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RESEARCH ARTICLE

EXPLORATION EFFECTS OF HANDWRITING ON CHILDREN'S WRITING PROGRESS

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Abstract

Handwriting has a low status and profile in literacy education and in recent years has attracted little attention from teachers, policy makers or researchers into mainstream educational processes. This article identifies a substantial programme of research into handwriting, including studies located in the domains of special needs education and psychology, which suggest that it is time to re-evaluate the importance of handwriting in the teaching of literacy. Explorations of the way handwriting affects composing has opened up new avenues for research, screening and intervention, which have the potential to make a significant contribution to children's writing progress. In particular, the role of orthographic motor integration and automaticity in handwriting is now seen as of key importance in composing. Evidence from existing studies suggests that handwriting intervention programmes may have a real impact on the composing skills of young writers. In particular, they could positively affect the progress of the many boys who struggle with writing throughout the primary school years.

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Introduction:-

There has been little significant educational research into handwriting in England since the work of Sassoon *et al* (1986) and Alston and Taylor (1987). Even the available research reviews (Graham & Weintraub, 1996) were written over a decade ago and include little evidence from a British context. The way handwriting is taught in English mainstream schooling is based on research and writing undertaken during the mid-1980s and early 1990s.

During the eighties and early nineties, a number of changes affected the teaching of handwriting. Firstly, a very significant experiment took place in schools in England, involving a fundamental change in the handwriting script taught to children in the primary years. Peters' research into spelling (1985) emphasised that English spelling provided a high degree of visual regularity and highlighted the link between visual and kinaesthetic learning of spellings. A strong theoretical case was thus made for a link between correct spelling and the use of fluent, joined up handwriting. By learning the movements of common spelling patterns by hand (kinaesthetically) as well as by eye, it was suggested (Cripps & Cox, 1989; Peters & Smith, 1993) that writers improved their chances of producing correct spellings. The popularisation of this theory in schools through spelling and handwriting schemes coincided with (or caused) a change in the handwriting of children all over the country as handwriting schemes based on this theory advocated the use of an alphabet including exit strokes right from the beginning of writing teaching, and the joining of letters as early as possible (Cripps, 1988). Interestingly, there has been almost no empirical research to examine

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the claims about the contribution of handwriting to correct spelling, to measure the effects of beginning writing using different scripts or to examine the effects of early joining.

The importance of handwriting: writing assessment

Whilst handwriting style streamlined across schools in England during the late 1980s and early 1990s, it was also put firmly in its place in terms of its importance relative to other aspects of writing. The National Curriculum for England (DfEE/QCA, 2000), for example, treats handwriting succinctly and deals with the development of movement and style, with no mention of speed or efficiency. The attainment target for writing at level 4 (the target for 11 year olds) demands only that: "Handwriting style is fluent, joined and legible". No mention is made of speed.

Handwriting is statutorily assessed as part of the Standard Assessment Tasks and Tests (SATs), the marking schemes for which allocate up to 40 marks for writing at age 7 (Key Stage 1) and 50 marks at age 11 (Key Stage 2). At both ages, up to 3 marks can be awarded for handwriting. The assessment for these three marks is made on a sample of handwriting done during a composition assessment and is a product analysis. Fluency is taken to mean evidence of the effective joining of letters and speed of writing is not included in the assessment. In short, this is a very imprecise assessment of handwriting style, not of handwriting efficiency.

The National Literacy Strategy also gives minimal attention to handwriting. It was included in the word level objectives in the NLS Framework for Teaching (DfEE, 1998) from reception year (age 4-5) until Year 4 (aged 9), after which handwriting does not appear as an objective. The assumption that handwriting will have been mastered by this time is common across publications about writing (e.g. Wyse, 1998; Medwell *et al.*, 2001; Nicholls *et al.*, 1989). In the light of research in the areas of neuroscience, cognitive psychology and special needs education, it is time to question this assumption and examine how research into handwriting can offer clues to improving composition.

The importance of handwriting: teaching writing

One reason for such a lack of attention to handwriting has been the perspectives on writing that have been popular in schools and the emphasis (or lack of emphasis) these perspectives have placed upon handwriting. In early years' education, evidence that children can write meaningful texts before they have mastered the writing system (Teale & Sulzby, 1986) changed the way researchers and teachers looked at children's early attempts at writing (Temple *et al.*, 1982). Analysis of children's early writing for evidence of understandings about the language system (Clay, 1975), spelling (Gentry, 1981) and audience (Hall, 1987; Czerniewska, 1992) shifted attention away from the teaching of writing through copying, with its emphasis on correct letter formation and legibility.

Emergent writing (Hall, 1987; Teale & Sulzby, 1986), placed the focus of attention firmly on the meanings children were able to create in their writing. Children were encouraged to write freely and to use their emerging, but incomplete, understandings of language and writing skills to express themselves in writing. This was a corrective to earlier emphasis on neatness and correct letter formation, which undoubtedly hindered the composition of beginning writers.

The teaching of writing to older children has been strongly influenced by theoretical perspectives that emphasise the difference between composing text and transcribing text. Graves' (1983) account of the writing process as a series of stages has been highly significant for theorised pedagogies of writing, even if these theories have not quite had the practical effects that have been claimed for them (Medwell, 1998). Cognitive models of the writing process, such as that of Hayes and Flowers (1980), also stress the planning and self-monitoring required by the writer, but these too have had limited influence on mainstream school practice. More recently, a genre focused approach to writing, emphasising the direct teaching of the structures of socially significant texts, was popularized by the work of Wray and Lewis (1997) and included in the requirements of the National Literacy Strategy (1998). In none of these perspectives on writing and its teaching does handwriting play a significant role. Indeed, current perspectives often explicitly assign handwriting to a peripheral role in writing success.

A composition-led view of the writing process is very much part of the mainstream culture of literacy teaching in England. The National Curriculum for English (DfEE, 2000) requires that children be taught to plan, draft, revise, proof-read and present their work, a direct reflection of the process approach, and this is sustained in the National Literacy Strategy (DfEE, 1998). Emphasis upon composing may, at times, have drawn attention away from handwriting.

The importance of handwriting: the research evidence

Despite its empirical rigour and replication, and its central concern with how children learn to write, the substantial body of cognitive psychological research on the writing process has had little impact on classroom practice. This may be because the largely experimental and non-naturalist design of such research makes its direct classroom application problematic. However, in psychology, neuropsychology and special needs education the substantial research into handwriting that has taken place in the last decade may offer insights into the composing processes of mainstream children. It may also ensure that the role of handwriting in composition is reconsidered and even the nature of handwriting itself reconceptualised.

A considerable amount of this research has focused on explorations of the role of working memory in writing. Working memory denotes the temporary storage of the information necessary for carrying out tasks. Long-term memory can store virtually unlimited amounts of material for many years, but working memory can hold only a few items for a short time - it is a limited resource. Kellogg (1996; 1999; 2001) and Hayes (1996) have both given a central role to working memory in their very influential models of the writing process. Understanding the ways in which different writing processes draw on the same limited working memory resources could explain why some writing processes are more difficult than others and how these processes may interfere with each other.

Identifying the role of working memory in writing may help us to understand the interference among memory processes that contend for the same scarce memory resources, in this case, the way handwriting may actually affect composition. The findings of Gathercole *et al* (2004) suggest that working memory is particularly associated with the literacy scores of younger children. If young writers have to devote large amounts of working memory to the control of lower-level processes such as handwriting, they may have little working memory capacity left for higher-level processes such as idea generation, vocabulary selection, monitoring the progress of mental plans and revising text against these plans.

Individuals can generally conduct only one cognitive task requiring attention at a time (Sweller, 1988; Sweller & Chandler, 1994). This means that the way an individual manages cognitive resources to facilitate all the different, attention-requiring aspects of a writing task is crucial to their success at writing (Saada-Robert, 1999). Christiansen (2002) identifies two main strategies to limit the demands on working memory. The first is to sequence tasks so that only one task is undertaken at a time. This has been a popular way to manage writing processes in classrooms and planning, drafting, revising etc. have been sequenced as steps in the writing process for many children, in an attempt to reduce their competing demands on young writers. However, models of writing (e.g. Hayes & Flower, 1980) suggest that writing processes are recursive and that writing is not a step-by-step linear process at all. In this case, sequencing tasks so that only one is undertaken at a time is unlikely to be a successful strategy for limiting demand on working memory at a cognitive level, since writing simply does not proceed that way. Moreover, in writing it is hardly possible to isolate or defer the handwriting element, since without it, nothing would actually be written!

An alternative solution to the problem of limited working memory capacity is to make some processes, such as handwriting, automatic, in order to free up cognitive resources to deal with higher level processes. La Berge & Samuels, (1974) define automaticity as having been achieved when a process can be effected swiftly, accurately and without the need for conscious attention. The development of skill in writing may require the automatization of lower-level skills so that they use less of the available working-memory resources.

A major programme of research undertaken over the last ten to fifteen years (e.g. Berninger *et al*, 2006; Berninger, 1994; Berninger & Graham, 1998) has investigated the role of handwriting in writing and its findings are extremely interesting. Firstly, it has been established that handwriting is far from a purely motor act. Berninger and Graham (1998) stress that it is “language by hand” and point out that their research suggests that orthographic and memory processes (the ability to recall letter shapes) contribute more to handwriting than do motor skills (Berninger & Amtmann, 2004).

Orthographic-motor integration of handwriting - that is the ability to call to mind and write letter shapes, groups of letters and words efficiently and effectively without allocation of cognitive attention, appears to be a very significant part of writing that has been largely overlooked in education. It involves mentally coding and rehearsing visual representations of these patterns and integrating them with motor patterns (Berninger, 1994). There is a growing body of research which suggests that handwriting is critical to the generation of creative and well-structured written text and has an impact not only on fluency but also on the quality of composing (Berninger & Swanson, 1994;

Graham *et al*, 1997). Lack of automaticity in orthographic-motor integration can seriously hamper the ability of young children to express ideas in text. (Berninger & Swanson, 1994; De La Paz & Graham, 1995; Graham, 1990).

Studies in this area have experimented with the removal of some of the competing demands for children's cognitive attention during writing. De La Paz and Graham (1995), for example, found that when the children were able to dictate their texts to an adult, thus freeing them from the task of handwriting, the quality of their composition significantly improved. Other studies have confirmed this effect in primary aged children (e.g., Hidi & Hidyad, 1983; McCutchen, 1996, 1998; Scardamalia *et al*, 1982).

Research suggests that orthographic-motor integration accounts for more than 50% of the variance in written language performance in children. Christensen and Jones (2000) put this as high as 67% for the 7-8-year-old children they studied. Some studies have suggested that the influence of orthographic-motor integration declines with age (Berninger & Swanson, 1994), but there are suggestions that it continues to exert an influence on writing in secondary school pupils (e.g. Christensen & Jones, 2000) and even in adults (Bourdin & Fayol, 2002).

If handwriting can have such an impact on writers' abilities to generate sophisticated text, it appears critical that children develop smooth and efficient handwriting. This raises two important questions. Firstly, for how many, and for which, children might inefficient handwriting be affecting their composition? Secondly, what evidence is there that teaching can make a difference to children's performance in handwriting and in composition?

The importance of knowing who may have problems

Ascertaining the numbers of children for whom lack of automaticity is a problem is difficult in Britain. Statutory assessments do not assess handwriting speed and there is no national screening for handwriting problems. Graham and Weintraub (1996) estimate that between 12 and 20% of school aged children experience handwriting difficulties, and other estimates have been as high as 44% (Alston, 1985; Rubin & Henderson, 1982), although these figures are based on teacher estimates and must be viewed with caution. Barnett *et al* (2006) suggest a figure as low as 5% for schools in south east England, but this is based on teacher report in a very small survey and again must be treated with caution. But if these figures are even approximately correct, it suggests that lack of handwriting automaticity may affect a significant number of primary and secondary aged children. Such an unrecognised lack of automaticity may interfere with the composing processes of these children. There is no evidence of concern about, screening of or intervention in this aspect of writing in the British system.

Although we do not have enough evidence to estimate what proportion of children may be experiencing handwriting difficulties in Britain, the research does suggest a strong gender effect. Boys are more likely to be identified as having handwriting problems than girls (Hamstra-Bletz & Blote, 1993; Rubin & Henderson, 1982) and research in the 1980s and 90s confirmed that girls are generally better handwriters than boys (Graham & Miller, 1980) both on measures of overall quality and of letter formation (Hamstra-Bletz & Blote, 1990; Ziviani & Elkins, 1984). Girls also tend to write faster than boys (Berninger & Fuller, 1992; Biemiller *et al*, 1993; Ziviani, 1984). This is an important detail if handwriting does have an impact on children's ability to compose. If boys are less likely to obtain the necessary automaticity in handwriting at the expected age, it may be that this interferes with their ability to compose.

At present, there is considerable concern in Britain about boys' underachievement in writing (UKLA/PNS, 2004). In the annual Standard Assessment Tests and Tasks, boys consistently do worse than girls at writing (Bearne & Warrington, 2003) but the data that is collected cannot reveal how handwriting is implicated in this. The issue of boys' handwriting has not been a focus of the projects aimed at addressing underperformance in writing by boys. A recent project in this area (UKLA/PNS, 2004) did not mention handwriting at all, despite the fact that the aspects of writing most often cited by the boys in the study as a reason for disliking writing were technical – including handwriting and spelling.

For children who are slow to develop handwriting automaticity (as opposed to neatness), handwriting is slower and demands more effort. This creates what Stanovich (1986) has called, in reading, the "Matthew effect" whereby those who are more able, (given the above evidence in handwriting - usually girls) achieve more successful practice and, in the case of orthographic-motor integration, have more attention available for composing processes. In turn, the less able handwriters have less opportunity to engage with higher order composing processes and to make progress in writing.

The importance of interventions

If a lack of orthographic-motor integration can have such serious consequences for the development of composing skills, it is important to know whether intervention can prevent these difficulties. There have been some studies of orthographic-motor integration to try to ascertain the effects of focused handwriting practice. Two studies undertaken in Australia (Jones & Christensen 1999; Christensen, 2005) used a relatively simple alphabet writing task designed by Berninger *et al* (1991) to measure orthographic-motor integration and to identify children with automaticity problems. One study measured the orthographic-motor integration, reading and written expression of 114 children in Year 2 (aged 7) before and after an eight-week long handwriting programme. The children undertaking the programme showed significant improvement in their handwriting and, crucially, in their composing skills. More than half the variance in scores on written expression was accounted for by orthographic-motor integration, even when reading scores were controlled. Christensen also reports a study of 50 older children (year 8 and 9 in secondary school) whose orthographic-motor integration and written expression were measured before and after an intensive handwriting programme. A matched control group did journal writing for a similar period. Although both the journal and handwriting groups were equivalent at pre-test, the scores for the handwriting group after eight weeks of intervention were significantly better on all post-test measures, for example, 70% higher in orthographic-motor integration and 46% higher in quality of written text than the journal group. The handwriting group also wrote approximately twice as much text as the journal writers. These are startling findings at a secondary level, where it might be expected that children who have not achieved automaticity would already have experienced demoralizing failure. These studies offer strong evidence that handwriting intervention can make a difference to the handwriting and, more importantly, the composition of children with poor automaticity. By improving their ability to produce letters automatically, these young writers freed up their attention for other writing processes.

Conclusion:-

The research suggests that the role of handwriting in writing has been underestimated in mainstream education. The concentration has been on the benefits to spelling of well formed, joined handwriting, and the necessity for speed and automaticity has been neglected in our handwriting pedagogy. Educators have prioritised composing processes in writing, in itself not necessarily a bad thing. But in doing so we may have neglected a skill which makes a strong contribution to the composing we so value. The research suggests that it is time to re-consider.

Handwriting, and in particular the automaticity of letter production, appears to facilitate higher order composing processes by freeing up working memory to deal with the complex tasks of planning, organizing, revising and regulating the production of text. Research suggests that automatic letter writing is the single best predictor of length and quality of written composition in the primary years (Graham *et al*, 1997) in secondary school and even in the post-compulsory education years (Connelly *et al*, 2006; Jones, 2004; Peverley, 2006).

Enshrined in our pedagogic theory, practice and policy is the assumption that handwriting becomes automatic relatively early on in writers' development. This assumption unfortunately remains untested, as national testing does not assess handwriting speed or fluency and addresses only writing style and neatness. We may be assessing the wrong aspects of handwriting and failing to assess an aspect which is crucial.

We know that a significant number of children experience handwriting difficulties throughout their schooling, although for most these are probably not judged as sufficiently serious to justify remedial action. More of these children are boys than girls and their handwriting difficulties are likely to impact upon their ability to compose written language. There is evidence that intervention to teach handwriting can improve not only the handwriting of these children, but also their written composition.

There are a number of ways forward. We need to examine in more detail whether the findings about orthographic-motor intervention can be generalised to the British context, where the extent of handwriting difficulty is unknown and children are taught a simpler, more efficient script than those generally taught in America. One small study (Connelly and Hurst, 2001) has suggested such generalisation is likely but a much larger sample and range of age groups is necessary. We need to assess the extent and distribution of handwriting difficulties by looking at levels of automaticity in primary and secondary school pupils. Establishing some bench-marks for orthographic motor-integration through the school years would be the first step towards looking for a simple screening instrument that could identify those children with handwriting difficulties who might benefit from interventions to improve their automatic production of letters. For such children, a short handwriting programme may be what they need to improve their composing. A research programme to consider what intervention might be most effective could then

be undertaken. Such a programme has the potential to benefit young writers, particularly boys, who struggle to compose throughout their primary and secondary schooling.

Handwriting has not been an important aspect of literacy for teachers in the last decade, but it has been the subject of important research. It is time for the research in this area to be made more accessible to educators and for it to be considered in the planning of pedagogies for struggling writers.

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