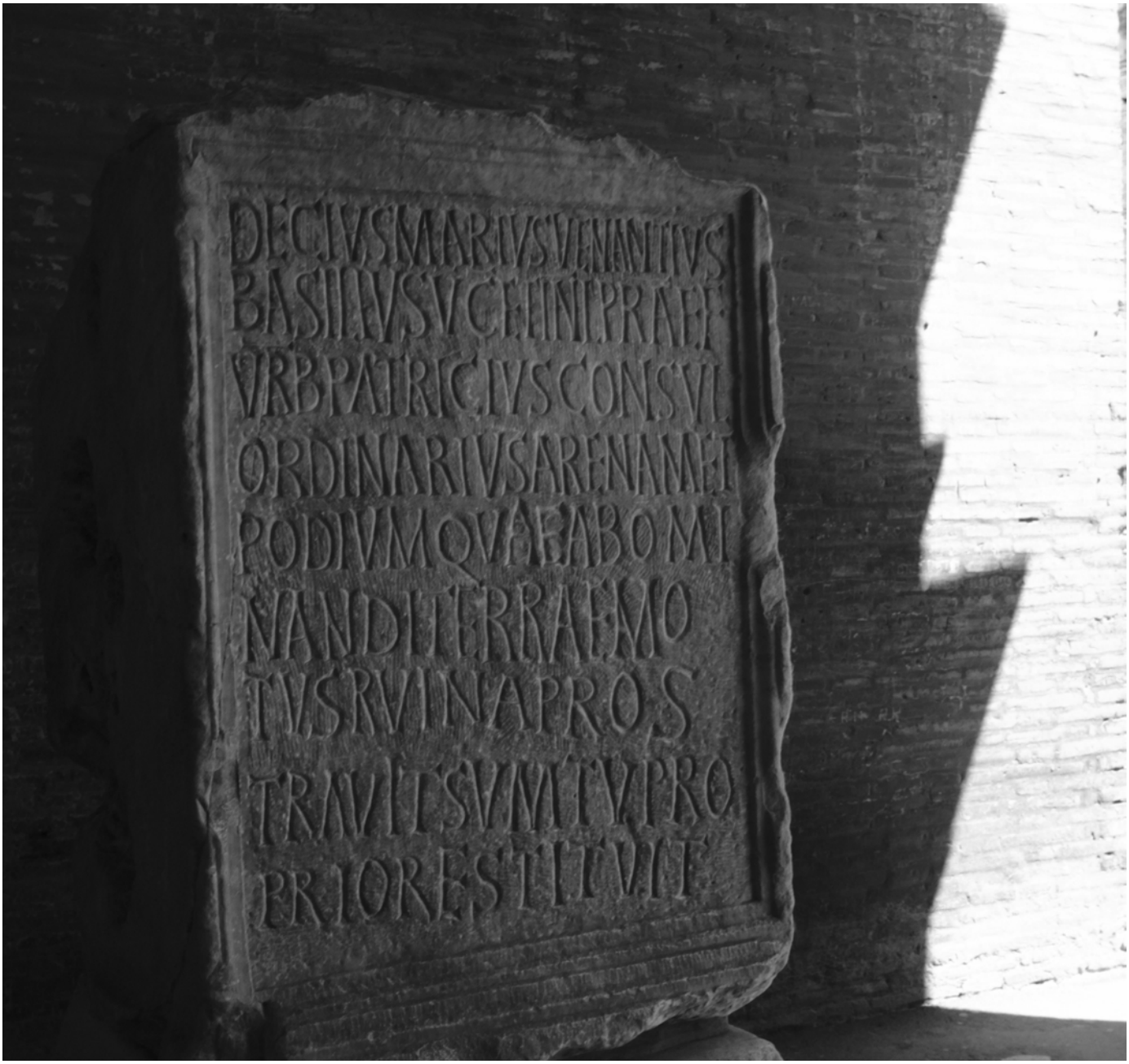
How does the use of paper or devices influence students' dialogue during collaborative learning tasks? An action research project exploring participation, interaction and group dynamics in Year 9 Latin lessons.

Marta D'Asaro



Introduction

For this research project, I set out to compare the use of paper and devices for student learning. In particular, I focused on student dialogue during group work with the intention of exploring whether writing on paper or devices changes the nature, frequency, and distribution of the students' contributions. The reason for my interest in this topic is two-fold. Firstly, I consider group dialogue a very important part of classroom practice, which encourages students to develop communication skills, collaborative skills, empathy, inquisitiveness, assertiveness, self-doubt and adaptability among other things. For this reason, the observation of on-task dialogue, separate from an analysis of students' work, can still, in my view, be useful. Secondly, in my classroom practice over the years, I have come to appreciate how important the physical space in which students learn can be: the position of the teacher, the position of their desks, but also how their resources are organised in front of them, the size and layout of their book or screen. This led me to want to explore the differences between using an exercise book, flat on the desk and visible to other members of the group, and an open laptop, which provides a somewhat more separate workspace for students.

Participants

For the project I used two Y9 classes, which will be referred to as Class 1 and Class 2. In each class, I focused on two groups of students, Groups A and B for Class 1, Groups C and D for Class 2. Group A consists of 4 female students, Group B of 4 male students, Group C of 2 female students and 2 male students, Group D of 2 female students and 3 male students. These were the students' pre-existing groups, based on the tables they had been sitting at for several weeks before the research project. This eliminated any element of novelty in the first lesson which might have influenced the group dynamic and therefore the group dialogue, but meant that I was not able to ensure a more comparable distribution of male and female students in each group.

Method

To compare student dialogue when using paper and devices, I recorded the four groups translating a passage of Latin into English together for 8 minutes – a task they perform frequently, which therefore required very little instruction. I recorded the groups during two separate lessons, Lesson 1 and Lesson 2, in which the students alternated writing their translation on paper, in their exercise books, or on their devices. Class 1 worked on paper in Lesson 1 and on devices in Lesson 2, while Class 2 worked on devices in Lesson 1 and on paper in Lesson 2.

Lesson 1 and Lesson 2 took place on the same weekday and at the same time for each class, with a two-weeks' gap between them. Each lesson (1 and 2) took place on consecutive days for Class 1 and Class 2, and at the same time in the school day. Because of this structure, changes in the behaviour of students using paper or devices across the two classes cannot be attributed to the different time of day or month of the recording, which allows for a better analysis of the impact of the devices. While the two passages of Latin used were similar and the impact of the content across the four groups is limited by the fact that devices were used in conjunction with different passages for each class, differences in the behaviour of each group between the two lessons can still be linked to the difference between the two passages.

Before recording, students were asked for permission and were told that the recordings would be used for a research project. Students knew I would be exploring the nature of their conversations while translating a piece of Latin, while they were not informed that the use of devices would be considered. From my observations, students did not seem to realise that the medium was also been taken into account.

	Lesson 1	Lesson 2
Class 1	Paper	Devices
Class 2	Devices	Paper

Figure 1: Counterbalanced observation design

I set out to analyse the conversations using a list of behaviours, which I used to categorise every on-task contribution for each student. I decided not to take into account off-task conversations as my aim was not to compare students' focus between the two lessons, but to identify changes in students' learning as shown by their group dialogue. The categories I used, with more contextualised examples to help the reader understand my interpretation of the categories, can be found below. This method allowed me to compare conversations using measurable data while still recording some qualitative data. Some behaviours inevitably involved an element of interpretation, particularly where a contribution could potentially fit more than one category (e.g. 'disagreeing' vs 'difficulty stating', or 'building' vs 'proposing'). I applied the same definitions consistently throughout the recordings, but having a second person analysing the recordings would have strengthened the reliability of the data.

Finally, I used Microsoft Copilot to assist with organising, calculating and presenting the coded data. I checked the resulting calculations and selected the analyses of the raw data presented in this report.

Findings

The data did not highlight any major differences in participation between the lessons on paper and those on devices, with some groups making more on-task contributions during the lesson on paper and others making more on-task contribution while working on devices. Overall, the number of contributions was comparable in lessons on paper and lessons on devices, but with a slight increase in the lessons on devices (7.0 %).

Overall number of contributions:

Lessons on paper:	171
Lessons on devices:	183

The broad nature of students' dialogue was very consistent between the lesson on paper and the lesson on devices. By comparing the number and percentage of each type of contribution or behaviour in lessons on paper and on devices, it is possible to observe that proposing, building, and seeking information remained the top three categories across lessons on paper and on devices. These overall results are reflected by an analysis of the contributions on a group level, which also shows consistency in the type of contributions between the two lessons for each group. A slightly more marked change can be seen in the increase of 'summarising' during the lesson on devices, which might be due to students' tendency to summarise their translation out loud while typing it, something which seemed to happen less frequently when they were writing on paper.

This seems to suggest that these groups' overall engagement and conversation was not influenced by the introduction of devices and that other factors would have contributed to the change in number of contributions between the two lessons for groups A-C. Interestingly, despite the change in number of on-task contributions, the nature of the conversations stayed consistent, showing that students' way of working and modes of interaction in a group stay more consistent than the their focus or engagement.

Behaviour	**Examples**
Proposing	A student suggests the translation for some Latin (word, phrase, or sentence) or a critical interpretation of the passage.
Building	A student's translation builds upon another student's contribution
Supporting	Agreement with a previous comment
Disagreeing	A student corrects a previously stated translation
Blocking/ Difficulty stating	A student points out a mistake in a previously stated translation without proposing an alternative
Testing understanding/ Seeking information	A student checks that their translation is correct or asks a specific question
Giving information	A student provides an answer to another student's question
Bringing in	A student asks a question to a student specifically or invites others to re-focus

Figure 2: Contribution categories and examples



From an analysis of results by student, it is possible to see that the changes observed at group level were not reflected evenly across all students, with some students' behaviours shifting more markedly and with every group showing a mixture of students whose number of contributions increased and students whose number of contributions decreased, regardless of the overall trend of the group.

It is worth noting that the student with the greatest change in the percentage of group contributions between a lesson on paper and a lesson on devices, decided independently to lay their device flat on the table and use a stylus; this meant that her way of working was different to other students working on devices and arguably more consistent with working on paper. Because of this, her data are retained throughout this report for completeness but treated cautiously.

With the exclusion of this student, the results range from a student whose participation decreased by 26.2% when moving from paper to device, to a student whose participation increased by 24.8%, with an average absolute change between the two lessons of 9.8 %. This picture seems to highlight that, although there is change in individual students' behaviours during group conversation across different lessons, this seems to be due to other factors rather than the use of devices. The three students whose participation percentage changed the least remained one of the top two contributors for their group across both lessons, highlighting that the most consistent students were good contributors.

The most interesting piece of information provided by this data is that in lessons on devices there was a student in each group who made no contributions, while this never happened during lessons on paper. In groups A, B, and C, these student were also the students with the lowest percentage of contributions during the lesson on paper, while in group D, the 'silent student' during work with devices had been an average contributor to his group during work on paper.

Interestingly, the 5 students with the greatest decrease in contributions in the lesson using devices were all male students. Of the 5 students with the greatest increase in contributions in the lesson on devices, 4 were female students. An interesting descriptive pattern was that the largest decreases in individual participation were observed among male students in this sample. Given the very small and unevenly distributed sample (groups A and B are single-sex, while C and D are mixed-sex), this cannot form the basis of any strong conclusions regarding the difference between male and female students when using devices, but it could form the basis of further enquiry.

Despite the variations in individuals' percentage of contributions, the data below highlights how the ranking of students by participation within each group remained very consistent across the two lessons, with 6 students ranking in the same position across the two lessons. Overall, only 3 students out of 17, all belonging to Group D, changed their ranking by more than 1 position. This appears to highlight that the dynamic of group conversations in terms of who are the most active contributors, is not markedly influenced by the use of devices.

Another question I considered was how well distributed contributions were among members of each group across the two lessons, that is how 'equal' participation was within each group. For this, I compared the standard deviation from the average percentage of participation in each group across the two lessons.

I found an increase of standard deviation from the average percentage of contributions in lessons on devices for all groups, meaning a more unequal distribution of contributions within each group when working on devices as opposed to working on paper. This means that while the identity of the more/less vocal students is relatively stable, the degree of inequality between them increases when devices are used.

Group	Lesson on paper	Lesson on devices	Change
Class 1	12.1	15.8	+3.7
Class 1	10.0	19.2	+9.2
Class 2	8.9	14.2	+5.3
Class 2	13.8	17.8	+4.0

Figure 3: Standard deviation from average percentage of participation

Discussion, Limitations and Perspectives

The study seems to suggest that the use of paper or devices had a limited impact on the overall levels of participation and engagement during group work. Despite marked differences in the number of contributions made within each group in different lessons, this does not seem to correlate with the medium used to record the translation. This suggests that other factors and circumstances are more likely to have determined variations in students' engagement. On the other hand, the nature of the discussion amongst students and the ranking of students within the groups in terms of their participation remain remarkably consistent across different lessons, showing that the mode of working used by students and the roles of each student within each group are fairly fixed. This is hardly surprising, since the way students carry out a class discussion relies heavily on their communication skills and routines, which are less likely to change in two lessons taking place two weeks apart than students' engagement. Equally, group dynamics, including who are the most and least vocal members of a group, also tend to be quite fixed; furthermore, this consistency might have been emphasised by observing established groups. The use of devices did not change these two aspects of group dialogue, however, it is worth noting that this study was not able to establish whether the nature of class dialogue or dynamics between group would have developed differently if students were consistently working on devices; if we assume that routines and group dynamics are built over time, then it might be worth exploring further whether these would develop differently in the presence of devices as a normal way of working.

The most interesting aspect was the presence of a silent student in each group observed when working on devices and the fact that this did not happen when students were working on paper. The fact that in three out of four cases, the student who did not participate to the device lesson were also the lowest contributors on paper, might suggest that devices provide an opportunity for underconfident or less vocal students to avoid participating in the discussion. The physical barrier provided by the screen and the ease with which students can avoid eye contact while using devices might provide an explanation of this phenomenon. As explained in the methods, this study did not aim to explore the relation between participation and quality of work, but it would be interesting to explore whether 'silent students' and students whose participation has decreased with the use of devices maintained a similar standard of work.

The disproportionate impact of use of devices on male students which might be suggested by these findings could be explored further alongside an analysis of the difference in social behaviours and everyday use of devices between female and male students for this age group. Given that these findings seem to point in the direction of the importance of social dynamics over use of devices in group work, another interesting factor to take into account might be the students' age.

The main limitation of this action research project is its scale: it focuses on four groups of students and a total of 17 students, so it is difficult to draw any conclusions which could be easily generalised. This is particularly true of the analysis of the standard deviation from the average of student participation, which has little significance when comparing the distribution of students' participation within each group of 4 or 5. Furthermore, only 8 minutes of conversation were recorded per group in each lesson, decreasing the amount of data which I was analysing and therefore its significance.

Another noteworthy limitation is that while writing on paper is the students' normal way of working in this subject, they had only used devices very occasionally in Latin lessons before this research project. I tried to mitigate this by not drawing too much attention to the fact that device were being used instead of paper, for instance avoiding specific device-related instructions, and by asking students to perform a very routine task.

Finally, as mentioned above, students' written work was not taken in consideration alongside their oral contributions to group discussion, despite the fact that it might shed light on what quieter students might be doing while the group discussion takes place. Integrating an analysis of students' work would be a very good next step to broaden the scope of this analysis.

Final reflections and impact on future practice

Overall, this study allowed me to explore what constitutes good group dialogue and spend time listening to the way students work collaboratively on a task. While more traditionally students are assigned different "roles" when it comes to group work, this project highlighted for me the importance of encouraging the students to participate as equally as possible to group discussions and to do so in a variety of ways, that trying to exhibit as many different behaviours as possible, to keep the dynamic between participants balanced and varied. Most of all, I noticed that it is uncommon for students to invite other students to take part in the conversation ('bringing in'), and I will also consider how modelling and structuring of group work might help students to develop this skill.

It was also interesting to observe the consistency in the nature of students' group interactions; this confirms what classroom practice has shown me over the years, the importance of fostering good relationships amongst students and of creating good routines.

Finally, the comparison between group dialogue while using paper or using devices, which was the focus of this research project, did not highlight major differences for this set of students. However, the small trends which did emerge and which I outlined above were interesting to observe and something which I will bear in mind when asking students to work with devices in the future.





AFTERWORD

Typed responses tend to be longer and perhaps, therefore, I should have penned this afterword by hand. In any case, it is a pleasure to commend this second annual edition of the Perse's staff Research journal. These articles present nuanced reflections upon our professional practices and, in particular, they grapple with aspects of what is now a topic of significant public debate: what is the role of digital technologies in school?

Typing may (for some children, under some assessment regimes, with some assessors) secure marginally higher marks. Tim Lunn concludes his study judiciously: 'typing enabled almost all students to write more', but 'increased output does not automatically translate into higher marks'. Tim's reflections here add to our growing body of evidence from public exams. That there is no universal advantage to be gained by typing assessed responses ought not to surprise us. For it is the student's understanding – and their fluency in communicating that understanding – that is represented through their script. Writing quality, as Tim Lunn reminds us, remains 'dependent on core compositional skills such as organisation, clarity, and analytical control.' The student with good understanding of their subject can communicate that well, with a pen or a keyboard.

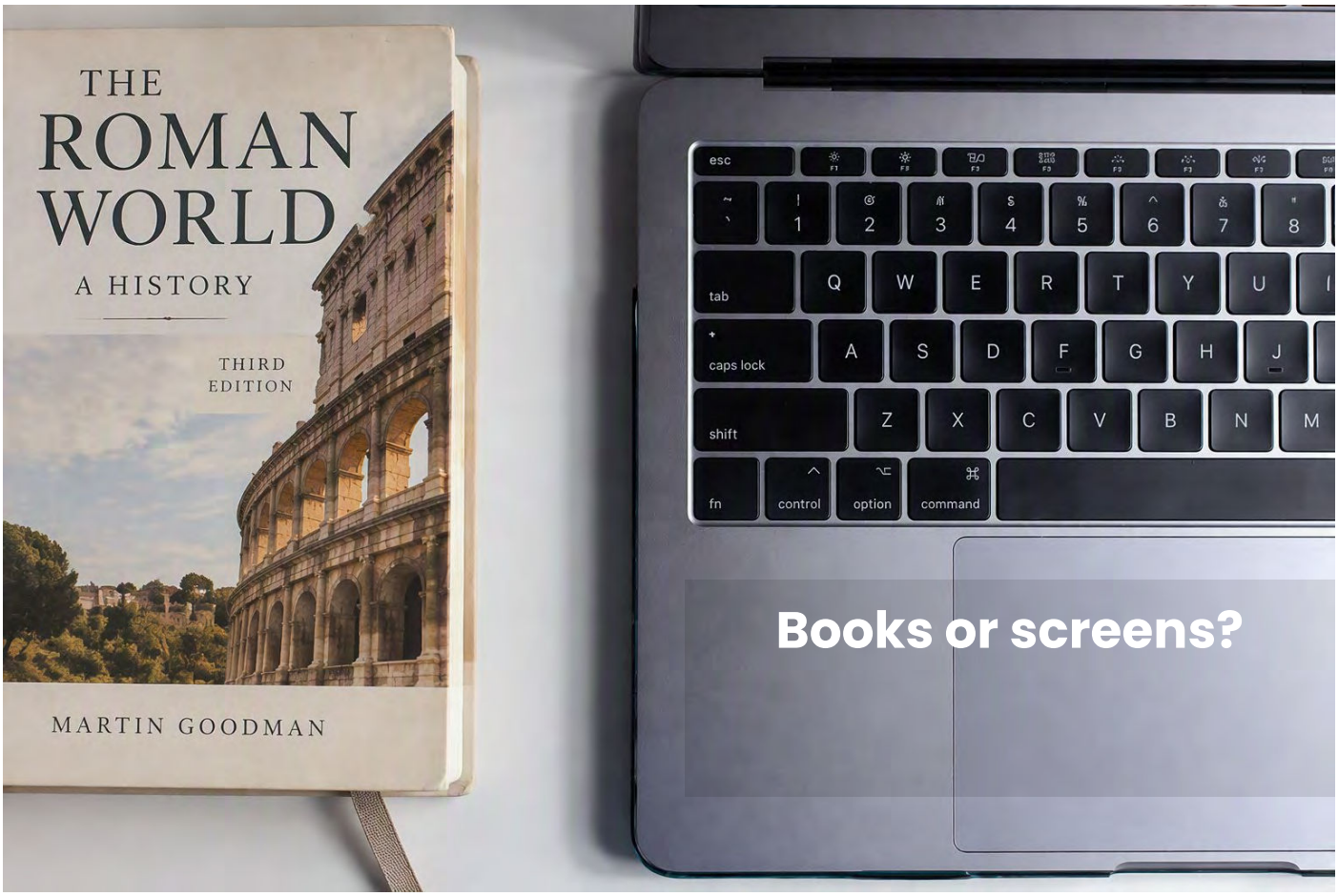
We know that the development of such understanding is advanced through the student's active engagement with challenging and interesting material. It is through their responding to feedback, through their communicating and experimenting – their essaying, indeed – that their motivation, confidence and understanding are built up. Digital tools can sometimes assist students to learn – quizzing apps can be used to support retrieval practice, for example – and so can paper-based and oral activities. The effectiveness of teaching and learning strategies depends 'less on the medium itself than on the extent to which activities promote active cognitive engagement', as Janet Symonds writes.

Discussion and factual recall are neither necessarily impaired by the use of devices nor simply improved by using paper. Again, 'pedagogical design', as Victoria Lipp concludes, is more important than 'the medium of delivery'. Whatever the 'workflow' advantage, for student organisation or adult convenience, it is the student's learning that matters. A decrease in individual participation in discussion or disengagement by a section of a class alerts us to a potential deficit in learning. Classroom practice teaches us the 'importance of fostering good relationships amongst students and … creating good routines', as Marta D'Asaro says. Attentiveness to those essentials endures whatever the technology might enable us to do.

When students 'talk more, question one another more' and are 'more willing to explain their thinking' (Symonds), that classroom environment is the more engaging, joyous and effective for learning. If, to encourage that, the laptop should stay in the bag, then so be it. After all, when inspired, supported and appropriately challenged, the most potent device for learning is still the class itself.

Alexander Courtney, Assistant Head (Teaching and Learning)
September 2026

Looking ahead...



Our next projects will continue our focus on the impact of digital workflow but focus specifically on reading; does reading from a screen impact students? In what ways? Why? What can we do about it?

Applications for the team close in October. Up to six funded places are available for staff from the Pelican, Prep and Upper on a roughly proportionate basis. Teachers may also join the team to complete research with a view to completing threshold 3.

Please contact Hazel Knight for further details.



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