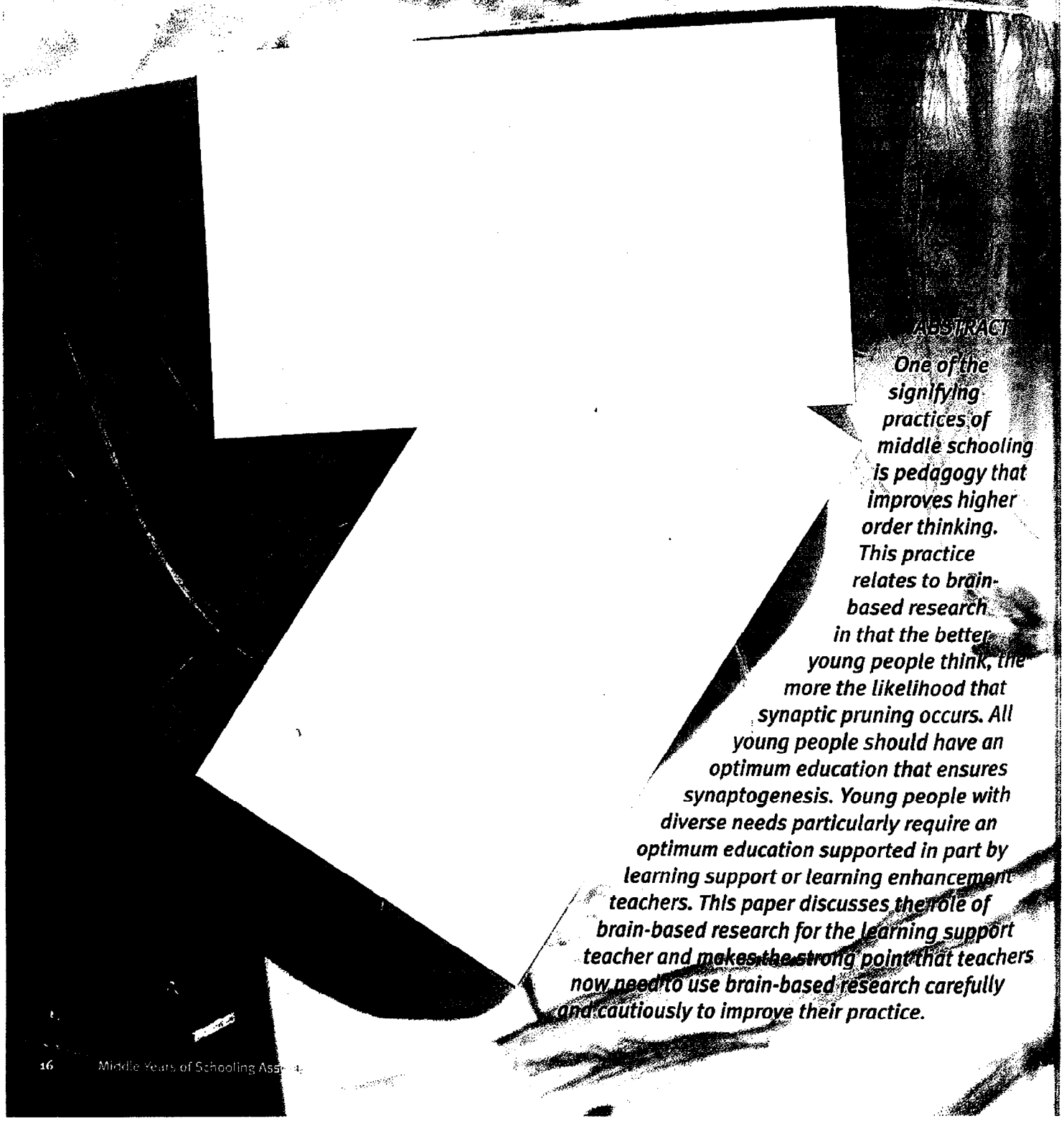
Smuggling in an anxious question: Brain-based research and the role of the learning support teacher in the middle years of schooling

Barbara Garrick



ABSTRACT

One of the signifying practices of middle schooling is pedagogy that improves higher order thinking. This practice relates to brain-based research in that the better young people think, the more the likelihood that synaptic pruning occurs. All young people should have an optimum education that ensures synaptogenesis. Young people with diverse needs particularly require an optimum education supported in part by learning support or learning enhancement teachers. This paper discusses the role of brain-based research for the learning support teacher and makes the strong point that teachers now need to use brain-based research carefully and cautiously to improve their practice.

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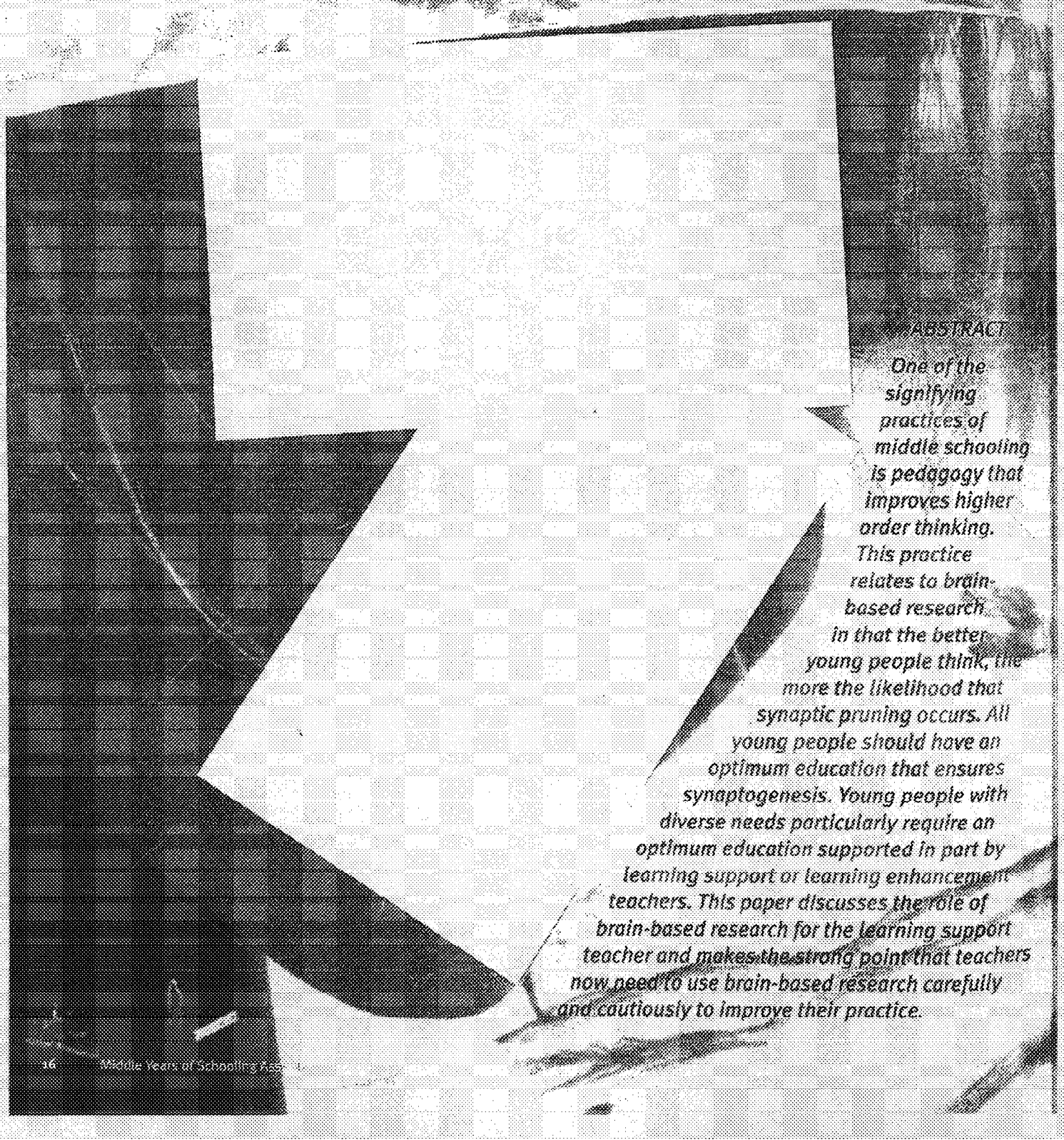

ABSTRACT

One of the signifying practices of middle schooling is pedagogy that improves higher order thinking. This practice relates to brain-based research in that the better young people think, the more the likelihood that synaptic pruning occurs. All young people should have an optimum education that ensures synaptogenesis. Young people with diverse needs particularly require an optimum education supported in part by learning support or learning enhancement teachers. This paper discusses the role of brain-based research for the learning support teacher and makes the strong point that teachers now need to use brain-based research carefully and cautiously to improve their practice.

Introduction

This paper is a theoretical paper in as much as it attempts to match the training provided for learning support teachers in Queensland Australia with the concepts of plasticity, synaptic pruning and synaptogenesis (Hall 2005) within the literature on brain research and often cited in the middle years of schooling research (Nagel 2005). In particular the concept of transition planning in the middle years will be investigated to show that such planning is timely in relation to the needs of adolescents and perhaps in relation to synaptic pruning. The paper reviews some of the literature around the training of and expectations for learning support teachers in Queensland. However there are a number of caveats that need to apply to the following discussion. First the author is very cautious not to claim an explicit link between learning and brain research. Information and knowledge can always be used to strengthen influence as easily as it can be used to challenge influence and both depend on those few who own the knowledge (Foucault 1998). At present neuroscientists own the knowledge.

Historically, brain research has had a checkered past and has been used, for instance, in pre-war Germany to ostracise the Jewish population from the German population and to claim a link between science and criminality (Bauman 1989; Arendt 1967). It has also not escaped the author's attention that George Bush (1990) claimed that the 1990s would be the decade of the brain and much of the early research was on mental health, degenerative disorders, or possibilities of understanding how drugs affect the brain. Some interest extended to the implications of brain based research for education (Hall 2005). One must be cautious here. Krasner (2002) also observes that brain research in the United States during this period occurred alongside a proliferation of educational resources using brain research and sold for profit to schools. One cannot overlook the economic imperative here (OECD 2002). Finally for the purposes of this paper, Goswami (2004) observes that while successful pedagogy is a goal of education research, it is not yet a goal of cognitive neuroscience. In their research to this point neuroscience has not yet been able to assess learning that is emotive and deeply analytic. The OECD (2002) reports that current research methods in cognitive science are limited by the types of questions researchers can ask. The OECD makes the distinction between such questions as how individuals learn to recognise written words and the question as to how individuals compare the themes of different stories. Neuroscience is still a blunt instrument in this regard.

In reaction, this paper uses a little of the mischief that was Michel Foucault. Foucault studied phenomena not to find the essence of the phenomena, but to uncover how the phenomena occurred and to discover the ways in which objects beneath ideas take shape so as to determine how the idea is framed. To achieve this, Foucault (1998:439) would '...take stock of things or smuggle in an anxious question' whenever he researched a phenomena. The anxious question this paper begins to address is whether or not the concept of synaptic pruning is helpful for teachers of students with diverse needs.

This paper has the following format. First, several key pieces from the literature concerning the role of the learning support teacher will be examined. Then the learning needs of students in the middle years will be discussed. A possible relationship between the learning support teacher's role in schools, transition planning and the concepts of plasticity, synaptic pruning and synaptogenesis is then investigated. This investigation is always with the caveat described previously in mind. The paper will then draw together ideas for future discussion.

The learning support teacher in Queensland schools

A learning support/enhancement teacher in Queensland schools manages the learning of students with behaviour and/or academic difficulties and disabilities. Their role is governed by a series of legislation and codes of conduct that make their role very explicit, particularly in relation to students with diverse learning needs in the middle years. The most influential Australian legislation is *The Disability Discrimination Act* (DDA 1992), followed by the *Disability Standards for Education* (Commonwealth of Australia 2005) which clarifies responsibilities around school enrolment, participation, curriculum development, accreditation and delivery, student support services and the elimination of harassment and victimisation (Ashman & Elkins 2009).

All states and territories in Australia are bound by this legislation, but each state interprets them through slightly different policy directives, practices and processes. Queensland is governed by the *Procedure No. SM-15 Policy Statement* (Education Queensland nd). Within these legislative boundaries, school administrators are the first respondents who must comply with the various disability discrimination acts, occupational health and safety acts, codes of conduct, financial obligations and in the context of this subject matter, middle schooling reforms. School administrations as first respondents must manage changes to the curriculum to ensure reasonable education adjustments (Dickson 2006). Education adjustments remove barriers to access and participation by making changes to building design to accommodate diversity and, most importantly, to ensure financial arrangements so that all students in a school receive access to and can participate in quality education programs. Before students with diverse needs enter the classroom, education authorities have charged individual school boards and administrations to comply with relevant legislation and to be accountable. Various legal cases have been settled in favour of the student with diverse needs when breaches to the law have been made (see, for example, Olmstead v LC 527U5581 1999; Beanland v The State of Queensland & Anor 2008). This shows that the legislative acts have teeth.

In the policy guideline entitled *Education Queensland Suggested framework for secondary educational provision* (Education Queensland nd) the exact role of the learning support/enhancement teacher in the secondary school is made very clear. Learning support teachers are to help provide appropriate educational provision for

students with learning difficulties and learning disabilities in schools. They are to welcome the diversity of knowledge, social and cultural experiences, beliefs and values of their students. Learning support/enhancement teachers are meant to help provide the seamless, *transparent transition* (my emphasis) for students with learning difficulties and learning disabilities during the phases of learning. They are charged to provide flexible, relevant, accessible education, including appropriate curriculum adjustments and accommodations and special consideration, within the context of the individual school community.

Broadly, a learning support teacher works with students to decrease their anger and frustration with learning, to help the establishment and re-establishment of an identity of learning, to help students develop thought processes and above all to help students through school transitions such as from a Preparatory Year to Year 1, Year 3 into Year 4 and Year 7 into Year 8 (Weiner & Murawski 2005). Issues of transition are problematic for many students in the middle years, even when and if educationists can agree on the discursive terms used to describe these young people (Patel et al 2007). These transitions however become more problematic for students with diverse needs (Garrick & Keogh 2010). Learning support teachers address these issues (Wentzel 2003). Forlin (2000) argues that this is not an easy task for support teachers. In order to achieve their function van Kraayenord (1996) claims that support teachers need four major skill sets namely the ability to share information about a student, the ability to plan collaboratively in order to help the class teacher make adaptations and modifications for the student, the ability to work in classroom settings and finally the ability to evaluate teaching and student learning accordingly. This means that support teachers in Queensland schools are generally trained in interpersonal skill development, negotiation and agency (see here Trusty & Brown 2005 for a discussion of this issue in relation to teachers in the United States), reflection and resiliency skills and above all support teachers must have excellent transdisciplinary and interdisciplinary academic knowledge. Interestingly, these are the same skill sets used to train teachers for the middle years of schooling.

Students with diverse needs in the middle years of schooling in Queensland

Students with diverse needs in Queensland are defined under the policy CS-13: *Educational Provision for Students with Learning Difficulties and Learning Disabilities* (Education Queensland nd) using a variety of categories. First learning difficulties and learning disabilities refer to barriers which limit some students' access to, participation in and outcomes from the curriculum. Barriers to education, namely poverty, disability and issues of ethnicity, for example, are the issues to be worked upon in these years so that the individual child can progress their learning. Students with learning difficulties are defined as those whose access to the curriculum is limited because of problems in one or more of the areas of literacy, numeracy and learning how to learn. Students with learning disabilities are defined by the policy as a small group of students with neurologically based learning difficulties. These students may have long term problems and high support needs in the learning areas. These students may have learning styles that are determined by the nature of their specific disorders. These may inhibit their learning at school. Interestingly for the purposes of this paper, Education Queensland uses a neurological definition here.

It is this definition that has caused difficulties for the learning support teacher in the past (Westling et al 2006). Even when support teachers come to their courses with a psycho-sociological background and a desire to see the child and not the label the child carries, a lot of their training and experience seems to stop at the child's head in what Hall (2005:3) refers to as the 'black box' level of brain research and activity. Support teachers sense what may be happening inside the 'black box' from performance indicators, achievement standards and behaviour rating scales, but the skill set listed above is the set marshalled to alleviate some of the problems these students experience. This does not mean that these are the wrong skill sets. Indeed support teachers often see success above and beyond what labels and indicators imply. These skill sets could be augmented if educators take up research where neuroscience ends. This does not mean that educators become pseudo-scientists. Nor does this mean that the socio-cultural focus of the learning support teacher is irrelevant. Indeed the author is clear that it is the barriers to learning that need to be addressed and not the child themselves. The author is well aware that many in the community continue to use the existence of these barriers to exclude. As Slee (2007:12) asserts, exclusion 'is inadvertently exacted through bureaucratic arrangements, through limited and limiting teacher repertoires and curriculum options'. The elimination of barriers to learning is now established as the key to learning performance (QSRLS 2000). One of these barriers is the new regime of repeated national tests aligned with old thinking around the age/stage psychological models (Ashman & Elkins 2009). This barrier will be discussed below.

The concepts of synaptic pruning and synaptogenesis may have a great deal of merit for the learning needs of students. This could be because current cognitive neuroscience challenges the notion of "critical periods" in brain development (Hall, 2005) where we once believed that children could not learn more after Year 3 (Bruer, 1999), but paradoxically and at the same time we also once believed that students should be achieving at the same rate and same stage by such critical periods. The resurgence of this old thinking compared with an awareness of contemporary brain research may offer a greater range of learning experiences for students. Interestingly again current brain research aligns well with middle schooling pedagogy in this instance (Bahr & Pendergast, 2005).

What brain-based research tell us

Reviews of the literature concerning brain based learning have been conducted by the *Office for Economic and Community Development* (hereafter OECD) (2002), the *Education*

Commission of the States (1998) in America and the *Scottish Education Department* (Hall 2005). The OECD called for educators to distinguish between brain based research using three categories namely that the concept of plasticity or the ability of the brain to learn is 'well established', that there is a 'probability' that there are sensitive periods in the brain's development but that there are definitely not 'critical periods' of brain development, that there is some 'intelligent speculation' about differences in brain development based on gender and that the roles of the left and right brain is 'popular misconception' and a 'misunderstood' concept.

Both enthusiasts of brain-based research (Nagel 2005; Berninger & Corina,1998; Clark 2001; Diamond & Hopson 1999) and skeptics (Bruer 1999; Davis 2000) agree on a number of findings. The most consistent findings from the uses of Magnetic Resonance Imaging (hereafter MRI) in humans and from autopsy and neuroscientific medical interventions with humans is that over 100 billion active neurons which are connected via synapses are present in the human body from birth. Synaptogenesis or the process of linking various neurons through the synapses seems to occur in different parts of the brain at different times such that the developing brain will have more synaptic connections than that present in the adult brain. These numbers of synapses are gradually fine tuned in response to environmental stimuli as the human matures. Scientists agree that this fine tuning occurs around experience expectant behaviours and experience dependent behaviours. That is, the brain is organised to accept and use language, but experience dependent behaviours such as reading and studying may occur only when and if the need arises (Hall 2005) and with training.

Rather than the concept of 'critical periods' of brain development referred to for example as 'the first three years' (Bruer 1999) researchers now agree that there are 'sensitive periods' that affect the ease of certain types of learning and that these sensitive periods move out from the early years into late teenage and early adulthood. There have been a number of longitudinal studies of the neuroscience of the teenage brain where snapshot MRI pictures are time lapsed to show interpretations of the changes in brain activity from age 5 to 21. These studies show that brain development occurs for a much longer time span than previously imagined. There is a growing consensus that brain based research may have further insights into what researchers have previously considered within psychological and behavioural theories. The research may assist students to improve skill deficits right up to and including the senior phase of schooling. In the next section the paper turns to a discussion of school structures, a discussion of transitions between structures and a discussion concerning specific tasks that the learning support teacher undertakes that could be improved by brain based research. As Hall (2005:21) observes:

> It seems clear that if any 'grand theory' of learning is to emerge it will do so from a combination of neuroscience, psychology and education and not from neuroscience alone (OECD 2002). At present we are only on the first stages of a journey towards such a theory.

How research can inform the learning support teacher's role and the learning of young people in the middle years

In the discussion to follow concerns about transition to and through crucial assessment junctures within a national curriculum framework are canvassed. There is a discussion about the transition to and beyond the middle years of schooling (MYS). The discussion then examines transitions in classroom learning.

Transitions during assessment junctures

Foucault (1998) described phenomena using why, how and what questions. He looked at issues and moments in time to find the exact moment that a change occurred, to find the meaning of the change at that point in time and to determine the value that could be ascribed to the issue or phenomena under review. In the case of the content of this paper brain based research is still counterintuitive to the ways that schools are currently structured in Australia and to the newer structures of schooling proposed by the ACARA reforms (ACARA 2010). Even when schools accommodate for the important phases of schooling such as the early years phase, the middle phase and the senior phase (MYSA Position Paper 2008), there are academic decisions made on behalf of students at each critical juncture. Indeed, national testing coincides with these critical junctures and students may well have a literacy and numeracy tag far more prematurely than perhaps is needed. If brain based research tells us something it tells us that the plasticity of the brain means that the brain has the ability to physically restructure and change its organisation with the demands placed upon it (Hall 2005). This plasticity can occur into adulthood and therefore does not follow the age stage model accepted by the national testing procedure and Piaget's stage theory. If we accept the OECD's (2002) view of the well established scientific accuracy of brain plasticity then students may very well perform better at different periods of testing than those already established.

The OECD (2002) suggests that there are 'sensitive periods' of synaptogenesis rather than 'critical periods'. By smuggling the anxious question into this discussion it would seem that schools in Australia are still working towards the critical period model where pen and paper tests are meant to determine just what is happening with a child at critical junctures. This may well prove to be useless information.

Transitions through and beyond the middle years of schooling

In the pedagogy that serves middle schooling reform, the concept of transition is very important. It is generally accepted that many students have issues of transition in the middle years of schooling and this is more so for students with diverse needs (Garay 2003; Nelson 2005). Luke et al (2003) and Siemon, Virgona and Cornielle (2001) have shown how MYS students begin to struggle academically, with a noticeable and statistically significant dip in school performance. Many begin to find some literacy and numeracy tasks difficult. Grootenboer and Zevenbergen (2008) argue that students need a strong personal identity in relation to mathematics in these years.

Research in the MYS suggests that this is exactly the time when students in the middle years face changes to their identity brought about by hormonal, social and cognitive change. Such transitions are compounded for students with a language background other than English, students who move from school to school and students who have learning problems.

This period is indeed a sensitive period and students require a safe and supportive environment in which to thrive. The learning support teacher is trained to provide that environment and to remove barriers that students may face in this transition. Unfortunately, presently many of these barriers occur nationally now and it is increasingly more difficult for learning support teachers to argue against these barriers and support teaching has become a very difficult job both in Queensland and elsewhere (Westling et al 2006). Beginning in the Howard era in Australia funding for literacy and numeracy in schools has been tied to the agreement of State Ministers of Education to accept national goals. This makes the task of the learning support teacher that much harder. Rather than providing for and welcoming the diversity of knowledge, social and cultural experiences, beliefs and values of students, learning support teachers are increasingly turning to teaching for tests and teaching access skills (Quenemoen, Lehr, Thurlow & Massanari 2001) to tests so that students feel a sense of belonging in their school. Rather than providing a seamless, transparent transition for students with learning difficulties and learning disabilities during the phases of learning, learning support teachers are concerned about national testing and the naming and shaming of schools. Anecdotal evidence supports the evidence from the USA (Destefano, Shriner & Lloyd 2001) that schools are entreating children with diverse needs to stay away from school on the days of the national tests.

Learning support teachers in Queensland are charged to provide flexible, relevant, accessible education, including appropriate curriculum adjustments and accommodations and special consideration within the context of the individual school community. This is becoming increasingly more difficult because the 'sensitive' periods of brain development are giving way to 'critical' periods of testing. Students who come to secondary school from primary have a thick and weighty file on what they have not been able to do in the primary years. This file is handed from guidance officer to guidance officer (van Kraayenord 1996). Students need a fresh start in a new school and need to be able to transition effectively with their peers. National testing results just provide one more weight to their file.

Transitions in classroom learning

Learning support teachers work closely with students who have a learning disability or difficulty. They are trained in learning practices that are very similar to the ten middle years signifying practices outlined by Pendergast and Bahr (2005), Foreman (2005) and Garrick and Keogh (2010). Often learning support teachers have to wade through the anger and frustration expressed by students when faced with a learning task. Learning support teachers in Queensland are trained to recognise the link between such emotions and learning. In their training pre-service teachers come to experience psychological perspectives that have suggested for some time that excess stress and fear can inhibit cognitive performance. Both the ten signifying practices and brain based research is helpful here. Brain based research is beginning to understand the role of the amygdala in relation to emotions and learning. The amygdala acquires and retains memories of emotional experiences and when emotional arousal is pleasant recall is more likely to occur. McGaugh (2004) suggests that learners are better able to learn when they are emotionally involved in their learning and this is the aim of the middle years' ten signifying practices (Garrick & Keogh 2010). In this respect brain based research supports what learning support teachers already know and do.

Conclusion

Much more work and study needs to be undertaken before the answer to the question posed by this paper will emerge. Using Foucault's techniques of studying phenomena, it would appear that we are at a sensitive juncture where the relationship between neuroscience and education is beginning to be framed. It is important that future research in education uses concepts of plasticity, synaptic pruning and synaptogenesis as well established concepts and that we desist from using the notion of critical periods in brain development and use instead the probability that there are sensitive periods of brain development. Here the neuroscience aligns with educators who use concepts of early, middle and senior phases of schooling. These are a set of philosophies of thinking and doing that have plasticity themselves. These concepts do not support the continued use of the rigid structures of schooling we have grown accustomed to. The most recent research in this area looks at the philosophy of each of these phases rather than the structures of schools in these phases (Pendergast & Bahr 2005). The author accepts that there is neuroscience which can help the learning support teacher in their role to help those students in the middle years with learning difficulties or disabilities. There is a cautious acceptance that the brain continues its developmental work long after the crucial first five years of life and the crucial Grades 3, 5, 7 and 9 years of national testing. The paper has described a scenario where education systems seem to keep our students in a limited environment where the only interventions possible are straight jacketed as well. Learning support teachers persist in the work that supports students develop despite this environment. Hopefully, further work on the neuroscience of the brain can add to what we know of the psycho-social world of learning. Science tends to have political weight. Perhaps this can be marshaled to help students become well-learned adults.

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