Research report

Primary education: A literature review

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Executive summary

Introduction and method adopted

This executive summary and the full report are the result of a project commissioned by the International Baccalaureate (IB) to inform a review of its Primary Years Programme (PYP). The brief was to *'conduct a comprehensive search and systematic review of literature on primary education in relation to the written curriculum and taught curriculum for students aged six to twelve years.'* Three main questions are addressed:

- What have been the main political, social and cultural influences, and the key trends evident across different countries and jurisdictions, in relation to the written and taught curriculum in the primary years since 2003?
- What are the key theoretical lessons from research, especially since 2003, about children's learning in the primary years, and their implications for the written and taught curriculum?
- How might the aims of the IB and its current PYP be affected by the influences and trends identified and how does it, and could it best, take account of the lessons from research about young children's learning?

The report attempts to summarise accessibly complex, sometimes contested, ideas from a very substantial field of research, especially in the developmental sciences. It draws on as comprehensive as possible a search of recent peer-reviewed literature in English to identify key trends and research and synthesise these into a coherent argument about what is most relevant to the curriculum for 6-12 year old children and a review of the PYP.

Key points in each section

Section 1 of the full report provides an overview and **Section 2** a brief discussion of the methodological challenges and approach adopted**. Section 3** considers inherent challenges in curriculum design. A distinction is made between the written and the taught curriculum, with the latter encompassing the whole learning and teaching experience, and between different views of knowledge, not just as propositional (factual) but also procedural (ways of working) and personal/interpersonal. A written curriculum to be implemented worldwide across different cultures must take account of different cultures and traditions of pedagogy. Since indirect influences, including social and cultural and other educational policies, are powerful drivers of how the written curriculum is taught, teachers need a deep understanding of principles and practice and how these interrelate. Frequent change makes it hard for schools and teachers to embed new initiatives. Curriculum design should be, though rarely is, based on educational aims, principles and values about the purpose of education and the type of society to be achieved. Historically, what is often described as 'the basics' -reading, writing and mathematics – has usually dominated the primary curriculum.

Section 4 highlights that the IB's mission and learner profile are central to the all its programmes. The mission involves developing inquiring, knowledgeable and caring young people, helping to create a better and more peaceful world through intercultural understanding and respect. The learner profile sets out specific attributes to enable this. The PYP organises the written curriculum by both subject areas and transdisciplinary themes, with a strong emphasis on concept development, on curricular breadth and coherence and on sustained meaningful enquiry.

Section 5 highlights as significant recent social and cultural trends changing patterns of economic and political power, changes in the structure of communities and families, greater cultural, linguistic and religious diversity, technological innovation and a greater concern with children's health and well-being. There has been convergence, worldwide, in the written curriculum, with an increasing concern with equality, human rights and inclusion, often emphasising children's well-being and in many cases citizenship;and seeking to respond to globalisation and use opportunities presented by technological advances. There has been a strong trend towards greater political intervention and prescription, with frequent changes, often based on policy-borrowing from those jurisdictions perceived to be doing well, despite well-documented hazards in doing so.

Among key influences in setting the curriculum priorities above are international organisations such as UN agencies and the OECD. However, comparative assessments such as Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS) have led, in recent years, to greater focus on data and performativity. There is increased pressure on teachers, through high stakes assessment and accountability mechanisms, to improve test scores, leading to a greater emphasis, in the taught curriculum, on subjects to be tested and the marginalisation of the arts and the humanities. There is an uncertainty about the balance to be struck, in practice, between 'academic' attainment and a broader sense of children's well-being and social, emotional and character/values development. This exemplifies one of many tensions to be considered in curriculum design in the primary years, in part, because education, especially in the primary years, has multiple, often-conflicting aims, making the idea of 'what works' simplistic. Section 5 ends by listing seven tensions discussed further in Section 7.

Section 6 starts by considering the research related to the structure, functioning and development of the brain. Neuroeducational researchers warn against too definite an interpretation of behaviours as related to these and applying their findings directly in the classroom, casting doubt on the value of many initiatives claiming to be based on brain research. Ethical implications related to informed consent and the equitable use of research findings are highlighted. The research indicates that learning involves a complex interaction of emotion and cognition and of many non-conscious and conscious learning mechanisms. Neural networks, in different areas of the brain, are created, or pruned, throughout life, depending on how much they are used, emphasising the brain's plasticity and the importance of repetition and habituation. The literature advocates the early identification of sensory or motor impairment or difficulties with communication to enable remediation and normal development, where feasible; but argues against trying to accelerate development except in cases of developmental delay. Normal developmental processes require appropriate levels of nutrition, hydration, exercise and sleep. The role of chemicals in regulating brain function

emphasises that the level of stress should be sufficient to provide challenge but not so great that anxiety leads to 'fright or flight' responses which impair inhibitory and self-regulatory processes. The neuroeducational research provides more insight into learning difficulties, such as dyslexia and dyscalculia, the autistic spectrum and attention deficit hyperactivity disorder (ADHD), than normal learning processes; but it remains inconclusive on the causes and possible ways of remedying these difficulties.

Recent research from cognitive psychology provides a large amount of detailed work about children's learning, rather than overarching theories. The research tends to confirm the constructivist view on which the PYP is based, with young children able to understand more than was previously thought, given the appropriate environment and support. This reinforces that learners need to be active and engaged, that learning is reciprocal and social and that concepts are best learned by knowledge and skills being applied in real, meaningful contexts. It emphasises the role of a more experienced person helping to lead learning, especially for those less experienced as learners, setting challenging, but realistic, expectations and providing modelling and feedback to re-inforce appropriate behaviours.

The research suggests that, in the 6-12 age range, children increasingly develop conscious learning mechanisms, with working memory (the processes used to store, organize and manipulate information temporarily) and retrieval from memory important elements in developing the concepts to engage in abstract and generalised thinking. These years are vital for children to learn consciously to understand their own and other people's emotions and behaviour, to develop intrinsic motivation and empathy for others since social conformity becomes increasingly important and attitudes towards other groups more fixed. While children must become increasingly confident users of language and use metacognition so that they are more able to reflect on, and regulate, their own learning processes, the research supports the value of continuing to use multi-sensory approaches. Some skills associated with learning to play a musical instrument and learning language, to do with grammar and accent (in an additional language), are best learned before the age of 12 or 13. Developing learning attributes and dispositions and a growth mindset, where children (and adults) recognise that success depends on qualities such as resilience and resourcefulness rather than inherent and unchanging intelligence, have increasingly been emphasised in recent years.

Section 7 considers possible implications for a review of the PYP of social, cultural and technological changes, of the research in the developmental sciences and how the tensions highlighted in Section 5 may be best resolved. **Section 8** sets out the main conclusions in relation to the three main questions. The implications and conclusions are summarised on the next page. However, readers are recommended to read the full report and to recognise that conclusions must be tentative, rather than research directly leading to specific implications for curriculum design.

A brief summary of the main conclusions

This review concludes that the concept- and enquiry-led approach of the PYP is appropriate for the 21st century and broadly reflects current research on how children in the 6-12 age group learn best. The emphasis on the learner profile accords well with the need for children

to develop attitudes, values and dispositions required for lifelong learning in a changing world.

A review of the PYP must take account of the context of globalisation and the resulting greater mobility and diversity, the effects of social and cultural changes on children's lives and technological change. This highlights the importance of global citizenship and that children must be encouraged to be active makers of meaning and to exercise critical thinking and learn to live with uncertainty. The impact of technology is still uncertain, opening up many opportunities for accessing and using information, but harbouring dangers related to attention and how children can best use, and protect themselves while using, the internet.

Neither the neuroeducational research nor that in psychology suggests the need for significant change to the PYP, broadly supporting the constructivist principles on which it is based. It emphasises the reciprocal nature of learning, the close link between emotion and cognition and the importance of using different learning mechanisms and means of representing experience, especially, but not exclusively, language. Given the importance of working memory, metacognition, self-regulation and intrinsic motivation, children in the primary years need a wide range of opportunities across the curriculum which encourage these and qualities such as independence, empathy, and resilience rather than relying on extrinsic factors such as reward and sanctions.

The tensions highlighted in Section 5 are best resolved by a curriculum based on educational values, aims, principles and values, as well as research, with these reflected throughout, as is the case with the PYP. This emphasises the need for a broad and balanced curriculum where knowledge, concepts, skills and attitudes are taught together rather than discretely, with adults modelling learning behaviours and where possible relinquishing control. Successful implementation depends on teachers having a deep understanding of the curriculum and its underlying principles, emphasising the need for sustained professional development and a collaborative culture. Concepts and approaches such as growth mindsets, 'learning to learn' and updated understandings of feedback processes will help to provide a rationale for how the PYP's transdisciplinary pedagogical approach can best be implemented. More emphasis should be placed on generic approaches such as formative assessment and 'visible learning' than on short-term and/or prescriptive initiatives. It is suggested that the PYP might include more emphasis on the role of religion, on procedural knowledge associated with specific (subject) disciplines and on children's rights. The IB should recognise that the pressure from external drivers such as high-stakes assessment and accountability mechanisms may militate against the broad and balanced curriculum, including significant experience of the humanities and the arts, which is appropriate for primary-age children.

1 Introduction

The purpose of this literature review is to conduct a comprehensive search and systematic review of literature on primary/elementary education in relation to the written curriculum and taught curriculum for students aged six to twelve years. The report addresses three main questions:

1. What have been the main political, social and cultural influences and the key trends evident across different countries and jurisdictions, in relation to the written and taught curriculum in the primary years since 2003?
2. What are the key theoretical lessons from research, especially since 2003, about children's learning in the primary years, and their implications for the written and taught curriculum?
3. How might the aims of the IB and its current Primary Years Programme be affected by the influences and trends identified and how does it, and could it best, take account of the lessons from research about young children's learning?

This report is primarily intended to inform the review and development of the PYP. It tries to express in simple and accessible language complex ideas over a very substantial field of research, examined as comprehensively as possible, as described in Section 2. Section 3 outlines general challenges in curriculum design and implementation. Section 4 describes briefly key features of the IB and the PYP, drawing on an analysis of the relevant documentation, providing the basis for how the subsequent discussion is linked to the priorities of the IB and the PYP.

Section 5 starts by examining, in **5.i,** the broader context and social and cultural trends and influences, and in **5.ii** recent trends in curriculum design for young children. **5.iii** considers the main influences on the written and taught curriculum in recent years and **5.iv** describes recent curricular initiatives and approaches relevant to the PYP. **5.v** summarises the implications of recent trends and highlights seven tensions in designing the primary curriculum.

6.i outlines the approach adopted in summarising recent theoretical and empirical research in the developmental sciences as it applies especially to 6-12 year olds and offers two cautionary notes. **6.ii** highlights key areas in which neuroscience and neuroeducational research can, and cannot, shed light on educational practice. **6.iii** reviews the research in cognitive psychology and associated fields. **6.iv** summarises key points relevant to the primary curriculum.

Section **7** discusses the possible implications for the review of the PYP in the light of the preceding discussion. Section **8** summarises the main conclusions in relation to the three main questions. This report is, therefore, a synthesis of, and reflection on, key elements of research as it pertains to the curriculum and the PYP in particular rather than a summary of all recent initiatives and research in curriculum design and the developmental sciences.

The term "jurisdictions" is used to describe different types of policy body with responsibility for curriculum organisation and implementation, and other mechanisms such as those for assessment and accountability, given the wide variation as to whether this is the responsibility of national or local government. The term "primary" is used for the phase before secondary education, though the ages to which this refers vary somewhat between jurisdictions, with some referring to this age group as "elementary". However, broadly speaking, most of the age span between 6 and 12 years old is included within the term "primary". Where possible, specific aspects referring to this age group, or to part of it, are highlighted, though often, for reasons to be discussed, distinct cut-off points in children's learning are inappropriate.

2 Methodological challenges and approach

This section describes briefly two main challenges and the approach adopted to draw the most important lessons from a very large body of research.

Section 5 tries to identify the key trends on how the curriculum has been developed and taught in the primary years in different countries and jurisdictions, in the last ten years, and the main factors influencing these. Such a process is difficult, partly because trends and influences vary both between and within different countries and partly because trends take place over a long period of time and often unevenly in different jurisdictions. Reference is made to comparative studies and to country-specific literature for exemplification. The shortage of literature about some areas of the world, and the predominance of work from more affluent or economically developed countries, makes it difficult to ensure worldwide coverage. Any analysis is therefore selective and makes a judgement about the intensification or otherwise of such trends.

Second, the amount of research in the developmental sciences is huge. Much recent work in cognitive psychology is focussed on narrow, measurable aspects, often on cognitive function related to language, mathematics and learning difficulties, rather than providing overviews. The implications for the 6-12 age group are often not well differentiated from those of other age groups. Neither are the implications for those of different ages within the age group, despite the needs of 6 year olds varying from those of 9 year olds and both from those of 12 year olds. While development is in some respects age-related, any individual may have several parallel developmental trajectories[1] at any one time and to generalise for any individual, let alone for a group, is hazardous. This review has selected those aspects relevant to the primary years and, at times, extrapolated lessons from more general studies to draw out the implications for this age group. Therefore, the conclusions drawn are necessarily tentative rather than leading directly from specific research.

[1] For example, a child may be at different developmental stages in relation to science, the arts and the use of language and at different stages emotionally, intellectually, physically and in other ways.

This review has been restricted to sources in English, mostly drawing on peer-reviewed articles. The approach adopted has been initially to identify key issues related to the PYP's priorities from books and meta-analyses, with these explored and, in some cases, further issues identified, from a search of the relevant literature in databases, notably the OECDilibrary, ERIC and PsycINFO. Almost all references are to peer-reviewed literature or to books by authors with an extensive academic publication record in the field. The annotated bibliography provides a brief commentary on the most relevant and accessible texts.

3 Understanding primary curriculum design and implementation

This section describes the conceptual and practical challenges of understanding curriculum design and implementation worldwide for primary aged children.

3.i Conceptual and philosophical considerations:

A conceptual distinction must be made between the written and the taught curriculum. The former is a document (or set of documents) more accurately called a syllabus and accompanying guidance. The taught curriculum is used more broadly to encompass the whole learning and teaching experience, including learning environments, pedagogy and assessment procedures. The IB includes, as a third element, what was initially called the assessed, but is now called the learned, curriculum. Fiala (2006) highlights the relationships, and disjunctions, between what he calls the intended, formal and active curriculum. Whatever terms are used, the success or otherwise of any written curriculum depends on how it is taught and is to be judged, ultimately, in what and how children learn.

The written curriculum is only one of many “drivers” how children are taught and in how, and what, they learn. As Baker and Wiseman (2005:ix) write, "policy is often diluted by policy administrators or ignored by classroom teachers." External expectations, both social and cultural, and those from other educational policies are often powerful drivers of how a written curriculum is taught. So, one should not consider the written curriculum in isolation. In Fullan's words, (1991:117), “educational change depends on what teachers do and think. It's as simple and complex as that.” This highlights the importance of pedagogy; and therefore of the teacher and of continuing professional development.

Behind many debates on the curriculum are philosophical differences about the nature of knowledge and what counts as success. For instance, Hirsch's work which tends to emphasise content (that is propositional) knowledge remains influential, especially among politicians in the United States and England; and that of Young (2008) on "powerful knowledge" (that which helps children to succeed) has been used to argue for more emphasis on content knowledge than on skills. However, this tends to equate "knowledge" with propositional knowledge. In Eaude (2012), I suggest that knowledge must also be seen as procedural - ways of working – and personal/interpersonal – knowledge of self and relationships. While this was used in relation to

teachers, propositional, procedural and personal/ interpersonal knowledge are closely linked in young children's learning, given how emotion and cognition affect each other and the importance of applying skills in meaningful contexts. Research discussed in Section 6 suggests that to link these forms of knowledge is especially important for young children. Whether success is seen largely in terms of measurable outcomes, and in what areas, or learning processes or attitudes and character (or a combination of these) depends on how the purpose of education is understood. Consensus on such matters, on the basis of empirical research, is therefore impossible.

3.ii The influence of culture:

Alexander (2000) compares five different systems- England, India, Russia, France, and Michigan in the United States. He identifies how approaches to pedagogy are deeply embedded in cultural traditions, with teachers often strongly attached to particular teaching styles and resistant to new initiatives. For instance, in Russia and France, an emphasis on spoken language and discussion, usually in a whole class group and led by the teacher, is common; while in Michigan a more individualistic and informal, child-led approach is taken for granted. Such considerations should make one wary of thinking that any curriculum can be grafted on to an existing system without considerable time for it to be understood, internalised and embedded in their practice. This suggests that frequent changes to the written curriculum militate against teachers being willing, and able, to internalise changes prescribed, or suggested, by policy makers, though there is little recent research evidence to confirm or counter this.

Rogoff (2003) demonstrates that the qualities and behaviours encouraged in children vary considerably between cultures. These result from, and lead to, varying beliefs about, and approaches to, childhood and learning. She describes how in many cultures young children are expected to listen and to watch, and then to practice, at first under adult supervision, and then more independently. Rogoff argues for more emphasis on what she calls "guided participation", or an apprenticeship approach, where children learn by watching, listening and doing under the guidance of someone more experienced. Pedagogical approaches associated with Confucian systems and those from central Europe which draw on Vygotsky's work emphasise the teacher's role in leading development; and children being active participants in a group. Such views challenge current Western assumptions that children should be protected from participating in activities perceived to be risky and encouraged to articulate their thoughts and feelings and work largely on their own. While recent research in this field does not focus on the primary years, Lancy (2010), for instance, highlights that many current assumptions about teaching differ from historical traditions which place more reliance on the child-as-learner.

3.iii Curricular aims and focus:

The Cambridge Primary Review makes two important points in this context. The first (Alexander 2010: especially 174-202) results from curriculum design usually being driven by political considerations rather than based on explicit aims. Alexander argues that curriculum design must start from aims and principles and that policies and practices must be compatible with these; and that “educational aims, however self-evident or instrumental they may seem, reside by their nature in the domains of values and even speculation." (ibid: 174). This last point refers to the

need to educate children both for the present and a future which is (necessarily) unknowable. Moreover, in White's words (ibid: 200), "the broad outlines of the curriculum and the aims on which they should rest should be inextricable from the kind of society which is thought desirable and which school education can help to bring about." This makes curriculum design complex, especially for successful implementation in different jurisdictions and cultures, in a world of constant change. The implications for the IB and PYP are considered in Section 7.

The aims of primary education are often seen in simple terms. Yet, as argued in Eaude (2012), education has multiple aims, with these, especially in the primary years, long- rather than short-term. For instance, while the purpose of primary education is often presented as "learning the basics", most jurisdictions, as discussed in **5.ii,** espouse the "education of the whole child" and aspects such as human rights and citizenship. Different aims may be in tension or in conflict, especially in the taught curriculum. So, a focus on improving test scores is likely to discourage divergent thinking and curricular breadth and balance; and an emphasis on those aspects to be tested may reduce opportunities to apply knowledge and skills in practical situations. Moreover, as explored further in Section 5, external drivers such as high stakes assessment and accountability mechanisms can be powerful factors in, *de facto,* narrowing the aims set out in the written curriculum.

The second key point (ibid: 241-243) is the historic dominance in the primary curriculum in most jurisdictions of what Alexander calls Curriculum 1 – "the basics"- over what he calls Curriculum 2- "the rest." These are generic terms to describe a distinction for which the terminology used and composition of these may vary over time and between jurisdictions, However, Curriculum 1 includes reading, writing and mathematics and, in some cases, science and information and communications technology (ICT). Curriculum 2 includes the humanities, such as history and geography, the expressive arts, such as art, music, dance and drama and physical education. The importance of breadth and balance, linking Curriculum 1 and 2, is discussed in Section 7.

4 The International Baccalaureate and the Primary Years Programme

This section draws on a range of IB documentation, listed in the Appendix, to articulate the main features of how the IB, and particularly the PYP, has been designed and should be implemented. This is summarised only briefly, to provide the basis for considering in Sections 7 and 8 possible implications for its review in the light of the research, with Sections 5 and 6, therefore, highlighting general themes which are related subsequently to the PYP.

The IB's mission statement includes as a central aim:*"to develop inquiring, knowledgeable and caring young people who help create a better and more peaceful world through intercultural understanding and respect,*" continuing that the IB works with schools, governments and international organisations to *"develop challenging programmes ... which encourage students across the world to become active, compassionate and lifelong learners who understand that other people, with their differences, can be right."*

This is supported by the IB's learner profile, which presents the aim of all IB programmes as being *"to develop internationally minded people who, recognising their common humanity and shared guardianship of the planet, help to create a better and more peaceful world."* The IB seeks to develop learners who will strive to be:

inquirers	**knowledgeable**	**thinkers**	**communicators**	**principled**
open-minded	**caring**	**risk-takers**	**balanced**	**reflective**

This list, and a more detailed description of what these involve, is included in every IB document, though the learner profile is currently under review. It is understood that one main area for discussion relates to whether the term "risk-takers" is appropriate or should be amended.

The IB's programmes of international education are currently implemented in about 145 countries, both in international schools and in schools within national or local educational systems. They share a vision, informed by the values in the learner profile: 1) focussing on learners and promoting healthy relationships, ethical responsibility and personal challenge; 2) developing the attitudes and skills needed for both academic and personal success; 3) increasing understanding of languages and cultures and exploring globally significant ideas and issues; and 4) exploring significant content through a curriculum that is broad and balanced, conceptual and connected.

The PYP was introduced in 1997 and is designed for 3-12 year olds, though this report is concerned with the 6-12 year old age band. All PYP students have the opportunity to learn more than one language from the age of seven. The six subject areas within the PYP are:

Language	**Social studies**
Mathematics	**Arts**
Science	**Personal, Social and Physical Education**

However, the IB identifies as a significant and distinctive feature the six transdisciplinary themes to incorporate local and global issues, allowing students to move beyond the confines of subject areas. These themes are:

Who we are	**How the world works**
Where we are in place and time	**How we organise ourselves**
How we express ourselves	**Sharing the planet**

The transdisciplinary themes help teachers to develop a programme of substantial and in-depth inquiries, requiring a high level of student involvement and usually lasting for several weeks. These are intended to be engaging and challenging, involving both individual and group work, and related to the world beyond the school. In the final year of the PYP, all students undertake a collaborative, transdisciplinary inquiry process, identifying, investigating and offering solutions to real-life issues or problems.

This description (see also Giddings 2013) indicate that the PYP is based on a constructivist view of learning and is concept-led, with concepts comprising one of five essential elements underpinning the curriculum framework, the other four being knowledge, skills, attitudes and action. There is a strong emphasis on values, curricular breadth, sustained enquiries, making connections between existing and new knowledge and being part of a community of learners. Successful inquiry is intended to lead to action. Eight key concepts are:

Form What is it like?	**Function** How does it work?	**Causation** Why is it like this?	**Change** How is it changing?
Connection How is it connected to other things?	**Perspective** What are the points of view?	**Responsibility** What is our responsibility?	**Reflection** How do we know?

Four phases of development are identified within the 6-12 age group, but these are seen as fairly fluid, rather than sequential and potentially limiting; and a progression in subject areas is set out in detail. For instance, in relation to the arts - music, visual arts, dance and drama - key developmental features are identified and a distinction is made between creating and responding. However, guidance stresses the need to recognise that learning is not sequential and to link different elements, points reflected in the research discussed in Section 6.

The Programme Standards and Practices highlights the key aspects of how the PYP should be implemented. While the IB programmes do not prescribe a particular teaching approach, the PYP requires a considerable level of facilitation by teachers, rather than relying on transmissive pedagogy. Recognising possible tensions between the role of generalist and single subject teachers, all teachers are expected contribute to the overall outcomes of a transdisciplinary programme. Giddings (2013: 1) expresses scepticism about modes of innovation and initiatives which depend heavily on data for their rationale or evaluation of their success. The prime objective of assessment is seen as to provide feedback. The IB emphasises pedagogical leadership and a collaborative culture for professional development.

5 Recent trends, influences and initiatives in the primary curriculum

5.i The broader context and social and cultural trends

5.i.1 The broader context:

At the World Conference on Education for All (EFA), organised by UNESCO in 1990, the second of six goals was, by 2015, to *"provide free and compulsory primary education for all."* This was echoed in the UN Millennium Goals, agreed in 2000, where one key goal was to:"*ensure that by 2015 children everywhere, boys and girls alike, will be able to complete a full course of schooling.*" This commitment to EFA was confirmed in the Oslo Declaration "Acting Together" in 2008.

There has been substantial progress towards these goals. However, as Brook Napier (2005: 71) writes, "the goal of universal primary education has yet to be attained in many developing countries. These huge areas of underdevelopment demand careful formulation of notions of 'success' or 'failure' of reform programmes when capacity is lacking and when goals are overly ambitious in the face of stark realities." EFA remains a prominent focus, especially in developing countries where access to, and attendance at, school and teacher quality remain major issues. Difficulties are often strongly linked to the socio-political and economic situation. For example, Naidoo (2005) reported that, while provision and uptake in much of sub-Sarahan Africa had improved in the previous decade, groups such as women, the rural population and ethnic and linguistic minorities remain marginalised or relatively excluded.

Attempts at educational reform in such countries are often complicated, or inhibited, by factors such as poverty, disadvantage, corruption, neocolonial domination, foreign debt and rapidly growing population; and by such factors as children having to work, paid or unpaid, with girls, especially, having heavy domestic responsibilities and in some cases having experienced displacement or war. Such factors inevitably influence adversely access to, and the quality of, education. Strong educational regulation with nationally produced guidelines and textbooks is the norm in such countries, in part because of considerable difficulties with teacher recruitment and quality. However, this report draws lessons mainly from jurisdictions where such factors are not of overriding importance.

In recent years, economic power has moved significantly from the previously most affluent countries, notably in North America and Western Europe, towards those in North-east and South-east Asia, such as China, South Korea and Singapore; and those such as Brazil, Russia, India and South Africa. Concerns about economic competitiveness have intensified in the last five years, especially in traditionally affluent countries, since the banking crisis and subsequent recession and low growth. The need to ensure greater economic competitiveness is often used to explain the perceived need for more flexible skills, in the context of globalisation, a term whose meaning and how it is related to the aims of primary education is discussed by Chawla-Duggan and Lowe (2010). However, OECD/UNESCO (2002) suggests that the strongest correlations between schooling and economic growth occur in middle-income countries and that benefits in this respect are mostly related to post-primary

education. Issues related to technological change, often associated with globalisation, are considered in Section 7.

5.i.2 Social and cultural trends:

Recent years have seen significant migration and mobility between and within countries, though the nature, and impact, of this has been uneven. The constitution of many families and communities has changed, as a result of multiple factors, such as family break-up, the economic impetus to migrate and in some cases involuntary displacement. Many children no longer live where they were born and schools are more varied in terms of language, belief and culture. This has led to increased awareness, and contact, with those of other cultures, and concern about a loss of social, and in some cases national, cohesion, with children increasingly growing up with multiple identities. While such trends have affected some societies, especially in urban areas, for many years, their impact has recently increased in previously homogeneous communities.

Such trends have led to religion worldwide becoming more important. This is a complex subject, with declining attendance and continuing secularisation, in many European countries particularly, though complicated by the arrival of many groups for whom religious belief and practice remains a major basis of identity. In other regions, notably in Africa, North and South America and many parts of South Asia, religion remains an important basis for understanding the world. However, many traditional manifestations of organised religion, worldwide, have been under challenge from different, often more assertive, forms, such as evangelical Christianity and political Islam. In the context of events such as the attack on the Twin Towers in 2001 and the subsequent "war on terror", religious affiliation has in many societies become a source of controversy and, often, perceived discrimination.

Recent years have seen a growing concern with children's health and well-being, both physical and mental. In less affluent countries, the challenge is to ensure that children have enough to eat. In more affluent countries, this often relates to obesity and lack of fitness. The concern with children's mental health and well-being has been documented in reports such as Unicef (2007) and popular writing such as Layard (2005) and Layard and Dunn (2009). Among the concerns have been strong pressures for young children to "grow up" too quickly and to adopt behaviours and attitudes normally associated with adolescence. These pressures are increasingly international with changes in technology and the global reach of the media, involving sophisticated advertising, often targeted at children and encouraging consumerism. This plays on the wish to belong to a group by wearing the "right" clothes and the cult of celebrity. As a result, many children, especially in affluent societies, increasingly see identity and define success in terms of material possession and, especially girls, have become very concerned with body shape and image.

The busy-ness of life has resulted in many children becoming less active. For example, Brice Heath (2010: 115) writes that “childhood is becoming one prolonged stretch of spectatorship” and Mayall (2010) describes as "scholarised leisure" the situation where the opportunities for self-generated play are restricted, except through computer games. Such trends are associated with parents being more protective and risk-averse, especially in affluent countries and in

urban areas. This highlights the importance, and the challenge, of schools expecting children to be active and engaged learners.

To generalise about changes in children's attitudes, worldwide, with any confidence, is hazardous. The awareness of many children, especially approaching adolescence, about issues such as environmental degradation and climate change has been enhanced by the availability of worldwide media. In recent years, deference to those in authority has reduced, accompanied by a widespread concern among adults about children not knowing how to behave appropriately. While one should be wary of misplaced nostalgia from the older generation, children seem to face a wider range of pressures than previously, leading to greater uncertainty among parents and children.

So, many of the most powerful influences on children are social and cultural, from family, the immediate and wider community, peer-group pressure and the media. While such trends may not, at first sight, seem relevant to the primary curriculum, they provide the context for understanding trends in educational policy and curriculum design. The implications for the PYP are considered more explicitly in Section 7.

5.ii Trends in curriculum design and implementation:

This section draws on comparative and, to some extent, country-specific studies, to identify and exemplify trends in the primary curriculum. Among the comparative studies are those of:

- Le Metais (2003), a comprehensive, though somewhat dated, summary of the provision of primary education in the 18 countries of the INCA Archive[2];
- Pepper (2008), which compared information for 10 countries[3] on curriculum changes since 2005 and the policy rationale for these, though with little information on implementation and impact; and
- Hall and Øzerk (2008), which compared the curriculum and assessment arrangements in England with those in 20 other countries[4].

Many country-specific curriculum reviews have been undertaken, such as ACARA (2013) in Australia, though this is not specific to primary education. While no recent cross-jurisdictional studies similar to those above have been found, it seems likely, for reasons outlined below, that these trends have not altered significantly, and may in many cases have intensified.

[2] Australia, Canada, England, France, Germany, Hungary, Ireland, Italy, Japan, Korea, the Netherlands, New Zealand, Singapore, Spain, Sweden, Switzerland, USA and Wales (with some lessons from Northern Ireland and Scotland)

[3] France, Germany, Italy, New Zealand, Northern Ireland, Norway, Scotland, Spain, Slovenia and Australia-Tasmania

[4] Australia, Canada, France, Germany, Hungary, Ireland, Italy, Japan, Korea, the Netherlands, New Zealand, Northern Ireland ,Norway, Scotland ,Singapore, Spain, Sweden, Switzerland, USA and Wales

5.ii.1 Content of the curriculum

Le Metais (2003) reported that all countries (except Scotland) had a statutory curriculum, prescribed by national or sub-national authorities, with varying patterns of local flexibility and prescription. Hall and Øzerk (2008) indicate that, in different jurisdictions, the level to which different elements of the curriculum are obligatory, or encouraged, varies. However, they report that, worldwide, national primary curricula are remarkably similar in subject labels and priorities, writing (2008:378) of the "broad convergence in curriculum provision across all these countries. first language, mathematics, science, information technology, history, geography, art and craft, music, physical education and sport and religious education ……are now standard in the primary curriculum of all the countries (surveyed)." A foreign language is compulsory (especially for older pupils) in most jurisdictions, with an increasing trend towards offering one or more foreign languages, and/or extending provision for younger pupils, even where this is not mandatory. Cha (2006) describes how teaching English has been very widely adopted, a trend which the increasing impact of the internet seems likely to have intensified.

By 2003, citizenship had become part of the curriculum in all countries surveyed by Le Metais, either as a separate subject, or within the humanities. Soysal and Wong (2006), discussing citizenship education in European and Asian curricula, argue that increasingly national norms are being replaced by transnational and universalistic values. An increasing tendency to emphasise personal, social and health education is evident, linked to concerns about well-being. These trends have often been accompanied by a concern about the development of morals, character and values (see for example China, 2010, OECD, 2011 and OECD, 2013 in relation to China, Singapore and Korea respectively).

Cox (2006: 254) argues that "all education systems today bear the dual task of responding to requirements that are local and nationally specific, and requirements that are global and common to world society." Fiala (2006) suggests that the global emphasis on equality, democracy and the basic human right to education has increasingly been reflected in educational aims calling for the development of the full human being, on the one hand, and the strengthening of the nation state, on the other. This is accorded with the written curriculum increasingly reflecting a concern with matters as equality, human rights and inclusion, often emphasising children's well-being and in many cases citizenship.

5.ii.2 Subjects, skills and outcomes:

No clear pattern emerges as to whether the curriculum is organised by subjects or areas, that is broad domains of experience, such as knowledge of the natural, social and cultural environment (as in Spain) or autonomy and initiative (as in France). However, as Pepper (2008) indicates, the differences between subjects and areas are not hard and fast.

Increasingly, the curriculum has been formulated in terms of skills and learning outcomes. Le Metais (2003) reported a growing emphasis, in all countries, on transferable skills, perceived as relevant to lifelong learning, employment and social participation, such as "thinking skills", creativity and independent learning and social skills; and, in some cases, a reduction in prescribed content. Pepper (2008) indicate that, despite a trend towards the application of

knowledge using competences or skills, areas and subjects continue to be the basis for curriculum organisation and often assessment.

Le Metais (2003) reported a trend towards more external assessment – both statutory and voluntary – intended to help teachers identify pupil progress and plan their work and/or as an element of school accountability, though five countries had limited this to sample populations and two, Korea and Wales, had reduced the amount of compulsory universal external assessment. There was a tendency to publish results, either by school (England and the USA) or as anonymous trends (France, New Zealand and Spain). In a few cases namely Australia, Canada (Ontario) and England, the emphasis on learning outcomes was linked to achievement targets specifying the percentage of pupils expected to achieve a given level. More recently, such trends have intensified for reasons discussed in **5.iii.**

Le Metais (2003) stated that the demand for transferable skills and the introduction of Information and Communication Technologies (ICT) had led to greater emphasis on group work and independent learning in virtually all INCA countries. All had made considerable investment in equipment and, to a lesser extent, professional development, to develop ICT-related skills and support independent learning. Pepper (2008) wrote that several countries had recognised personalised learning as a way of raising attainment and establishing patterns of lifelong learning. However, personalised learning is used to justify, and results in, varying types of practice.

5.ii.3 Frequency of change and policy borrowing:

Le Metais (2003) identified a strong trend towards frequent and wide-ranging reform of educational policy, including, but not restricted to, reviewing the written curriculum. This has been accompanied by greater, and more frequent, intervention and prescription, at local or national level, in both the written and taught curriculum. She reported a considerable increase in all countries in centrally produced guidance to support teaching and learning (for example, schemes of work, lesson plans and ideas, exemplification of pupils' work), with a strong trend towards publishing these in electronic formats. In the years since her survey, such trends have intensified. Pepper (2008) reported that each of the 10 countries studied had recently made changes to the curriculum and/or related assessment arrangements and several had made changes in 2007. Such trends are often associated with the demands of globalisation and the opportunities presented by technology and an increased tendency for policy-borrowing from high-performing jurisdictions.

Baker and Wiseman (2005: x) write that it is "virtually impossible for educational policymakers in any country to make and implement policies that affect schools without first looking at what other nations do in similar situations." Policy-makers and politicians have become increasingly keen to discover "what works" and adopt this in their own context, with performance in international surveys, discussed in **5.iii**, used to justify policy changes. For example, Oates (2010) has been used to try and establish what can be learned about the curriculum in England from high-performing jurisdictions, notably Singapore, Finland, Hong Kong, Massachusetts (US) and Alberta (Canada).

The tendency to borrow policies from other, high-performing jurisdictions is fraught with difficulty. Oates (2010) recognises the challenges of comparing jurisdictions with populations of three to seven million people with that of England with over fifty-one million. He writes (2010:10) "this has considerable implications for improvement strategies. While large systems may have greater potential for important innovation to occur, they have greater challenge in disseminating that innovation in order to secure system improvement. Change processes possess higher risk in respect of misappropriation and distortion." However, the following three case studies illustrate deeper difficulties in drawing lessons from high-performing jurisdictions. These are from jurisdictions consistently near the top of the league tables and held up as examples for others to follow.

Three successful jurisdictions

Finland

OECD (2011) identifies as factors behind Finland's success a political consensus to educate all children together in a common school system, an expectation that all children can achieve at high levels, regardless of family background or regional circumstance, single-minded pursuit of teaching excellence, collective school responsibility for learners who are struggling, a focus of (modest) financial resources on the classroom and a climate of trust between educators and the community, with the last point evidenced by the highly qualified and respected teaching force and the lack of demand for school inspection. However, Finland has a relatively small and homogeneous population and is both more prosperous and egalitarian than most other countries.

Singapore

OECD (2011) analyses the success of Singapore in both economic and educational outcomes, emphasising the move from a knowledge-transmission education model to one based more on creativity and self-directed learning. The report emphasises the value of “a clear vision and belief in the centrality of education for students and the nation; persistent political leadership and alignment between policy and practice; a focus on building teacher and leadership capacity to deliver reforms at the school level; ambitious standards and assessments; and a culture of continuous improvement and future orientation that benchmarks educational practices against the best in the world." The report recognises that Singapore's small size makes it much easier to provide coherence to such change. Curriculum development involved greater focus on higher-order thinking skills, backed by sustained professional development. However, Tan (2011: 170-1) reports on concerns that success in higher-order thinking skills (ironically) resulted from children being drilled and coached in these, often outside school, and highlights the effect of league tables in marginalising those subjects or areas not tested.

Canada

OECD (2011) argues that Canada has achieved success with a decentralised system, with significant diversity, particularly with respect to language and country of origin. The success of the province of Ontario is linked to consistent application of centrally-driven

pressure for higher results, combined with extensive capacity building and a climate of relative trust and mutual respect, with a high level of morale. OECD (2011) highlights the importance of involving teachers, rather than imposing policy on them and comments that while Canada demonstrates, rather surprisingly, that success can be achieved without a national strategy; there is now ironically pressure for such a strategy, with education thought too important to be left to the provinces.

These case studies indicate that "cherry-picking" ideas from other systems is hazardous, though teacher quality and capacity is a common theme. However, it is tempting, especially for politicians, to draw selectively from comparative studies, for reasons discussed in **5.iii**.

5.iii Influences on the design and implementation of the curriculum:

This section considers the main influences on the written and taught curriculum, for the 6-12 year-old age group, both international organisations such as the United Nations and its agencies, such as United Nations Educational Scientific and Cultural Organisation (UNESCO) and the Organisation for Economic Co-operation and Development (OECD); and more local factors.

5.iii.1 International agreements:

The United Nations Convention on the Rights of the Child (UNCRC) was formulated in 1989 to grant all children and young people a comprehensive set of civil, political, economic, social and cultural rights. It sets out what every child needs for a safe, happy and fulfilled childhood regardless of their sex, religion, social origin, and where and to whom they were born. Among the rights which the UNCRC grants to children are those to: 1) special protection measures and assistance; 2) access to services such as education and healthcare; 3) develop their personalities, abilities and talents to the fullest potential; 4) grow up in an environment of happiness, love and understanding; and 5) be informed about and participate in achieving their rights in an accessible and active manner. While many of these are reflected in the PYP, children's rights do not have a high profile in its documentation.

The Salamanca Declaration resulted from the World Conference on Special Needs Education, held in 1994, under the aegis of UNESCO. The result was a Statement on the education of all disabled children, beginning with a commitment to Education for All. It called for inclusion to be the norm, the guiding principle being that schools should accommodate all children, regardless of their physical, intellectual, social, emotional, linguistic or other conditions. The Salamanca Declaration represented a turning-point in governmental concern about greater inclusion, not just in terms of disability, but for those excluded in other ways, a move exemplified in the UN Millennium Goals of 2000, described above.

Such international agreements and considerations of what it means to be educated for a changing world have provided the impetus for the increased emphasis on human rights and inclusion. The wish to combat social inequality and overcome the effect of deprivation has

provided the rationale for many governmental initiatives, such as No Child Left Behind in the United States and the Primary Strategies in England. However, the concern for social inclusion has led to different conclusions, for instance with many jurisdictions focussing on standards of literacy and numeracy; or to calls, such as Hargreaves (2003), for teachers to cultivate in children capacities such as deep cognitive learning, creativity and ingenuity to cope with constant change, in what he and others call the "knowledge society." There is no consensus on what inclusion or being educated for a world of constant change mean or the implications for primary-age children. Such questions both reflect and shape beliefs about the purpose of education.

5.iii.2 International comparisons:

Pepper (2008) reported that several countries had made curriculum changes to raise standards, particularly in literacy and numeracy, with international assessments providing the impetus in France, Germany and New Zealand. These changes have tended to be based on, and lead to, a significantly increased emphasis on data and performativity, especially in those subjects formally assessed. However, in other countries, changes had emphasised broader learning outcomes to prepare pupils to be lifelong learners and active participants in society, without these being very precisely defined. While these are not necessarily in conflict, strong political, or other, pressure for results has, for reasons considered below, tended to encourage a focus in practice on performativity.

International comparisons have been a major influence on the taught curriculum. The most prominent is the Programme for International Student Assessment (PISA), launched in 1997 by the OECD, intended to evaluate education systems worldwide by testing the skills and knowledge of 15-year-olds. Since 2000, every three years, a randomly selected group are tested, with focus in 2000 on reading, in 2003 on mathematics and problem solving, in 2006 science, in 2009 reading again and in 2012 mathematics, including an optional computer-based assessment of mathematics and reading. PISA tests are designed to assess to what extent students at the end of compulsory education can apply their knowledge to real-life situations and be equipped for full participation in society.

A second major comparative survey is Trends in International Mathematics and Science Study (TIMSS). First conducted in 1995, TIMSS reports every four years on the achievement of fourth and eighth grade students, roughly 9 and 13 years old. This is organised by the International Association for the Evaluation of Educational Achievement (IEA), an independent, international cooperative of national research institutions and governmental research agencies. The IEA also established the Progress in International Reading Literacy Study (PIRLS), with a five-year cycle of assessments, starting in 2001 and subsequently conducted in 2006 and 2011, to measure trends in reading literacy achievement in primary school.

Such surveys have led to comparison between jurisdictions and between different schools within jurisdictions. The rankings have had a significant impact, especially on the taught curriculum. The level of prescription has, in practice, increased in many jurisdictions as a result of the emphasis on outcomes. Moreno (2006: 207-8) sees such rankings as satisfying a

widespread craving for simple and nuance-free information, excluding everything beyond basic knowledge and competencies, resulting in the taught curriculum being narrowed. Oelkers and Larcher Klee (2006) argue that international comparisons like PISA have led to the marginalisation of aesthetic education.

The demand for measurable outcomes, especially in reading, mathematics and to a lesser extent science, have contributed to an increased emphasis on performativity and pace, with teachers required to raise levels of attainment especially in those areas tested. This has led in many jurisdictions to a narrowing and fragmentation of the taught curriculum, with a focus on Curriculum 1 and initiatives and interventions to achieve improved test results. The aims of education, *de facto,* are reduced to what is measured, and measurable, with less emphasis on spoken language and on the humanities and the arts.

5.iii. 3 More local influences:

The trends outlined in **5.ii** are drawn from comparative studies. When country-specific literature is considered, a more varied picture emerges. For instance, in some countries, most obviously those with a Muslim majority, religion provides a strong rationale for curriculum design and retains a strong place, as a subject, in some cases, and as a explanatory structure underlying other subjects and areas. In other countries, religion is not taught in schools, and in some cases is expressly forbidden. A second example is that East Asian countries, such as Singapore and Korea, which achieve highly in league tables, especially in maths, are often held up as exemplars as the best routes into high standards of what is tested. This is often ascribed to a culture of hard work and respect for, and deference towards, teachers associated with a Confucian approach, though these systems often place intense pressure on children. Such considerations should make one wary of broad generalisations about education worldwide or of solutions based on such generalisations.

The trends outlined in **5.ii** are mostly based on curriculum documentation. Although curriculum statements often emphasise broader and less measurable aims, including those related to well-being and the development of the "whole child", a somewhat different picture emerges when the taught curriculum is considered. A focus on summative assessment and ‘preparation for secondary education’ tends to reinforce a subject-based approach in core subjects such as the mother tongue and mathematics. For example, Drewery (2010: 432) noted that in New Zealand current educational discourse surrounding the pre-eminence of raising achievement has resulted in a preoccupation with the teaching of subjects at the expense of pupil empowerment.

High stakes assessment and accountability mechanisms are powerful influences on what and how teachers teach, imposing pressure to achieve specified outcomes. While almost all jurisdictions recognise, in principle, the importance of teacher capacity and quality, many, especially those concerned with low levels of attainment, have moved towards “scripted instruction” (Sawyer 2004: 13) and a greater reliance on textbooks and curriculum materials. This is to try and ensure consistency and make the curriculum as "teacher-proof” as possible. Local autonomy is accompanied in most countries by formal accountability mechanisms such as the publication of schools’ aims and curriculum and the outcomes of assessments and

examinations and school inspections (where conducted). OECD (2009) discusses the relationship between autonomy and accountability, arguing for autonomy as long as suitable accountability mechanisms are in place. However, for autonomy to be successful requires well-trained and -supported teachers. This argues against frequent changes in the curriculum, however strong the wish to respond to immediate pressures for results.

5.iv Recent curricular initiatives and approaches:

As indicated, one recent trend has been a plethora of initiatives, both in specific subjects and in areas such as social skills and emotional well-being and character development. Many are specific to a particular jurisdiction, supported by official guidance and training, and are not considered here, given the PYP's international nature.

Other initiatives and approaches aim for a broader impact. Many are commercial products, sometimes supported by training, and almost invariably by guidance, increasingly through web-based materials. Some, such as Accelerated Learning and Brain Gym, claim to be based on brain research, though Section 6 questions the validity of claims of this nature. Many such initiatives and those associated with social and emotional development appeal strongly to teachers. Most claim to be appropriate across the primary age range and to have long-term benefits. However, such initiatives are rarely evaluated independently, on a large scale and over several years, making it difficult to judge their success over time, with different age groups and contexts. This is not to say that they are not successful - and much evidence shows that they are perceived to be so, especially in the short-term.

This section neither lists nor seeks to evaluate such initiatives, partly because of space, partly because only more generic approaches which aim to enhance young children's learning across the board are likely to be valuable in implementing worldwide programmes such as the PYP. This section discusses a sample of these which aim to develop children's social and emotional well-being, attributes and values and attitudes towards learning. Such types of approach are likely to be most valuable in implementing the PYP, although these are hard to embed, as they seek to alter deep-rooted ways in which teachers teach and interact with children.

5.iv.i Initiatives and approaches on social and emotional well-being:

The emphasis on young children's well being has led to many initiatives designed to develop children's social and emotional skills (or emotional intelligence, though as Claxton (2005) argues this term has come to mean almost everything other than traditional academic learning). Some are based on nurturing, especially for those children whose behaviour does not conform to expectations, and in some cases working with parents/carers, usually in small groups, outside the regular curriculum. Those considered below are usually based on separate sessions, conducted during social studies (or similar) lessons, often based on games and whole -group discussion.

“Roots of Empathy" is based on monthly visits by an infant and his/her parent(s) as a basis for lessons on emotion understanding, perspective taking, caring for others, and infant

development. It aims to decrease children's aggression and facilitate their social and emotional understanding and pro-social behaviours. Schonert-Reichl et al. (2012), based on a substantial study with 4th to 7th -grade children, indicate significant benefits from teacher reports in relation to aggressive behaviour; and from children's own in relation to why the infant cries and peer nominations of prosocial behaviors, though no changes in empathy and perspective taking.

The Social and Emotional Aspects of Learning (SEAL) approach has been widely adopted in English primary schools. SEAL aims to improve emotional well-being and ability to control emotions; and to reduce bullying. Hallam's (2009) evaluation indicated that it is perceived to have had a significant impact in promoting children's emotional wellbeing and in pupils' ability to control emotions such as anger, although the impact was less in relation to bullying. However, these results were largely based on questionnaires and interviews and Hallam emphasises that the results are inconclusive.

Mindfulness is an approach which aims to change how people think about experiences and reduce stress and anxiety, based on meditation. Weare (2012) claims that two recent systematic reviews and twenty individual studies of mindfulness interventions with school aged children, suggest that well conducted mindfulness interventions can improve the mental, emotional, social and physical health and wellbeing of young people who take part. Other claimed benefits are reduced stress, anxiety, reactivity and bad behaviour, improved sleep and self-esteem, and greater calmness, relaxation, the ability to manage behaviour and emotions, self-awareness and empathy. However, one should note the emphasis on the word 'well-conducted' and be cautious about such a wide-ranging set of claims.

Values-based Education is an approach which, though it can be adapted, involves making explicit a set of universal values, ensuring that these are modelled by adults and using the language of values to help children to internalise how they should act. The approach is often associated with meditation. One distinctive element is that it applies to both children and adults throughout school life. It has been most systematically adopted (over about five years) and evaluated in Australia by Lovat et al., who claim (2009:10) that the work "attests to how a systematic and planned approach to values education can improve students' engagement with schooling and promote better learning outcomes, and enhance their social and emotional wellbeing."

While such evidence may seem positive about the benefits of such approaches, some cautionary notes are necessary. Ecclestone and Hayes (2009) argue that encouraging children (and others) to focus on feelings may lead to a sense of vulnerability. Such approaches tend to emphasise children being happy, in line with positive psychology, discussed further in **6.ii,** rather than learning to process the whole range of emotions. They seem likely to be more appropriate, and easier to sustain, for younger children than for 10-12 year olds. There is little evidence to indicate the extent to which children's attitudes and behaviours outside school are affected. And, above all, success seems contingent on how well such initiatives are implemented.

5.iv.2 Generic pedagogical approaches

Philosophy for Children (P4C) is one of many initiatives to develop thinking skills (see Trickey and Topping 2004 for others). P4C is based on group discussion of questions with no easy answers, emphasising processes such as respectful listening, building on other people's views and disagreeing without confrontation. P4C often takes place in separate sessions, but the skills and attributes which it seeks to develop are applicable across many subject areas. Trickey and Topping (2004)'s systematic review of ten evaluative studies concluded that P4C was beneficial for both talking and listening skills, though the benefits for primary age children are not specifically identified. They point to the potential of P4C across the curriculum but the difficulties of embedding such an approach.

Building Learning Power (Claxton, 2002) is an approach designed to build up generic qualities and attributes, particularly what Claxton calls the 4Rs -resilience, resourcefulness, reciprocity and reflectiveness. This is discussed in Claxton and Carr (2004) and Claxton (2007)'s discussion on "learning to learn", involving attributes and dispositions required for lifelong learning. Others identify similar qualities. For instance CBI (2012:33), an employers' organisation, highlights those such as tenacity, self-control, curiosity, enthusiasm, confidence, respect and sensitivity to global concerns as characteristics, values and habits that last a life time. Hargreaves (2003) argues that the growth of the knowledge economy requires skills, attitudes and dispositions such as creativity, flexibility and teamwork. The overlap with the IB's learner profile will become evident in Section 7.

While such approaches focus on learners, this section concludes with two approaches more focussed on pedagogy. Hattie's (2009) approach called Visible Learning is based on 800 metaanalyses of what enhances achievement. Rather than looking for 'what works', this offers explanatory stories on common aspects of the teacher's role, such as feedback, relationships and making clear what is to be learned. Hattie's conclusions are often counterintuitive. For instance, he writes (2009:4) 'it is the feedback to the teacher about what students can and cannot do that is more powerful than feedback to the student.' One implication is that teachers must pay careful attention to, and welcome, errors as key levers for enhancing learning, and discourage students from being afraid of making mistakes or articulating what they do not know. A secure but challenging classroom climate is essential to enable this. Feedback must be understood as working 'in both directions', not just the teacher making comments. Another example relates to enabling students to be responsible for their own learning. Hattie (2009: 5-6) illustrates this by showing how teachers of Maori students (in New Zealand) enhanced achievement by building on their students' lived experiences outside school and overcoming a widespread tendency to see these in deficit terms and causing disadvantage. While Hattie's work is not specific to 6-12 year olds, it offers valuable insights into the complex relationship between learning and teaching.

Formative assessment is another generic approach, widely used and misused. It is not simply a question of techniques such as traffic lights, where children decide on their level of understanding and the help they require, and setting short-term targets. Black and Wiliam (2009) see formative assessment as involving feedback processes, such as self- and peer-assessment, and self-regulation; with pedagogy designed to encourage this. However, they indicate how hard teachers find formative assessment because asking open questions, waiting

for answers and relinquishing some control of learning runs counter to many behaviours expected of teachers. Such broad approaches make them difficult to evaluate, but Section 7 will argue that these, rather than discrete initiatives, provide a more promising approach in the development of the PYP.

5.v Implications for curriculum design:

This section highlights seven tensions, reflected in recent trends, to be considered in curriculum design and review. These are described as tensions because they have no easy solution. However, in Section 7, relating these to the PYP, it will be argued that these must be resolved with reference to aims and principles; and that some apparent dichotomies are less sharp than they seem, once the research on how young children learn is considered.

Seven tensions in curriculum design

Should the curriculum focus on: 1) academic performance or a broader sense of well-being? 2) "Curriculum 1" or breadth and balance? and 3) content knowledge and skills or concepts and attitudes?

Should the curriculum be: 1) organised by subjects or areas of learning? 2) taught by generalist classteachers or single subject teachers? 3) controlled by the teacher or by the children? and 4) externally prescribed or reliant on teacher autonomy?

The concern with raising levels of attainment in reading, writing and mathematics has tended to lead to a focus on measurable outcomes, on performativity, on Curriculum 1 and on content knowledge and skills. Such trends are especially significant in the context of the marginalisation of the humanities and the arts. These trends, in practice, run counter to how the written curriculum has increasingly in most jurisdictions emphasised a broad sense of well-being and aspects such as citizenship and character. These tensions are illustrated in the first three questions below.

No strong trend is evident in terms of the organisation of the curriculum nor whether it should be taught by generalist or single subject teachers, though the latter often depends on the age of the children and subjects taught. However, the trends have tended in many jurisdictions to result in teachers exercising strong control of what, and how, children learn, with the teacher's role increasingly seen as that of a curriculum-deliverer - someone with limited professional judgement about how the curriculum is taught - rather than a curriculum-creator. These are closely linked to the extent of teacher autonomy, a dilemma to which Giddings (2013) refers as tightness or looseness. These tensions are illustrated in the four questions in the second block below.

Before considering these in relation to the PYP, the next section explores the research from the developmental sciences.

6 Research in the developmental sciences

6.i Approaching the research:

This section considers the implications for the primary curriculum of a very substantial body of literature from research in the developmental sciences, including several different but linked disciplines. Many studies are in areas where there is considerable debate about the underlying assumptions, notably the relationship between brain and mind, involving complex issues in philosophy of mind. Although there is no space to summarise such debates, one should at least be aware that this remains contested, often poorly understood, territory.

Hall (2005: 1/2) distinguishes between three types of study, namely; 1) "neuroscience concerned with the structure, organisation and development of the brain as a physical organism"; 2) psychology, where the brain is "studied experimentally from the outside"; and 3) "the practical application of knowledge about human behaviour to promote effective teaching and learning."

This is used to structure this section. **6.ii** discusses the research from neuroscience applicable to young children's learning, usually called neuroeducational research, including studies from a philosophical perspective. **6.iii** considers the findings from different psychological disciplines, highlighting those deemed most significant in the primary years. **6.iv** summarises key points from the whole section to identify lessons most relevant to the primary curriculum.

Before considering the research, two cautionary notes are necessary.

6.i.1 A bridge too far?

Much of the literature, such as Howard-Jones (2008) and Tommerdahl (2010), emphasises the difficulty of making direct links between the findings of neuroscience and specific educational initiatives or curricula. Bruer (1997) described this as "a bridge too far", with Hall (2005: 2) arguing that "it is a very long journey from a discovery about the physiology or organisation of the brain to a practical application in a classroom."

The techniques and instruments for studying how the brain works have become increasingly sophisticated in recent years, with neuroimaging technology enabling neuroscientists to see which areas are activated by different actions. However, in Bennett and Hacker's (2003:405) words, "neuroscience can investigate synaptic connections, but not conceptual ones." So one should be wary of thinking that the techniques showing areas of activity in the brain give more than a preliminary hint about learning, let alone how best to facilitate this for a whole class.

Blakemore and Frith (2005:88) emphasise that "one of the important lessons of brain research is that the behaviour that you see on the surface can have very different causes." Goswami (2011:3), while recognising the brain's plasticity, suggests that there is considerable

similarity in patterns of cognitive development across cultures and social contexts. However, explanations of children's behaviour are strongly conditioned by cultural assumptions. As Davis (2004:32) suggests, "behavioural symptoms associated with particular conditions become salient only in relation to particular cultural beliefs and practices." So, behaviours which would be acceptable, or encouraged, in one situation, or culture, may be regarded as inappropriate in another. A good example is attention deficit hyperactivity disorder (ADHD), involving significant difficulties of inattention or hyperactivity or both, often resulting in disruptive behaviour. Timimi (2005) suggests a diagnosis of ADHD is largely associated with children being expected to sit still. So, how behaviours are understood, and responded to, vary according to context.

The neuroeducational research suggests that knowledge of how the brain works explains more about problems and difficulties than solutions, especially in teaching a whole class, rather than an individual. For example, addressing the needs of a child with dyslexia or on the autistic spectrum, is difficult with individual attention, but even more so in a class. So, as stated in OECD (2007: 148), "while neuroscience can provide valuable insights into learning, it is important to recognise its limitations. Educators should be cautious when transferring results from controlled laboratory settings to the complex classroom."

Educators are far keener to claim a neuroscientific basis for initiatives and materials than neuroscientists are to make claims about the wider application of their work. Teachers often show considerable enthusiasm for what can be learned from knowledge of brain structure and function. As Howard-Jones (2010:1) comments, "this enthusiasm … brings with it dangers as evidenced by the long-running success of entrepreneurs in constructing and generating unscientific and unevaluated brain-based pedagogy."

As indicated, many initiatives and materials claim to be based on brain-based research. While these may have some basis in research, the results are often generalised beyond what can be justified. Such initiatives should be carefully evaluated, since many variables affect how they are implemented. This report does not evaluate specific materials but discusses what OECD (2007) (and others) have described as "neuromyths": claims about brain structure and function which, however attractive, cannot be justified by neuroscientific research. Neuromyths may lead educators to adopt approaches which are at best a distraction and, in some cases, can be damaging.

6.i.2 Possible ethical implications

OECD (2007) raises questions about the ethics of how neuroscientific research is carried out and used. One example is that, even though the technology has become less invasive and potentially upsetting, the ethics of placing young children in scanners and gaining informed consent remain problematic. A second is that Howard-Jones (in Patten and Campbell, 2011) warns against medicalising issues in our quest for understanding educational issues. One practical example relates to how medical diagnoses of ADHD are made and medication prescribed, with this affecting disproportionately boys and children from socio-economically disadvantaged backgrounds. A third is whether, as Stein and Fischer (in Patten and Campbell, 2011) ask, appropriate remediation or support will be available equitably if neuroscience can

find a correlation of genetic sequences with dyslexia or ADHD. So, applying neuroeducational research has considerable ethical implications.

6.ii Lessons from neuroeducational research:

While teachers may find it interesting and useful to understand brain structure, Geake (2009: 86) indicates that "brain function rather than structure is the more relevant aspect for educational neuroscientific research." While it is unnecessary, in this context, to know much about how the brain works, a brief description of key processes and terms may be useful (see Howard-Jones (2007), from which the following summary is drawn, for a clear and simple explanation).

Brain structure and function

The adult brain contains some 100 billion brain cells, or neurons, consisting of a cell body, to which are connected dendrites and an axon. These are connected to other neurons by synapses, creating complex neural networks. This enables electric signals to be passed down the axons. However, the process that allows signals to pass through the synapses is chemical, involving substances known as neurotransmitters.

The brain stem is crucial in processing emotion. Different types of memory rely on different neural systems. The structure of the brain is hierarchical, in the sense that the brain stem develops first, with other areas such as the cortex developing throughout childhood and beyond. For instance, Blakemore and Frith (2005: 145) indicate that performance in memory tests is linked to the development of the pre-frontal cortex. This helps to explain why some tasks are difficult, or impossible, for young children. While the left hemisphere is mainly concerned with verbal and the right hemisphere with spatial processing, most learning requires the interaction of many areas of the brain. Clark (2006:373) describes the brain as "a vast, parallel coalition of more or less influential forces whose unfolding makes each of us into the thinking beings that we are."

Early brain development involves the growth in the number of synapses and therefore connections. While synaptogenesis - the growth of synapses - occurs at a faster rate among children than adults, so also does synaptic pruning, in which infrequently used connections are eliminated. So, in a sense the phrase "use it or lose it" is accurate.

While the number of synapses grows rapidly in infancy, there is subsequently considerable pruning; and structural changes, including synaptogenesis and pruning, continue well into adolescence. The process of synaptic generation and pruning continues in a more restricted manner throughout the lifespan. While damage to a particular area of the brain may cause irreversible damage, most problems of brain function are temporary and reversible.

6.ii.1 Emotion and cognition

Neuroimaging studies suggest that emotions and thoughts operate within different neural networks. Patten (in Patten and Campbell 2011) indicates that emotions involve many more brain systems than thoughts do and that emotions perform the first level of appraisal for incoming stimuli. In discussing emotions, Patten distinguishes between: 1) *dispositions* (though this term is used differently in other contexts) which are primitive, unconscious and basic to survival; 2) *basic or primary emotion*s such as sadness, fear, anger, disgust and perhaps surprise which are largely innate and instinctive, not relying on "development for emergence nor on cognitive appraisal for their activation"; and 3) *feelings,* such as shame, guilt, jealousy and pride, which have a cognitive and a cultural element.

Emotional processes operate more quickly than conscious ones. These affect each other, with conscious cognitive processes usually able, as children mature, to override emotional responses but emotion often hindering conscious processes. As Geake writes (2009:115), "the principle that emotions are critically involved in learning at a neural level supports the behavioural observations of teachers over the centuries. There is a bi-directional dependency: aspects of emotion rely on cognition and aspects of cognition rely on emotion." He adds that many brain processes are unconscious unless one is "on the lookout for them" to exercise conscious control.

6.ii.2 Basic learning mechanisms

Goswami and Bryant (2010), providing an overview of brain structure and function and the implications for the primary years, identify four learning mechanisms: 1) what they (somewhat confusingly) call "statistical learning", in which neural networks are built, categorising visual and auditory stimuli on the basis of prototypes, or similarities, a process which is unconscious and continues throughout life; 2) imitation; 3) the use of analogy; and 4) causal learning, where explanations and reasons are consciously worked out. These are not sequential, but operate at all ages, though during the primary years children become more sophisticated users of causal learning.

The importance of statistical learning mechanisms indicates that much learning occurs through unconscious and automatic processes. Goswami and Bryant (2010) emphasise that frequent repetition helps to build neural networks, leading to automatic, non-conscious responses, which become "second nature", as with popular terms such as muscle memory.

How imitative processes work remains a matter of debate. A body of research (such as Rizzolatti and Craighero, 2004) has suggested that mirror neurons may play a major role in human learning, as they do in monkeys. Put simply, mirror neurons are triggered both when an action is performed and when it is observed in another person. So, in Blakemore and Frith's (2005:161) words, "by observing an action, your brain has already prepared to copy it." This could help explain why learning from observation is often easier than learning from verbal descriptions; and how even very young children learn through observation. However, the existence of mirror neurons in humans remains a matter of considerable controversy. Since learning is reciprocal, feedback encourages, or otherwise, particular responses, for example by a smile, a gesture or spoken language, both in what is said and in tone. Put simply,

young children tend to do more of what adults attend to, indicating the significance of adults modelling and re-inforcing, or discouraging, behaviours.

Neuorimaging indicates that many areas of the brain are activated when analogies are made. Geake (2009:96) writes that "the essence of intelligent behaviour lies in making insightful metaphors and analogies." He continues "insightful analogy is necessary for success in a wide range of educational endeavours, including pattern recognition, composition of musical variations, producing and appreciating humour, translation between languages, poetry, classroom exercise and much of everyday speech."

Causal, conscious learning mechanisms are slower and more deliberate than emotional responses, involving executive function - that is inhibitory control or self-regulation, so that one gains conscious control over thoughts, feelings and behaviours. Goswami (2008: 216-7) indicated that at that date there were no cognitive neuroscientific studies of causal reasoning in children, but suggested (2008: 219) from adult studies that improvements in metacognition - being aware of one's own learning processes - enable naive misconceptions - that is previous, less sophisticated understandings - "stored" in the brain to be inhibited.

Different memory systems receive and process information in different ways and this information is processed through distinct, though sometimes, overlapping neural systems. So, it is not advisable to consider one part of the brain as being solely responsible for any one task and the ideas that we use only a small part of the brain or that different parts - such as the left or right hemisphere - are entirely responsible for particular aspects of brain function are neuromyths.

6.ii.3 What the brain requires to function normally

Two important questions are the extent to which: 1) deprivation inhibits healthy brain development and function and 2) enrichment can accelerate or enhance such development.

Blakemore and Frith (2005:35) answer this to some extent writing: "to put it simply, deprived environments are never good for your brain. Deprivation is certainly bad for the brain; on the other hand, enrichment may not necessarily be good for the brain."

The research provides more insights into what is bad for the brain than what enables it to function better or quicker. Parents naturally wish to help their children to do well; and may assume that an enriched environment will help to accelerate learning. The research does not support ideas such as "more stimulation is better" or "the earlier the better." Indeed, Geake writes (2009:52) "the 'natural' environment of most children in Western societies is, if anything, over-stimulating. This is why hot-housing has only been shown to improve cognition in socially deprived children, and then only as a means of catching up to age norms." Exposure to a wide range of experiences and language - and the chance to integrate these into patterns meaningful to the learner - seems more likely to be beneficial in the long run than intensive interventions designed to accelerate particular types of learning.

Neuroscientific research emphasises the role of chemicals in regulating brain function. This can be altered temporarily by chemicals externally administered or those within the body. At the extreme end, toxic substances such as alcohol can cause irreversible brain damage, even for a foetus. Spratt et al. (2012) provide a psychological perspective on the effect of early neglect, concluding that children who have experienced this are vulnerable to cognitive, language and behavioural difficulties.

Blakemore and Frith (2005:158/9) write "optimal learning occurs under a certain level of stress, but too much stress impairs learning." Too little stress results in complacency and too much in unfocussed anxiety, tending to impair working memory (the processes used to store, organize and manipulate information temporarily), decrease one's ability to prioritise and weaken creative thinking, reducing one's ability to make conscious choice and self-regulate. For 6-12 year olds, whose working memory tends to be less efficient than older students', especially when struggling with new ideas, this will tend to reduce executive function and limit the range of learning mechanisms available.

Usually, such responses are temporary and brain function returns to normal. So, for children whose conscious, self-regulatory processes are not working well because of anxiety, the level of stress must be reduced. However, repeated, regular stress leads to the brain becoming habituated to chemical inputs, damaging the brain's normal regulatory mechanisms in some children, so that they require intensive support in an environment to enable these to be repaired.

Blakemore and Frith (2005: 167- 175) emphasise that normal brain function depends on regular routines of sleeping, exercise, eating and drinking. Sleep seems to enable processes such as the consolidation of long-term memory; and a lack of sleep is likely to affect the child's ability to concentrate and use working memory. The brain needs physical exercise to operate at an optimal level. In part, this ensures an adequate level of blood flow and oxygen, though chemicals known as endorphins which help to encourage a good mood are released through exercise.

Bellisle (2004) suggests that good, regular dietary habits are probably the most important nutritional issue influencing educational performance and achievement. While there is a continuing debate about the possible benefit of additives, such as Omega 3 fish oils, the evidence is clearer about chemicals which affect brain function adversely. Howard-Jones (2007:10) reports on a study showing that 9-10 year children who habitually consumed no more than two cans of cola (containing caffeine) a day demonstrated decreased alertness relative to low users. This alertness only returns to baseline levels with more caffeine and then only temporarily. A lack of adequate food or water over a long period is detrimental to brain development, but there is no evidence to suggest that eating when not hungry or drinking water when not thirsty enhances brain function. In short, the evidence suggests that children should normally respond to bodily signals as to what the brain requires, although they may need to be reminded to do so.

The brain is a largely self-regulating and very adaptable system. However, normal developmental processes are likely to be hindered by sensory and motor impairments, and communication difficulties, possibly leading to a reduced sense of agency and motivation. This points the need for early identification and where possible remediation of such impairments, or of specific support to ensure that the brain adapts to use other mechanisms.

The brain does not function in isolation from the environment. For instance, Geake (2009: 8), discussing whether girls' and boys' brain differ, writes “mostly no, but in many important respects definitely yes- both structurally and functionally.” He reports some differences of brain size and structures, but emphasises that, since brain function is influenced by external influences, understanding the role of culture is necessary to know in what ways boys and girls learn differently. For example, girls are generally better than boys at inhibitory control and paying attention. There is some evidence of boys as a group being better at mathematics and less keen on reading. While there may be some genetic basis for such gender differences, cultural norms and expectations both within the family and community and in the school environment, appear to exercise a much stronger influence.

6.ii.4 Are there critical periods in brain development?

For many years, the idea that there are critical periods in brain development, notably the earliest years, held sway. As Hall (2005:2-3) indicates, such a view is based largely on sensory deprivation studies in animals and the assumption that maximum synaptogenesis corresponds with the most learning is not supported by research. He states (2005:3) that “neuroscientists identify instead (of critical periods) certain types of learning when the brain seems to be primed for particular types of input” and that these are not confined to the early years of childhood and are not as dramatically critical as some proponents originally believed. Hall continues "skills and abilities which are naturally evolved in humans appear to be more prone to sensitive periods of development than culturally transmitted knowledge." What he calls "experience expectant learning" occurs where the brain expects visual, tactile or auditory stimuli, with sensitive periods when the brain is particularly ready to respond to these stimuli. In contrast, "experience dependent learning” will only occur if the need arises, tending to be of the sort featuring in culturally transmitted knowledge systems. So, some types of learning occur "naturally" when the brain is "ready", others only with the appropriate external input. This may help to explain the importance of recognising developmental stages in some respects, but of not seeing these as sequential and fixed.

Though many learning processes are similar throughout the life span, the primary years are vital for developing the ability to self-regulate thoughts, feelings and behaviours and increase the efficiency of working memory and attention. While some aspects depend on brain structure, and age tends to lead to improved self-regulation, the development of thoughts, feelings and behaviours is too closely linked to suggest that these should be seen sequentially.

Some skills, such as learning a musical instrument and languages, are best learned before the age of around 12 or 13. Geake (2009:52) writes "our ability to learn second languages, as opposed to most other subjects, declines with age. Musical abilities often show a similar age

relation." In relation to learning a language, this applies more to grammar and accent (in an additional language) than to vocabulary.

6.ii.5 Specific developmental disorders

As Ferrari (in Patten and Campbell 2011:30) writes, neuroscientific research provides more insights into "atypical performances of students with special needs" such as dyslexia, dyscalculia, the autistic spectrum and ADHD than into usual patterns of learning. This section provides a very brief overview, given the huge complexity of these issues and this review's focus on the curriculum.

Dyslexia involves a difficulty in learning to read fluently and with accurate comprehension; and often spelling, linked especially with phonological problems. However, in Blakemore and Frith's (2005: 88), words, "there are many reasons for difficulties in learning to read and write, other than a subtle abnormality in brain development." They mention emotional and social difficulties, and the value of early intervention before negative feelings about written language build up. Similar considerations apply to dyscalculia which entails difficulties with mathematics, such as understanding and learning how to manipulate numbers. Goswami and Bryant (2010: 159) indicate that dyscalculia is often associated with an early difficulty in counting and a lack of experience or understanding of counting in sequence. For older children to be expected to develop computational skills without this is likely to prove difficult and demotivating. More detailed discussions, from a cognitive neuroscience perspective, are in Goswami (2010) on dyslexia and Kaufmann (2010) on dyscalculia.

Snowling et al. (Bishop et al. 2008:13) describe an "autistic spectrum of disorders sharing core features of social impairment" rather than autism as such. The autistic spectrum includes a wide range of children who have difficulty in mentalising other people's emotions and thoughts, though their levels of attainment vary considerably. Such children usually find interpreting other people's behaviour and respond very literally to instructions. The reasons and proposed solutions remain a matter of considerable debate.

Neuroscientific research increasingly suggests that dyslexia, though understood and diagnosed differently according to language and cultural systems, and the autistic spectrum have a strong genetic basis. Yet, as Bishop states, (Bishop et al. 2008:17) research is a "long way away from understanding the neurobiological basis of autism":a comment also true of dyslexia.

ADHD is characterized by significant difficulties of inattention or hyperactivity or a combination of the two. This often results in disruptive behaviour in school, with ADHD increasingly diagnosed as a medical condition, so that significant numbers of young children are treated with medication such as ritalin, which is (counterintuitively) a stimulant which stops excessive dopamine reaching the basal ganglia and so speeds up inhibitory processes. Such medication can help children to control behaviour, but affects working memory, which may reduce the longer-term ability to self-regulate. As indicated above, such a diagnosis and treatment has significant ethical implications.

All these developmental disorders can be ameliorated by interventions to encourage appropriate responses to be become habitual. In particular, given how anxiety affects conscious processes, children on the autistic spectrum and with attention-related difficulties are likely to benefit from opportunities to practice social and communication skills in a small group.

6.iii Lessons from psychology and other developmental sciences:

The neuroeducational research warns against too definite an interpretation of behaviours in terms of brain structure or development. As Della Sala and Anderson (2012:3) suggest, “it is cognitive psychology that does all the useful work or 'heavy lifting' to try and bridge the gap between how the brain works and how to teach.” This section draws out key lessons for the written and taught curriculum for 6-12 year olds from a huge body of research in psychology and associated fields. It is arranged thematically on generic issues related to learning and teaching.

6.iii.1 Agency, engagement and motivation

OECD (2011), looking at successful educational systems worldwide, re-affirms the value of learners being actively engaged. This recalls Bruner's emphasis on agency and how from an early age children are meaning-makers, trying to make sense of experience, with learning an active, interactive and reciprocal process. In Papert's (1999) words, “children have real understanding only of that which they invent themselves and each time we try to teach them something too quickly we keep them from re-inventing it themselves.” This supports the constructivist view on which the PYP is based.

The Teaching and Learning Programme (TLRP), a large scale research programme across all phases, concluded (2006) that "more prominence needs to be given to the importance of learning relationships throughout the life cycle." Attachment theory (see Goldberg 2000) emphasises that how the prime carer -usually the mother - responds affects how babies learn to control their responses. In brief, models of attachment may be secure or insecure, with the latter usually divided into avoidant, anxious (or resistant) and disorganised. While there is considerable debate about the extent to which models of attachment affect later learning, in Salzberger-Wittenberg et al.'s words (1983: ix), “our learning, in infancy and for a considerable period, takes place within a dependent relationship to another human being. It is the quality of the relationship which deeply influences the hopefulness required to remain curious and open to new experiences, the capacity to perceive connections and to discover their meaning.” Donaldson (1992) emphasised the importance of the context and relationship between the child and the person setting the task in determining success. Recent work in cognitive psychology has focussed less on relationships, possibly because their impact is difficult to quantify, but the role of predictable and caring relationships in engaging and motivating primary- age children, especially in emotionally or cognitively challenging situations, should be remembered.

Haun and Tomasello (2011) emphasise the strength of human desire to conform and for social approval. The approval of trusted adults is a stronger influence on children's behaviour and attitudes in the younger part of the 6-12 age group, the peer group increasingly so in the older part. Extrinsic factors such as targets and the desire for approval or reward and the fear of punishment are often strong motivators for 6-12 year olds. Reliance on rewards or grades tends to enhance ego - rather than task- related involvement (see Dweck, 2000) . Both academic learning and character development require intrinsic motivation, if children are to become autonomous, self-motivated learners. The primary years are an important time for children to set their own targets if they are to become autonomous learners. This requires habituation, with an increasing use of self-regulating processes, implying that children -and teachers- should try to reduce reliance on extrinsic motivators and devise activities where children have an increasing control of learning processes and outcomes.

The proponents of positive psychology claim to use psychological theory, research and intervention techniques to understand the positive, adaptive, creative and emotionally fulfilling aspects of human behaviour; and to find and nurture genius and talent, based on neuroscientific studies of happiness and sadness. Such aims and ideas have a strong emotional appeal, providing the basis of many approaches to foster well-being. Gable and Haidt's (2005) description and critique of positive psychology, emphasises the lack of effective interventions based on this. An underlying assumption seems to be that if children are happy and optimistic they will learn well. While happiness may help children to learn, this is not enough in itself. Learning requires attention and persistence, with an appropriate level of challenge and support, with the level varying not only according to the age of the child and nature of the task but other social, cultural and individual factors.

TLRP (2006) also concluded that "the conception of what is to be learned needs to be broadened beyond the notions of curricula and subjects associated with schools." A tradition of research (see Hogg, 2011) emphasises that school learning too often does not draw on children's "funds of knowledge" - what they bring from experience outside school - and that doing so is especially motivating for those disengaged from school learning. This implies that linking what is to be learned in school with children's wider life experiences and knowledge is important in curriculum design and implementation, for instance in drawing on the group's existing information and experience in planning an inquiry.

6.iii.2 Memory and metacognition

Cognitive psychologists categorise memory as: 1) non-declarative, which is implicit, not involving conscious mechanisms and 2) declarative, with two types, episodic (of events in one's own past) and semantic (more general, involving words and concepts), which involve more conscious processes, with working memory essential to enable these.

Much learning in non-declarative memory happens by habituation and repetition, supporting the old adage that practice makes perfect, though what is practiced must accord with what is to be achieved. However, declarative memory needs both to be encoded and retrieved. Long-term memory is developed in part unconsciously, in part through conscious processing. As Cowan (2012) indicates, working memory is vital to enable the learner to attend to a range of

information. Reasoning, in particular, makes considerable demands on working memory and attention, helping to explain why young children find this difficult. Summarising Cowan's previous work, Geake (2009:72) writes "working memory combines information with the perceptual here and now with information from long-term memory, under attentional selection for what is relevant to the task in hand." However, this is affected by the individual's storage capacity and filtering efficiency (that is the ability to remember information in usable chunks). Both of these tend to improve with practice and as children become older.

Metacognition - being aware of and controlling one's own learning processes- involves a type of monitoring during a task which enables learners to take (at least some) control of how they learn and deliberately and consciously adapt their approach. This is strongly associated with self-regulation and inhibition of emotional responses, for which the primary years are an important time. Bialystok and Craik (2010) offer some support for the view that bi- and multi-lingualism is associated with improved metacognition as a result of the awareness that the meaning of a concept or idea is not attached to a particular word.

6.iii.3 Ways of representing experience and learning concepts

The 6-12 age group roughly co-incides with what the psychoanalytic tradition calls the latency stage, a time of relative stability before the turbulence of adolescence; and what Piaget described as the concrete operational stage, during which he believed children remained focussed largely on themselves, found it difficult to recognise other people's perspectives and could not engage in abstract reasoning. Donaldson (1992) demonstrated experimentally that young children can, in the right context, think in more sophisticated ways than Piaget's decontextualised tests and theories based on fixed, sequential stages suggested. Her research indicated that children gradually become able to operate in different modes but factors such as the nature of the task, the context and the support and guidance available should determine which mode is most suitable. This implies that teachers should encourage children to use different modes of representation and guide them to select those most suitable for the task.

Bruner categorises modes of representation as enactive, visual and symbolic, including language. As Vygotsky demonstrated (see Daniels, 2005), language is the vital symbolic tool to enhance cognition and develop the concepts which enable generalised and abstract thought; and learning takes place together (intermentally) before it is internalised intramentally. As Goswami and Bryant (2010:143) state, "social interaction plays a critical role in perceptual learning", continues that for children verbal mediation is not enough and that "shared activity is required to mediate the child's acquisition, mastery and internalisation of new content." This emphasises the value of children using both spoken language and other forms of representing experience throughout the primary years (and beyond).

Questioning, to focus attention, and retrieval - the active, cue-driven process of reconstructing knowledge - help to improve encoding in memory. Karpicke and Blunt (2011:774) write that "retrieval is not merely a readout of the knowledge stored in one's mind; the act of reconstructing knowledge itself enhances learning." Retrieving information and representing it in ways meaningful to the learner help to develop abstract and conceptual thinking and to fix this in long-term memory. While retrieval can occur using different means of representation, spoken

language is the one used most commonly. Teachers have long recognised the importance of talk, but the focus has often been on teacher talk. There is an increasing recognition (e.g. Mercer 2000 and Myhill et al. 2006) of the value of children listening carefully to others and talking confidently, using focussed and structured dialogue. While most 6-12 year olds learn to use spoken language with increasing fluency, they often find it hard to do so in large groups because of embarrassment and worries about being made to feel foolish. The chance to rehearse one's ideas often helps.

Derry (2007: 54) highlights an overlooked element of Vygotsky's research, citing his words "direct instruction in concepts is impossible... The teacher who attempts to use the approach achieves nothing but a mindless learning of words." Concepts are learned by recognising analogies and links, rather than being taught them as separate entities. Karpicke and Blunt (2011) suggest that more learning of concepts, albeit with undergraduates, occurs with retrieval than with elaborate studying with concept mapping. However, the psychological evidence remains inconclusive about how concepts are formed.

The idea of visual, auditory or kinaesthetic learners (VAK) gained some credence among teachers, but has been misused to label children as having one particular learning style, and so not needing to use others. There is a strong consensus (e.g. Geake 2008, Sharp et al. 2008) that the idea that individuals have one particular learning style is a neuromyth which can be damaging, though an individual may find a particular representation of experience more helpful than others. Rather, learning is enhanced by different sorts of representation, not only through language but through action and visual representation, especially when the learner is unfamiliar with the material and concepts involved. This is accorded with the conclusion from neuroeducational research that learning is enhanced by tasks and ideas being represented in multiple ways and provides a rationale for activities such as art, music and drama being prominent in the primary curriculum.

6.iii.4 Theory of mind and empathy

Developing an understanding of other people's thoughts, feelings and behaviour is often called theory of mind, the capacity to attribute wishes, feelings and beliefs to other people to explain their behaviour. As Fox (2005:106) indicates, "knowing that someone else has different beliefs and different desires to yours is fundamental to understanding their actions." This requires a level of empathy which is a vaccine against, and antidote to, egocentricity. As Nussbaum (2010) indicates, empathy involves imagination, to interpret cues, especially about feelings, and to understand other people's perspectives. This is hard for young children, since they are often pre-occupied with themselves. Noddings (2003) suggests that developing empathy requires opportunities to care-for others as well as to be cared-for. For children to develop qualities such as empathy and compassion seems to require practice and, at times, explicit messages and examples, and reflection, to indicate what these entail. This implies that cognitive processes may help children in the primary years to understand what such terms mean, but that practical application of these, across and beyond the formal curriculum, is necessary to embed these; and to counter social pressures which discourage such actions.

Dowling (2010: 90) indicates that children learn to recognise the meaning behind people's actions and understand more complex emotions -in themselves and others- only gradually, starting with those whom they know well. This is unsurprising, given the extent to which basic emotions are largely unconscious, while feelings have a cognitive element. Beck et al. (2012) indicate the close link between language and emotional competence in middle childhood. However, for children to understand how other people feel may not always be beneficial. Sutton et al. (1999) indicate that some bullies have a well developed theory of mind enabling them to know how best to upset others. The question of which behaviours and responses are to be encouraged is always underpinned by aims and values.

Rowley et al. (2007) suggest that stereotypes about others are becoming more embedded by the age of 9 or 10. So, attempts to promote thoughtful attitudes towards those who are different and to challenge stereotypes are particularly important by this age. The interlinked nature of emotion and cognition suggests that this requires not only factual information but a range of experiences to help children understand the world from perspectives other than their own.

6.iii.5 Intelligence and mindsets

The idea that intelligence is fixed and can be measured reliably through IQ tests has long been discredited. As Sternberg (2011: 758) writes, "intelligent children know their own strengths and weaknesses and find ways to capitalise on their strengths and either to compensate for or correct their weaknesses." Gardner's work (1993) on multiple intelligences suggested understanding intelligence more broadly than verbal and mathematical reasoning to include aspects such as musical, artistic and intra- and inter-personal intelligence. While multiple intelligences has been called a neuromyth, this is so only if different activities are thought to be dependent only on discrete areas of the brain. If seen more as a metaphor, multiple intelligences helps to create a broad sense of human potential and to value a wide range of qualities.

Dweck's (2000) work on ability has become increasingly influential. She challenges (2000: 1-2) the belief that what she calls mastery-oriented qualities, similar to the attributes of successful learners: 1) are more likely to be displayed by children with high ability; 2) are directly fostered by success in school; or 3) depend on children's confidence in their intelligence.

Dweck uses the terms fixed and growth mindsets to describe, respectively, the belief that achievement depends on inherent ability, which cannot be altered, and that it can be improved, for instance with more persistence, experience or support. While achievement depends to some extent on a high level of self-esteem - a belief that one can succeed - Dweck argues that a growth mindset matters more than success as such. Cowan (2012:123) provides a practical example, suggesting that Asian children tend to be better at maths than those in the United States, because the former believe that when unsuccessful they must work harder and the latter attribute this to just not being good at mathematics.

Dweck advocates praising children for behaviours associated with mastery-oriented qualities rather than for intelligence or the completion of easy tasks. She writes (2000:2) "far from instilling confidence ... praise (for smartness) can lead students to fear failure, avoid risks, doubt

themselves when they fail, and cope poorly with setbacks" unless they maintain a growth mindset. While a low level of self-esteem leads easily to disengagement, "self-esteem is much more potent when it is won through striving whole-heartedly for worthwhile ends, rather than derived from praise, especially praise that may be only loosely related to actual achievement", as Claxton (2005: 17) argues. So, feedback should not consist simply of constant praise, regardless of effort, which can easily lead children not to recognise the need for hard work and persistence.

6.iv Key points relevant to the primary curriculum:

This list highlights from the research in the developmental sciences those aspects most relevant to curriculum design and implementation for the 6-12 age group, will be related to the PYP in Section 7.

- the close link between emotion and cognition emphasises that children need to feel safe but to be challenged in a wide variety of situations;
- sensory and communication difficulties need to be identified and, where possible, remedied early to allow normal developmental processes to occur;
- while learning activities should be age-appropriate, this should not be seen too sequentially and will differ between subject areas;
- while motivation is based on multiple factors, the primary years are a crucial time for developing self-regulatory processes and intrinsic motivation;
- while primary-aged children become increasingly confident users of spoken and written language, they still benefit from varied ways of representing experience;
- the primary years are important in understanding other people's emotions and in consciously developing qualities such as empathy and challenging stereotypical attitudes;
- some skills, notably to do with language learning and music, are best learned before the age of about 13**.**

7 Possible implications for a review of the Primary Years Programme

This section identifies possible lessons for a review of the PYP from the analysis of trends, influences and initiatives and recent research in the developmental sciences. It considers how the main features of the PYP identified in Section 4 reflect, and may be affected by, these, to identify key principles, concepts and approaches; and opportunities and challenges. Such a review must take account especially of the social and cultural trends outlined in 5.i and of the research discussed in Section 6**.** However, the curriculum must be based on, and led by, aims and principles, recalling the warnings against short-term initiatives and policy-borrowing; and recognise pressures likely to make it hard to implement the written curriculum in some jurisdictions, given the IB's mission and wish for a curriculum which can be implemented within different jurisdictions.

7.i The impact of social and cultural change

Changes to children's lives outside school make new demands of teachers. For instance, building resilience requires opportunities to make mistakes and overcome difficulties, with appropriate support and feedback; but resilience is likely to be reduced if adults are over-protective or praise too freely given. This suggests that children should learn to be "risk-takers", and develop strategies to manage risk, though protected from the emotional cost of repeated failure. Increased individualism may mean that 6-12 year olds will find it harder to develop empathy, so that teachers will need to look for new ways to encourage this across the curriculum, especially through the humanities and drama and opportunities to 'care-for'. Greater public awareness of, and concern about, trends such as globalisation, environmental damage and climate change presents opportunities to consider such issues in meaningful ways, though these should be related where possible to children's own lives and experience. The "busyness" of many children's lives makes providing space for enquiry and reflection essential. The reduced deference towards teachers, and the need for tasks to be meaningful, argues for teachers to make the purpose of tasks explicit, but without constraining children's opportunities to take these in directions the teacher may not have anticipated.

Putnam (2000), in discussing the breakdown in social cohesion in the United States, describes as what holds together similar people "bonding" capital. He calls working with, and understanding people who are different "bridging" capital. The IB's emphasis on global citizenship suggests the need to build both types and promote an increased understanding of both similarity and difference across and within cultures. This requires work in the primary years to challenge stereotypes, both at a cognitive level and, for instance, in how enquiries are set up and how work in groups is organised. More emphasis on promoting a greater understanding of religious belief and practice may be valuable.

7.ii The impact of technological change

The rapid change in recent years in technology and communications, and how these are used, with further change inevitable, has considerable social and educational implications. A revised curriculum must assume that almost all children will be digital natives and enable them to use technology appropriately.

The spread of information technology has made possible widespread access to the internet and mobile phones, even for children in the 6-12 age range. This provides all children and teachers with increasingly easy and immediate access to a wide range of information and creates new possibilities for those locations where getting to school may be very difficult. Children often spend long periods in front of a computer screen, notably with the increased popularity of computer games. Mobile phones and the internet have altered how many children, especially adolescents and those in the older part of the 6-12 year old group, communicate with, and relate to, each other, encouraging instant response. The rise of social media has blurred the boundary between public and private space.

Concerns about young children viewing images deemed to be unsuitable, because of violence or sex, and a loss of contact with the natural world are widespread. Anderson et al.'s

metanalysis (2010) concludes that exposure to violent video games is a causal risk factor for increased aggressive behaviour, cognition and affect and for decreased empathy and prosocial behavior. Swing et al. (2010)'s study of 6-12 year old children concluded that viewing television and playing video games each are associated with increased attention problems. It is often thought that the anonymity afforded by the internet may encourage people, especially adolescents, to write what they would not say face to face and not to recognise that what is said there is public. However, no research on this in middle childhood has been found. Such considerations emphasise the role of teachers in protecting children - and helping them protect themselves - from harm in their own use of new technologies and other' people's use. This suggests the incorporation in the curriculum of specific work on issues such as internet safety and cyberbullying.

Technological innovation presents considerable opportunities, for instance in easy access to a wide range of material and information and the chance to use photographs, video and other media with great ease and flexibility from an early age; and making it easier to link with children and schools in other parts of the world. Technology has the potential to enrich children's learning in most curricular areas and transform how some subjects such as art and music, and aspects of mathematics, are taught. It may become increasingly valuable to support some children with learning difficulties, to teach specific skills and to motivate reluctant learners. However, memorising information may come to matter less and deciding on its validity and reliability more so. Technology's value for teachers depends on how it is used. Hennessy and London (2013:12), while recognising the great possibilities of interactive whiteboards for encouraging involvement, indicate that they can lead to transmissive style of teaching,with students “increasingly reduced to a largely spectator role.” While online materials can help to provide access to education to those in remote locations, the evidence in Section 6 emphasised the importance, for young children, of relationships and social interaction. So, one should be cautious of personalised learning if interpreted to mean solitary learning, rather than activities and experiences adapted to individuals' interests and needs.

7.iii Resolving the tensions in curriculum design

This section considers the seven tensions highlighted in **4.v** and how these can be resolved in the light of the research and the aims and principles underlying the PYP.

Academic performance or a broader sense of well-being?

The content of the written curriculum has shown considerable convergence, worldwide, with increasing emphasis on the whole child and aspects such as well-being and citizenship. However, the pressures associated with measurable outcomes have tended towards fragmentation into separate subjects and short-term objectives, rather than meeting multiple and long-term aims. The emphasis of the PYP on global citizenship and intercultural understanding makes long-term aims, related to attitudes and values, and curricular coherence, so that the whole curriculum works towards meeting these, essential.

Neuroscientific research has highlighted the close link between emotion and cognition and the link between non-conscious and conscious learning mechanisms. Children's academic

success depends on their being both nurtured and challenged; and their well-being on being motivated and enabled to learn. So, young children need challenge but without becoming so anxious that conscious processes are paralysed; and the academic and pastoral aspects of learning must be interlinked, like two strands of a rope. Early identification, and where possible remediation, of sensory and motor impairments and of social and communication difficulties and opportunities to develop the necessary skills in appropriate situations, to avoid a loss of motivation, will be valuable. However, attempts to accelerate learning appear less important than a wide range of opportunities using different learning mechanisms.

"Curriculum 1" or breadth and balance?

The research evidence runs counter to the current tendency for the taught curriculum in many jurisdictions to focus heavily on skills in Curriculum 1 at the expense of the humanities and the arts. The Cambridge Primary Review (Alexander 2010: 243), drawing on a long tradition of research and reports, argues that the primary curriculum needs to be broad and balanced. This is because a broad and balanced curriculum is inclusive and, in the long term, provides the best route into deeper understanding and application of the skills associated with Curriculum 1. Too great a concentration on skills without applying them neither develops such skills nor provides the practical, scientific or aesthetic opportunities which young children need. This is linked to the need for procedural and personal/interpersonal, as well as propositional, knowledge and the danger that a heavy emphasis on content tends to lead towards superficial learning and transmissive pedagogy.

An emphasis on the whole child and developing gifts and talents which may emerge only through opportunities to exercise them supports the case for a broad range of opportunities and experiences. While becoming literate and numerate is essential, so are the humanities and the arts, not only to develop specific disciplinary knowledge, understanding and skills, but in terms of attitudes and values. While the humanities have an obvious role in promoting intercultural understanding, Nussbaum (2010) argues that they help to encourage empathy and are an essential underpinning for a democratic society, in their contribution to citizenship education. The expressive arts both motivate children and enrich their lives; and contribute to a society which values the full range of human experience. Learning an additional language is not simply about learning to understand or speak a language, but helps children to develop understanding about language itself and about culture. Perhaps the term "the basics" should be re-defined to incorporate a much wider range of what children require for living in a globalised world, including the characteristics set out in the learner profile.

Content knowledge and skills or concepts and attitudes?

A world of constant change implies that children require concepts, attitudes and dispositions which can be applied in different contexts; although they also need propositional knowledge and skills. These need to be integrated, as the PYP proposes. Claxton (2007) uses the term "ready, willing and able" to suggest the need not only for skills and knowledge but the dispositions to use these. The evidence suggests that children learn concepts best by linking them and applying them in different contexts, suggesting that children in the primary years should be encouraged to use a wide range of learning styles and modes of representing experience, including those which may be unfamiliar. Indeed, the research tends to suggest that children should learn skills, attitudes, behaviours, knowledge and concepts together rather than as discrete elements.

Organised by subjects or areas of learning?

There is no easy solution to the question of whether to structure the curriculum by subject or by area, with each having advantages and disadvantages. However, the combination of subjects and transdisciplinary areas seems appropriate to enable the type of sustained enquiry for children to relate school learning meaningfully both to their own experience and to the wider world. If qualities such as compassion or open-mindedness are to be embedded, this must take place across the whole curriculum rather than just in separate sessions, although the latter may be appropriate either to emphasise these or to help children finding it hard to develop such qualities.

Taught by generalist classteachers or single subject teachers?

The importance of relationships and the need for curricular coherence highlight the value of the generalist classteacher throughout the primary years. However, children in the older part of the 6-12 age group are likely to require teachers with significant subject expertise, to develop the procedural knowledge associated with specific disciplines, especially those such as music and foreign languages, and to a lesser extent other subject areas. The evidence considered in this review does not suggest whether generalists or single subject teachers are more appropriate- and a reliance on either model is likely to prove simplistic. Moreover, an answer to this question is heavily dependent on what one hopes to achieve, with each model providing different benefits and disadvantages. So, a combination of classteachers and single subject teachers with all expected to contribute to the overall outcomes of a transdisciplinary programme seems appropriate, given the PYP's aims.

Controlled by the teacher or by the children?

A more subtle dilemma is that of who controls learning, the teacher or the children. An emphasis on curriculum coverage and on outcomes encourages the teacher to control what goes on, in terms of content, pace and outcome. The research has emphasised children's agency and engagement and that learning is a reciprocal and social activity. This re-affirms that how the learning environment is created and sustained is crucial in how learning takes place. For children to develop the qualities in the learner profile implies them understanding, and taking control of, their own learning and teachers trying to relinquish control and to avoid a predominantly transmissive pedagogy. The teacher needs to be in control, but without controlling. Claxton and Carr (2004) detail many practical implications, even though their main focus is on the early years. However, children in the primary years need: 1) space as well as pace; 2) regular opportunities to observe, to talk, and to apply skills creatively and imaginatively in real, meaningful contexts; and 3) increasing self-regulation rather than too great a reliance on external motivators.

External prescription or teacher autonomy?

Section 5 indicated that many jurisdictions have moved towards greater prescription and a reduced level of teacher autonomy. However, the implication of what is outlined above and of the PYP is that teachers require a high level of expertise, a wide repertoire of pedagogies and a significant level of autonomy. Prescription reduces the opportunity for reciprocal learning, where teachers respond to children's ideas, comments and errors. As Hargreaves (2003:161) states, “teachers are not deliverers but developers of learning. Much of the language

(currently) used is that of standards and targets, of delivery indicative of military and delivery models. Those who focus only on teaching techniques and curriculum standards ... promote a diminished view of teaching and teacher professionalism that has no place in a sophisticated knowledge society." So, teachers need to see themselves not just as deliverers but as creators of the curriculum; and to adopt, and seek to internalise, cross-curricular approaches rather than relying on initiatives supposedly based on "what works".

Such approaches involve aspects of pedagogy like: 1) drawing on children's "funds of knowledge" from outside school; 2) using a sophisticated understanding of feedback, as outlined in Hattie's work and that on formative assessment, including self- and peer-evaluation; 3) encouraging a growth mindset, in line with Dweck's work, with children encouraged and praised for behaviours and for effort rather than for inherent intelligence; and 4) modelling the attributes and qualities associated with lifelong and lifewide learning.

Teachers need a long time and substantial professional development to understand and internalise these. The 'Programme Standards and Practices', outlining expectations for how the PYP is to be implemented, but allowing scope for teacher autonomy, seems to address this tension well. While any curriculum should be reviewed periodically, a new curriculum requires several years to become embedded. Therefore, the long period between major reviews of the PYP is appropriate.

This review has tried to focus on the 6-12 age group, but without being specific about the different challenges at the younger and older ends of the age group. Clearly, the needs of 6 and 7 year olds vary from those of 11 and 12 year olds, but the research suggests that phases of development should be seen relatively fluidly in teaching a whole class and that children should be encouraged to use different means of representation. Given the considerable variation of developmental trajectories in any class, a written curriculum defined strongly by age and perceived level of ability is likely to be limiting. This emphasises the importance of the teacher's mediation and of professional development.

The PYP, with its roots in the IB's mission, vision and values and emphasis on the learner profile and on intercultural understanding, exemplifies a curriculum based on aims and principles, with these reflected clearly in the PYP and its accompanying documentation. Social and cultural changes and the pressures on children tending to lead towards consumerist and individualistic attitudes re-inforce the need from an increasingly early age to protect children, in some respects, but to equip them to cope with such pressures themselves. This, and how lasting values, attitudes and qualities can help children cope with a world of constant change, fits well with the learner profile, given the IB's mission and emphasis on intercultural and global citizenship. The prominence given to the learner profile in the PYP documentation seems appropriate.

8 Conclusions

This section sets out the main conclusions on the three key questions in relation to: 1) recent political, social and cultural trends and influences in relation to the written and taught curriculum; 2) the key theoretical lessons from recent research about children's learning in the primary years and their implications for the written and taught curriculum; and 3) how the IB's aims and its current Primary Years Programme may be affected by the influences and trends identified and how it does and could take account of these lessons.

A review of the PYP curriculum should take account of recent social, cultural and technological changes. The social and cultural changes deemed most significant in relation to the 6-12 age group relate to greater cultural and linguistic diversity, technological innovation and how childhood is seen by both adults and children. The greater diversity of communities, and the likelihood that almost all children will encounter unfamiliar people, places and experiences, makes the promotion of the intercultural understanding and values central to the IB's mission particularly pertinent. This provides a strong justification for the emphasis on learning an additional language and on enquiry into themes related to the world beyond school.

The changes associated with globalisation, and a world of constant change, emphasise not only literacy and numeracy skills, but the readiness, ability and willingness to apply skills in different contexts. This highlights the need to develop in the primary years different types of knowledge, intrinsic motivation and the attributes, qualities and dispositions associated with lifelong and lifewide learning. This provides a powerful rationale for the types of attribute in the IB learner profile and of activity encouraged through the PYP's transdisciplinary approach. There may be scope for more explicit emphasis on procedural knowledge -ways of working - associated with specific disciplines, especially towards the older end of the 6-12 age range; on promoting a greater understanding of religious belief and practice; and on children's rights in line with the UNCRC.

While the longer-term effects of technological innovation and children growing up as digital natives are unclear, the curriculum should take account of the opportunities and dangers presented. Among the many opportunities are chances to: 1) communicate with others and access information from different sources very rapidly; 2) present material in new and often motivating ways; and 3) alter how subjects such as art, music and language are experienced and taught. However, there is a danger of children spending considerable time in front of a screen, possibly affecting their attention and how they relate to other people. Children must learn to be critical of the validity of information and aware of the danger of manipulation; and be helped to protect themselves.

The changing nature of childhood presents more subtle challenges, relating more to the taught than the written curriculum. The range of prior experience likely to be present in most classrooms emphasises that teachers must be sensitive to this, capitalising on the range of children's experience and responding to difficulties. The impact of powerful messages from

the media and peer group emphasises that children, especially in the older part of the 6-12 age group, must be enabled to make difficult decisions.

While the evidence from the developmental sciences tends to support the PYP's overall approach, as Ansari, Coch and de Smedt (in Patten and Campbell 2011:37) state, "expectations for silver bullets … for easy to follow 'recipes for practice' based on cognitive neuroscience are bound to be disappointed quickly." The neuroeducational research indicates how emotion and cognition interact and the need for appropriate levels of stress and of nutrition and hydration and and of exercise; and that many "brain-based" initiatives are based on "neuromyths" and at best a distraction. The research in the developmental sciences emphasises the benefit of primary-age children: 1) learning actively and interactively with motivating and challenging tasks; 2) developing confident spoken language, providing opportunities to rehearse, to retrieve and to re-capitulate, both orally and through other means of representation, especially when the level of challenge is demanding; 3) receiving positive feedback focussing on behaviours rather than inherent qualities and indicating "next steps"; and learning to provide such feedback to themselves; 4) regulating their emotional responses and developing intrinsic motivation.

With early identification, and where possible, remediation of sensory, motor and communication difficulties, rather than focussing on accelerating normal developmental processes. This suggests that teachers should adopt a wide repertoire of pedagogies, to model the qualities to be encouraged, to emphasise values, concepts and processes as well as content, to provide breadth and balance and to encourage children to devise their own challenges, where possible. Such a list indicates the value of approaches such as formative assessment and "learning to learn" and of helping children to develop empathy for others and a growth mindset. More generally, teachers need to see themselves as curriculum-creators rather than -deliverers and to be attuned to children's emotional as well as cognitive states.

Section 3 argued that the written curriculum should be based on educational aims and principles, with guidance rather than prescription so that the taught curriculum reflects these. Section 5 noted the increasing convergence, worldwide, of the written curriculum, but argued that other factors related to assessment and accountability can easily override the intentions in the written curriculum. It warned against the temptation to borrow what is perceived to work without regard to aims and the context and traditions of particular traditions and jurisdictions.

This report concludes that recent research suggests no substantial change to the IB's aims, although these should have regard to social and cultural change, especially related to globalisation and technology. The research supports the principles on which the PYP curriculum framework was established, particularly the emphasis on process and concepts and working beyond the confines of subject areas. However, external drivers can easily threaten the transdisciplinarity, breadth and coherence which the PYP seeks to achieve. In particular, these include high stakes assessment and accountability mechanisms, as a result of an increasing concern with data from measurable outcomes. This emphasises that teachers require a deep understanding of, and commitment to, the IB's aims and principles and sustained professional development to implement these in practice.

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Rowley, SJ, Kurtz-Costes, B, Mistry, R and Feagans, L. 2007. Social Status as a Predictor of Race and Gender Stereotypes in Late Childhood and Early Adolescence. *Social Development.* Vol 16. number 1, Pp 150-168.

Salzberger-Wittenberg, I, Henry, G. and Osborne, E. 1983. *The emotional experience of learning and teaching.* London, UK. Routledge.

Sawyer, RK. 2004. Creative Teaching: Collaborative Discussion as Disciplined Improvisation. *Educational Researcher.* Vol 33. number 2. Pp 12–20.

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Spratt, EG, Friedenberg, S, LaRosa, A, De Bellis, MD, Macias MM, Summer AP, Hulsey, TC, Runyan, DK and Brady, KT. (2012). The Effects of Early Neglect on Cognitive, Language, and Behavioral Functioning in Childhood. *Psychology.* Vol 3. number 2. Pp 175-182.

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Sutton, J, Smith, PK, and Swettenham, J. 1999. Bullying and 'Theory of Mind': A Critique of the 'Social Skills Deficit' View of Anti-Social Behaviour. *Social Development.* Vol 8. number 1. Pp 117-127.

Swing, LE, Gentile, DA, Anderson CA and Walsh, DA. 2010. Television and Video Game Exposure and the Development of Attention Problems. *Pediatrics .*Vol 126, number 2. Pp 214 -221.

TLRP (Teaching and Learning Research Programme). 2006. *Improving teaching and learning in schools.* London, UK. www.tlrp.org

Tan, J. 2011. Singapore: schools for the future? In Brock, C. and Pe Symaco, L. 2011. *Education in South-East Asia.* Pp 57- 175. Didcot, UK. Symposium.

Timimi, S. 2005. *Naughty boys: Anti-social behaviour, ADHD and the role of culture.* New York, US. Palgrave Macmillan.

Tommerdahl, J. 2010. A model for bridging the gap between neuroscience and education. *Oxford Review of Education* .Vol 36, number 1. Pp 97-109.

Trickey, S and Topping, KJ. 2004. 'Philosophy for children': a systematic review. *Research Papers in Education*. Vol 19. number 3. Pp 365-380.

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Making the PYP happen: a curriculum framework for international primary education. 2007.

Making the PYP happen: Pedagogical leadership in a PYP school. 2007.

Developing a transdisciplinary programme of inquiry. 2008.

Subject specific expectations defined by age ranges. 2005.

Annotated Bibliography[5]

This is an annotated bibliography to accompany 'Primary Education: a Literature Review in relation to the written curriculum and taught curriculum'. Except for a few classic texts which provide the context for the discussion of more recent work, only literature published since 2000 is included. These is arranged thematically in four sections, giving details of academic articles, reports, chapters and books, with a brief commentary of key points they raise in relation to the review. Neither general websites (of which there are several) nor specific teaching programmes or materials are included. Those works which provide comprehensive and accessible summaries of key issues are marked with an asterisk*.

The sections are: 1) curriculum design and implementation; 2) the structure, functioning and development of the brain; 3) cognitive and experimental psychology and developmental sciences; and 4) social and cultural trends and other literature relevant to the review.

1 Curriculum design and implementation

Alexander, R. 2000. *Culture & Pedagogy: International comparisons in primary education.* Oxford, UK. Blackwell.

A huge book exploring primary education on five countries (India, Russia, France, USA (Michigan) and England), highlighting and comparing the very different cultural traditions and assumptions in each of these systems.

*** Alexander, R. (ed). 2010. *Children, their World, their Education - final report and recommendations of the Cambridge Primary Review.* Abingdon, UK. Routledge.**

A large-scale review of primary education in England, drawing on a series of summaries of international evidence, set out thematically in a separate volume (The Cambridge Primary Review Research Surveys. Abingdon, UK. Routledge.) The Review is critical of the current emphasis on outcomes in Curriculum 1 and the 'culture of compliance' created.

* **Benavot, A. and Braslavsky, C. (eds). 2006. *School knowledge in comparative and historical perspectives: changing curricula in primary and secondary education.* Comparative Education Research Centre, Hong Kong. Springer.**

A collection of chapters, mostly from a UNESCO perspective, covering a wide range of topics related to the curriculum, internationally, from a theoretical perspective, some of which discuss the primary years. The chapters drawn on are referenced in the full report, but not included in this bibliography.

[5] While the comments are as accurate as possible, they represent the author's view in relation to the requirements of the review commissioned by the IB and should not be taken either as definitive of the key points of the material described or the view of the International Baccalaureate.

Black, P. and Wiliam, D. 2009. *Developing the theory of formative assessment. Educational Assessment, Evaluation and Accountability.* Vol 21. number 1. Pp 5-31.

An article which updates the authors' substantial body of previous academic and practical work about formative assessment. While quite dense, this provides a good overview of their own and other people's writing in the field, with the references section especially useful in this respect.

Brook Napier, D. 2005. Implementing Educational Transformation Policies: Investigating issues of ideal versus real in developing countries. pp 59-98 in Baker, D. and Wiseman, AW, (eds). (2005). G*lobal Trends in Educational Policy.* Amsterdam, Holland. Elsevier.

A somewhat dated but valuable reflection of specific problems of less developed countries, especially successes and problems in post-apartheid South Africa.

Claxton, G. 2002. *Building Learning Power.* Bristol. UK. TLO Ltd.

A clear and practical book, mainly for teachers, about 'learning to learn', drawing on Claxton's academic work to suggest what this might mean in practice, but without reducing this to 'tips for teachers.'

Eaude, T. 2012. *How do expert primary classroom teachers really work? - a critical guide for teachers, headteachers and teacher educators.* Critical Publishing. www.criticalpublishing.com

This short book draws on the literature on expertise, in general, and teacher expertise in particular, to explore how primary classteachers with a high level of expertise work, emphasising the complexity of the task and the need for complex, fluid, and interrelated types of knowledge.

*** Hall, K. and Øzerk, K. 2010. *Primary Curriculum and Assessment: England and other countries.* In *The Cambridge Primary Review Research Surveys.* Pp 375-414. Abingdon, UK. Routledge.**

A clear and accesible comparison of how the written curriculum and assessment arrangements are designed in 21 countries, with an emphasis on how those in England reflect these trends or otherwise. The authors emphasise how strongly the written curriculum is affected by assessment procedures.

*** Hattie, J. 2009. *Visible learning: a synthesis of over 800 meta-analyses relating to achievement.* London, UK. Routledge.**

A book based on a large-scale overview of what enhances achievement, highlighting the danger of initiative-borrowing. Instead, Hattie offers explanatory, often counterintutive, stories on aspects of the teacher's role, such as feedback, relationships and making clear what is to be learned. While not specific to 6-12 year olds, this offers valuable insights into the complex relationship between learning and teaching.

Hennessy, S. and London. L. 2013. *Learning from International Experiences with Interactive Whiteboards: The Role of Professional Development in Integrating the Technology.* (OECD Education Working Papers, No. 89). OECD Publishing.

A paper which highlights the potential benefits of interactive whiteboards, with examples of how they can be used well, but emphasising the importance of professional development.

Hogg, L. 2011. Funds of Knowledge: An investigation of coherence within the literature. *Teaching and Teacher Education.* Vol 27. Pp 666- 677.

A helpful summary and critique of a long tradition of research on funds of knowledge, indicating both the value of this concept in helping to provide culturally responsive pedagogies and the different meanings ascribed to the term.

*** Le Metais, J. 2003. *International Trends in Primary Education - INCA Thematic Study No. 9.* London, UK. QCA.**

Although somewhat dated, this provides a very useful overview of international trends in primary education, comparing eighteen jurisdictions but with some insights from another two.

Lovat, T, *Toomey*, R, Dally, K and Clement, N (eds). 2009. *Project to Test and Measure the Impact of Values Education on Student Effects and School Ambience.* Newcastle, Australia, University of Newcastle.

An evaluation of the large-scale Values in Action Schools Project in Australia, describing this approach and concluding that it had a significant positive impact on students' engagement with schooling and promoted better learning outcomes and enhanced their social and emotional wellbeing.

Oates, T. 2010. *Could do better: Using international comparisons to refine the National Curriculum in England* http://www.cambridgeassessment.org.uk/images/112281-could-do-better-using-international-comparisons-to-refine-the-national-curriculum-in-england.pdf

A report used by the English government to examine lessons from high performing jurisdictions highlighting the dangers of policy-borrowing and arguing for a concept-led curriculum.

*** OECD. 2011. *Lessons from PISA for the United States, Strong Performers and Successful Reformers in Education.* OECD Publishing.**

A nuanced discussion of the multiple factors which have contributed to the success of those jurisdictions judged to be successful on the basis of PISA, looking at the features of successful systems. The report indicates the importance of long term strategies and of teacher quality, while recognising cultural and social differences.

*** Pepper, D. 2008. *Primary Curriculum Change: Directions of Travel in 10 Countries since 2005.* London, UK. QCA.**

A brief and helpful comparative study whose title is self-explanatory, though the focus is on the written curriculum rather than how it is implemented.

Sawyer, RK. 2004. Creative Teaching: Collaborative Discussion as Disciplined Improvisation. *Educational Researcher.* Vol 33. number 2. Pp 12–20.

A readable article which discusses how "scripted instruction" is opposed to constructivist, inquiry-based, and dialogic teaching methods that emphasize classroom collaboration; and argues rather for a view of teaching as "disciplined improvisation."

Shuayb, M. and O'Donnell, S. 2010. *Aims and values in primary education: England and other countries.* In *The Cambridge Primary Review Research Surveys. Pp. 306-340.* Abingdon, UK. Routledge.

A comparison of the stated aims, purposes and values of primary education in England, Scotland, Germany, New Zealand, Sweden and the Netherlands, providing a historical perspective on this over the decades of 1980s, 1990s and 2000-8, arguing that these are driven by two sets of ideas: variants of child-centred education and social and economic progress, with the latter increasingly dominant.

Trickey, S and Topping, KJ. 2004. 'Philosophy for children': a systematic review. *Research apers in Education.* Vol 19. number 3. Pp 365-380.

An article which both places Philosophy for Children in the context of broadly similar programmes and provides an overview of the research on what P4C claims to achieve. This illustrates that many initiatives and approaches over claim about their benefits in practice and that how they are implemented is the main factor in success or otherwise.

2 The structure, functioning and development of the brain

Ansari, D and Coch D. (2006). Bridges over troubled waters: education and cognitive neuroscience. *Trends in Cognitive Sciences.* Vol 10. number 4. Pp. 146-151.

A relatively short and accessible article about the challenges of drawing practical lessons for educators from neuroscience, challenging to some extent that this is a 'bridge too far' and suggesting how future research might usefully develop, especially by a closer dialogue between educators and researchers.

*** Blakemore, S-J and Frith, U. (2005).*The learning brain: lessons for education.* Oxford, UK. Blackwell.**

A very accessible summary of key points about brain structure and function and the implications for educators, which, while not specific to primary education, provides many useful insights.

Bishop, DVM, Snowling MJ and Blakemore, S-J, (eds.). 2008. *Neurocognitive approaches to developmental disorders: a festschrift for Uta Frith.* Hove, UK. Psychology Press.

A collection of articles most of which are very technical but which includes useful discussions of the role of cognitive neuroscience in understanding autism and dyslexia.

Bruer, JT. 1997. Education and the Brain: A Bridge Too Far. *Educational Researcher.* Vol 26. number 8. Pp.4-16.

A seminal though now dated paper which cautioned strongly against assuming that the lessons of neuroscience can be applied directly to educational practice.

Damasio, A. 2000.*The Feeling of What Happens: Body, Emotion and the Making of Consciousness.* London, UK. Vintage.

A reasonably accessible book by a well-respected clinical practitioner which emphasises the role of the emotions, but ranges considerably beyond issues related to curriculum design.

Davis, A. 2004. The Credentials of Brain-Based Learning. *Journal of Philosophy of Education.* Vol 38. number 1. Pp 22-35.

A philosophical critique of the types of claim which 'brain-based' learning can legitimately make. Davis highlights that the contribution of the study of the brain to understanding learning is limited, with the greatest contribution in the area of specific learning disabilities.

Della Sala, S and Anderson, M. 2012. *Neuroscience in education: the good, the bad and the ugly.* Oxford, UK. Oxford University Press.

R recent collection of articles mostly but not exclusively by scientists, which review key areas in which neuroscience can, and cannot, provide lessons for educators. As the title indicates, these try to distinguish the value of how research is used, re-inforcing the need for caution in applying neuroscientific research directly to practice.

Geake, JG. 2008. Neuromythologies in Education. *Educational Research.* Vol. 50. number 2. Pp 123-133.

An article by an academic with a background in neuroscience considering why some popularly held views supposedly based on brain research do not stand up to scrutiny and should be dismissed as 'neuromyths'.

Geake, J. 2009. *The brain at school; educational neuroscience in the classroom*. Maidenhead, UK. Open University Press.

A book designed to bridge the gap between research and practice. Written by an academic with a background in neuroscience, it makes useful reference to research but at times, in trying to be accessible, becomes slightly populist and does not focus much on specific age-groups.

Goswami, U. 2004. Neuroscience and education. *British Journal of Educational Psychology.* Vol 74. number 1. Pp 1-14.

Although now somewhat out of date, this short article provides a valuable summary about what neuroscience can, and cannot, demonstrate which is likely to be of value to educators. It packs in a lot detail dispelling some common neuromyths and illustrating how easy it is for neuroscientific research to be (often unwittingly) misinterpreted.

Goswami, U. 2008. *Cognitive Development: the learning brain.* Hove, UK. Psychology Press.

A comprehensive but very dense discussion of the massive literature on the various areas under the umbrella of cognitive development with valuable discussions of what cognitive neuroscience can (and cannot) offer. However, it is hard to identify those aspects most relevant to the 6-12 age group.

Goswami, U. 2008. Principles of Learning, Implications for teaching: A Cognitive Neuroscience Perspective. *Journal of Philosophy of Education.* Vol 42. number 3-4. Pp 381-399.

An article providing a clear overview of recent issues in cognitive neuroscience and its educational applications, somewhat more positive about what can be learned in this respect than other authors, though cautioning against commonly-held 'neuromyths'.

*** Goswami, U. and Bryant, P. 2010. Children's cognitive development and learning.** *In The Cambridge Primary Review Research Surveys.* Pp. 141- 169. Abingdon, UK. Routledge.

A good overview of the research into cognition, discussed thematically and clearly, with each section concluding with the implications for education, though not always specific to primary age children. Written from a neuroscientific perspective, it relates the findings to cognitive psychology, but focuses mostly on school learning.

*** Hall, J. 2005. *Neuroscience and education: what can brain science contribute to teaching and learning?*** www.scre.ac.uk/spotlight **Research report 121/2**

An excellent four page summary of key issues in the field. Highly recommended for a brief overview.

*** Howard-Jones, PA. 2007 *Neuroscience and Education: Issues and opportunities.*** *A Commentary by the Teaching and Learning Research Programme.* **London, TLRP. http://www.tlrp.org/pub/documents/Neuroscience%20Commentary%20FINAL.pdf**

A very helpful and simple pamphlet summarises the research about brain structure, function and development, drawing out key lessons and areas where neuroscience does, and may, contribute to educational practice.

Howard-Jones, P. 2008. Philosophical Challenges for Researchers at the Interface between Neuroscience and Education. *Journal of Philosophy of Education.* Vol 42. number 3-4. Pp 361-380.

A clear article by a neuroscientist about the difficulties of applying the lessons from neuroscience directly to education. Although neither an easy read nor specific in terms of age, it provides a good summary of key aspects of learning from both a neuroscientific and educational perspective, emphasising social interaction.

Howard-Jones, P. (ed.). 2010*. Education and Neuroscience. Evidence, Theory and Practical Application.* London, UK. Routledge.

A short book with six articles summarising key lessons regarding neuromythologies, reading/dyslexia, mathematical reasoning, dyscalculia, musical education and creativity in drama education from a neuroeducational perspective. Recommended for short summaries of up to date research in these areas.

*** OECD. 2007. *Understanding the Brain:The Birth of a Learning Science.* OECD Publishing. http://dx.doi.org/10.1787/9789264029132-en**

A substantial and useful overview of neuroeducational research, with various aspects related to how the brain works, learning in different subject areas, neuromyths, ethics and discussed in separate chapters. Inteestingly, despite a chapter on early childhood and one on adolescence, there is not one on middle childhood.

Patten, KE and Campbell, SR. 2011. *Educational neuroscience.* Oxford, UK. Wiley-Blackwell. (previously published as a themed issue of *Educational Philosophy and Theory*. Vol 43. number 1.)

A recent collection of short articles from different disciplines debating the current state of neuroeducational research, summarising key lessons and possible lines of research, and the many difficulties involved. The authors argue against simplistic models of applying research to practice, but little work specifically on young children is included.

Perry, BD. 2002. Childhood experience and the expression of genetic potential; what childhood neglect tells us about nature and nurture. *Brain and Mind.* Vol 3. Pp 79-100.

A useful summary of the implications for brain function and development of the effect of neglect in early childhood, emphasising the importance of environmental factors, though in some respects slightly dated.

Pickering SJ. and Howard- Jones, P. (2007). Educators' Views on the Role of Neuroscience in Education: Findings From a Study of UK and International Perspectives. *Mind, Brain and Education.* Vol 1. number 3. Pp 110-113.

An article describing a survey of teachers' views on the implications of neuroscience for education. This indicates a high level of enthusiasm but very different views about what this

might entail. The authors argue for more dialogue between educators and researchers to set a realistic and useful agenda.

Siegel, D. (2007). *The Mindful Brain: reflection and attunement in the cultivation of well being.* New York, USA. WW. Norton.

A book which argues for the importance of (a particular approach to) reflection and mindfulness, based on research into the structure of the brain and the author's clinical experience. While careful with how the implications of the research are described, the style and lack of references to empirical studies suggests that there may be an element of over claiming on the benefits of mindfulness and reflection.

Tommerdahl, J. 2010. A model for bridging the gap between neuroscience and education. *Oxford Review of Education* .Vol 36, number 1. Pp 97-109.

A useful article about the difficulties of 'bridging the gap' and possible ways of doing so, but cautioning against overclaiming for the practical implications of neuroscientific research.

3 Cognitive and experimental psychology and developmental sciences

Claxton, G. 2005. *An intelligent look at Emotional Intelligence.* London, UK. Association of Teachers and Lecturers.

An accessible pamphlet which draws on research to critique simplistic ideas of emotional intelligence and how these are applied in practice, emphasising the need for qualities such as empathy and resilience to be built up across the whole curriculum.

Claxton, G. 2007. Expanding Young People's Capacity to Learn. *British Journal of Educational Studies.* Vol 55. number 2. Pp 115-134.

A thoughtful analysis of concepts such as qualities and dispositions involved in 'learning to learn' associated with lifelong learning, and the implications for teachers. The article relates practice to theory but recognises that this involves establishing and sustaining an environment for learning and pedagogy, rather than relying on specific programmes.

Claxton, G and Carr, M. 2004. A framework for teaching learning: the dynamics of disposition. *Early Years.* Vol. 24. number 1. Pp 87- 97.

Although mainly concerned with the early years, this article provides a practical discussion of what is meant by learning dispositions and the role, and types, of environment in enabling this.

Cowan, N. 2012. Working memory: the seat of learning and comprehension. In Della Sala, S and Anderson, M. *Neuroscience in education: the good, the bad and the ugly.* Pp 111- 127. Oxford, UK. Oxford University Press.

Although quite complex, this chapter provides a helpful good summary of whyworking memory matters, what it consists of, how it functions and what inhibits this.

Daniels, H. 2005. *An introduction to Vygotsky.* Hove, UK. Routledge.

A book of chapters of varying relevance and difficulty, though all academic, summarising on-going discussions about Vygotsky's work. Although one of the best ooks on Vygotsky's ideas, it is not an easy read, but worth consulting for recent hinking on many of these.

*** Donaldson, M. (1992). *Human Minds - an exploration.* London,UK. Allen Lane.**

A classic study, by a cognitive psychologist, and beautifully written. This remains a wonderful synthesis of her own researech and that of other, challenging many assumptions and since justified by much of the neuroeducational research, especially in the recognition of the role of the unconscious and implicit learning.

Dowling, M. 2010.*Young Children's Personal, Social and Emotional Development.* London, UK. SAGE.

A readable and useful book, though at times it lacks the depth and nuance which an approach more based on academic research would have provided. While mainly concerned with pre-primary children, the book provides a helpful explanation of the background to, and process involved in, personal, social and emotional development in older children.

*** Dweck, CS. 2000. *Self Theories: Their Role in Motivation, Personality and Development.* Philadelphia, USA. Psychology Press.**

A very clear and accessible summary of Dweck's research, setting out her approach and conclusions about intelligence, about mindsets, their consequences and how to influence them in a way which highlights the implications of research for practice, especially in relation to feedback, though without being specific about the 6- 12 age group.

Gardner, H. 1993. *Frames of mind: the Theory of Multiple Intelligences.* London, UK. Fontana.

A classic and influential work, but to be understood, in my view, as presenting a different way of understanding intelligence. This involves seeing and valuing intelligence(s) as applying to many types of activity rather just those related to abstract reasoning. However, the term should not be used to argue for different areas of the brain being 'responsible' for different types of intelligence.

Goldberg, S. 2000. *Attachment and Development.* London, UK. Hodder Arnold.

Still, in my view, the best and most nuanced summary of the huge literature on attachment in infancy. While not directly relevant to the review of the PYP, this helps to explain the basis of why young children, especially, act and interact as they do.

Goldin-Meadow, S and Wagner, SM. (2005). How our hands help us learn. *Trends in Cognitive Sciences.* Vol.9. Number 5. Pp 234-241.

An intriguing short paper which argues for the importance of gesture and suggests why, illustrating the point in the report that language, while vital, needs to be supplemented by other means of communication; and that these assist in learning more than one might imagine.

Goswami, U. (ed.). (2011). *The Wiley-Blackwell Handbook of Childhood Cognitive Development.* Malden, USA, Wiley- Blackwell.

A rather daunting volume consisting of articles by experts in their field which explore aspects of children's cognitive development, both in areas such as memory, reasoning, science, reading and mathematics and in atypical development.

*** Mercer, N. 2000. *Words and minds.* London, UK. Routledge.**

A book which combines research and practice on the functions of human language, drawing heavily in Vygotsky, in a way which captures the complexity of the processes involved but is accessible. The use of case studies to illustrate points is very helpful.

*** Myhill, D, Jones, SM. and Hopper, R. 2006. *Talking, listening, learning: effective talk in the primary classroom.* Maidenhead, UK. Open University Press.**

An accessible and clearly written book mainly for teachers, which draws out practical lessons from theory based on the importance and nature of children's talk, especially in the primary years,

Rogoff, B. 2003. *The Cultural Nature of Human Development.* Oxford, UK. Oxford University Press.

A fascinating book which illustrates how cultural expectations and upbringing shape children's beliefs about themselves, with many examples from anthropological sources, emphasising the role of guided participation and an 'apprenticeship model.'

Sharp, JG, Bowker, R and Byrne, J. 2008. VAK or VAK-uous? Towards the trivialisation of learning and the death of scholarship. *Research Papers in Education.* Vol 23. number 3. Pp 293 – 314.

An article which examines the idea of learning styles and learners being characterised as visual, auditory or kinaesthetic learners, arguing that the way that this is used trivialises the complexity of learning and that it has been promoted and used in ways detrimental to young children's learning.

Smith, EE. (2009). *Cognitive Psychology: Mind and Brain.* Upper Saddle River, USA. Pearson/Prentice Hall, Pearson Education International.

A textbook on cognitive psychology which outlines key issues and the associated research in a reasonably accessible fashion, but without being specific about the primary years.

Snowling, MJ and Hulme, C. (Eds.) (2005) *The science of reading: A handbook.* Oxford, UK. Blackwell.

A large collection of articles mostly on the scientific basis of how children learn to read and difficulties in doing so, of which some are relevant to the primary years, especially on developmental difficulties and dyslexia.

4 Social and cultural trends and other literature relevant to the review

Baker, D. and Wiseman, AW. (eds). 2005. *Global Trends in Educational Policy.* Amsterdam, Holland. Elsevier.

A collection of articles on policy referring to a wide range of systems worldwide but with the detail about the primary curriculum embedded in more general descriptions.

Brock, C. and Pe Symaco, L. 2011. *Education in South-East Asia.* Didcot, UK. Symposium.

A book of chapters, some country-specific, some thematic, which survey historical and cultural trends and the current situation in education in South -East Asia. This highlights the wide variety of practice and levels of success and the factors involved. However, aspects related primary education and the curriculum have to be gleaned from the larger picture.

*** Chawla-Duggan, R. and Lowe, J. 2010. *Aims for Primary Education: changing global contexts. The Cambridge Primary Review Research Surveys.* Pp 261-281. Abingdon, UK. Routledge.**

A valuable discussion of the meaning of globalisation and its impact on the aims of primary education worldwide, placing this in a historical context and illustrating how this has affected education in India and China as case studies.

Confederation of British Industry. (CBI). 2012. *First steps -a new approach for our schools.* http://www.cbi.org.uk/campaigns/education-campaign-ambition-for-all/first-steps-read- the-report-online/

A recent report from an organisation representing employers in England which considers what is required for young people to succeed in the workplace. This emphasises, as well as being literate and numerate, personal qualities such as determination and creativity, and provides a well - argued critique of a narrow curriculum from an unexpected source.

*** Coolahan, J. 2002. *Teacher Education and the Teaching Career in an Era of Lifelong Learning.* OECD EducationWorking Papers, No. 2. OECD Publishing. http://dx.doi.org/10.1787/226408628504**

A very thoughtful paper re-emphasising the centrality of the teacher's role in the changing context of globalisation and discussing the challenges to developing a committed and well-trained workforce and the implications for teacher education.

Ecclestone, K. and Hayes, D. 2009. *The Dangerous Rise of Therapeutic Education.* London, UK. Routledge.

A book which argues that being encouraged to dwell on one's feelings tends to contribute to a greater obsession with oneself and create a sense of vulnerability; and that teachers should place more emphasis on traditional forms of knowledge.

*** Hargreaves, A. (2003). *Teaching in the Knowledge society – education in the age of insecurity.* Maidenhead. UK. Open University Press.**

A book which discusses theoretically, but thoughtfully, the implications for teaching of trends associated with globalization. This provides a rationale for concentrating on qualities and attributes rather than just skills; and highlights the challenges for teachers, though without these being specific to primary education.

Layard, R. and Dunn, J. 2009. *A good childhood – Searching for values in a competitive age.* London, UK. Penguin.

A popular book summarising the views of the economist Richard Layard that in recent years children have become increasingly unhappy and uncertain because of the society in which they grow up; and that they require a much clearer sense of values.

Johnson, DF. 2008*. The changing landscape of education in Africa: quality, equality and democracy.* Oxford, UK. Symposium Books.

A book consisting of a series of articles about education in various countries in Africa. While neither about the curriculum as such, nor a very easy read, does it provide useful background to the challenges of curriculum design and implementation in less affluent, post-colonial societies.

*** Mayall, B. 2010. Children's lives outside school and their educational impact. *The Cambridge Primary Review Research Surveys.* Pp 49- 82. Abingdon, UK.** Routledge.

A thoughtful discussion of the research, especially from a sociological perspective, about the impact of modern life on young children, their lives and their attitudes. Mayall provides an academic underpinning to more popular work expressing concern about the context in which young children grow up.

Noddings, N. 2003. *Caring - a feminine approach to ethics and moral education.* Berkeley, USA. University of California Press.

A readable and engaging book by a feminist philosopher who emphasises the importance of relationships in moral development and the importance of both being cared-for and caring-for-others.

*** Nussbaum, M. 2010. *Not for profit: why democracy needs the humanities.* Princeton, USA. Princeton University Press.**

A wide-ranging and lucid discussion, providing both a broad political rationale for the humanities and some cleverly integrated discussion of research, for instance on early childhood development, to explain the benefits which the humanities bring.

OECD. 2009. *Doing better for children.* Paris, France. OECD Publishing.

A large report which discusses the state of children's well-being in OECD countries, the spending priorities of governments and the impact of issues such as changes in family structure and patterns of inequality on well-being; and includes recommendations. While not about the curriculum, the report provides detail on social and cultural trends which may affect this.

Putnam, RD. 2000. *Bowling Alone: the collapse and revival of American community.* New York, USA. Simon & Schuster.

An analysis from both a sociological and psychological perspective of why communities in the United States have become increasingly fragmented, discussing the need for both 'bonding' and 'bridging' capital, the former to build up a sense of identity with those who are similar, the latter with those who are different.

Timimi, S. 2005. *Naughty boys: Anti-social behaviour, ADHD and the role of culture.* New York, USA. Palgrave Macmillan.

A thought-provoking book by a psychiatrist, arguing that diagnoses of ADHD are heavily dependent on cultural beliefs and challenging the widespread medicalisation of this.

Unicef. 2007. *Child Poverty in Perspective: An overview of Child Well-being in Rich Countries: A comparative Assessment of the Lives and Well-Being of Children and Adolescents in Economically Advanced Nations.* Florence, Unicef Innocenti Centre (Innocenti Report Card 7). http://www.unicef-irc.org/publications/pdf/rc7_eng.pdf

An influential comparative assessment of the well-being of children and young people in 21 nations of the industrialized world, based on six dimensions – material well-being, health and safety, educational well-being, family and peer relationships, behaviours and risks and subjective well-being. This summarised concerns about children's well-being, especially since this was not closely correlated with wealth.