Irish Learning Support Association

I.L.S.A.

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Readers are invited to submit papers to be considered for inclusion in the 2013 issue of LEARN. Papers should reach the Editorial Committee, LEARN, ILSA, c/o Drumcondra Education Centre, Drumcondra, Dublin 9, by January 31, 2013. Papers should be relevant to some aspect of Learning Support and should not exceed 3,000 words. For information on electronic submissions please contact the administrator on our website at *www.ilsa.ie*

The Association is concerned with the education and support of children who experience difficulty in learning, whether in special or inclusive settings, and those for whom English is an additional language. Its aims include promoting co-operation between all involved in Learning Support and Resource Teaching and enhancing the quality of the service they offer, through the provision of resources, conferences, lectures and seminars.Besides the journal LEARN, a newsletter is published for members.

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The views expressed in the articles do not necessarily reflect those of ILSA.

Editorial

When I behold the economic morass that Europe has been plunged into, I can't help but recall the opening lines from Dickens' *A Tale of Two Cities*. "It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of Light, it was the season of Darkness, it was the spring of hope, it was the winter of despair…"

Obviously, in these harsh economic times, education has not escaped its share of cutbacks. There was a political adage some years ago that said "cutbacks hurt the young, the sick and the old". Unfortunately, that adage is as true today as it was then. Educational cutbacks hurt the young; but as Dr Joseph Travers indicates in his article *Safeguarding Inclusive Education in a Time of Austerity,* the change in policy from entitlement to a certain level of resources, present since November 1998, to the distribution of a set amount of resources to an expanding student population is a sea change. *To* quote the CEO of the *National Council for Special Education (in Travers article): "The Department of Education and Skills has advised the NCSE that we may no longer allocate resource teaching and special needs assistant posts on a demand-driven basis."* The reality, as Travers asserts, is that in the context of a rapidly expanding student population, and the birth rate has been rising over the last decade, maintaining the same number of resources with extra students is a severe cut in services. It means that existing resources will be diluted further and spread ever more thinly for the foreseeable future.

The Department of Education and Skills (DES) introduced a new Literacy and Numeracy Strategy last year (2011). One very disappointing aspect of this strategy is the requirement on all schools to produce an annual report using standardised testing as the **sole** measure of achievement levels. We know that these tests are unsuitable for administering to children with special education needs and do not measure their achievements. There is clear evidence that assessment for learning, criterion referenced tests and diagnostic assessments offer a far greater opportunity of providing key information that will help to raise standards for children with special education needs. I would urge members not to accept a situation where the performance of many children with special educational needs is recorded for the Board of Management and DES as a number among those excluded from standardised tests. We should insist, in the debates that will rage about this matter, that a separate record, which acknowledges the achievements of special needs children be also placed into the public domain alongside the standardised test results, if we are serious about inclusion.

Howard Gardner initially introduced the theory of multiple intelligences to the world through a book: *Frames of Mind.* The book received many awards, huge

media publicity and was ultimately named as one of the most influential books on education of the 20th century. Modern culture appears to value linguistic intelligence and logical-mathematical intelligence above the other intelligences. In this Olympic Year, with the achievements of Katie Taylor and others still fresh in our minds, we should put forward the multiple intelligences theory as a critique of the values of our schools and of our culture. We need to pay far more attention to the neglected intelligences, especially the spacial, bodily-kinaesthetic and musical that may be particular strengths of individuals who have had special difficulties in successfully making their way through our heavily linguistic school system. I am suggesting that we need to re-evaluate the subjects taught in our schools, with an increased emphasis placed on the arts, physical education, nature and other topics that have been traditionally limited to the periphery of the curriculum.

In that regard I am delighted that a number of articles in this edition of *Learn* focus on aspects of learning other than literacy and numeracy. *Drawing* by Michael O'Reilly with the subtext of *Learning to Draw/Drawing to Learn*, posits the notion that for children mark making/drawing is about

- helping to organise thoughts, feelings and ideas
- sharing thoughts, feelings and ideas with others
- developing these feelings, thoughts and ideas.

O'Reilly goes on to state that emotional intelligence is also developed through drawing, which focuses on the inner world of the child. Imagined worlds, fears, dreams, feelings and ideas can often be the subject matter of children's drawings.

Colette McGettrick in her contribution *Movement and Learning* begins with the quote:

> "The greater duration of time in the chair,
> The greater the depth of student despair." *(Jensen 2000)*

McGettrick points out that in today's society there is less of a need to physically exert oneself. Over recent decades there has been a marked decline in demanding physical work and this has been accompanied by sedentary lifestyles and reduced leisure-time activity. Weeding the garden, baking and helping out with jobs are no longer part of most children's weekly routine. Children who once resourcefully devised their own construction toys tend to have more prefabricated materials to play with. Encouraging pupils to take part in a wide variety of physical activities can have many additional benefits for pupils – cooperation in group situations, acceptance of success and failure, concepts of working hard and 'fair play' and an appreciation of the skills and attributes of others.

To quote a wise man:

> "The quality of life is determined by its activities".
> *Aristotle (Greek philosopher, 5th Century B.C)*

I am convinced that literacy is really nothing short of a miracle. To be able to see worlds and to create universes by making marks on a page is incredible. In that context, it is amazing that so many people learn to read and write with so little effort. Too little attention has been focused on the marvellous capacity of the brain that appears to have been pre-adapted for literacy; using gesture, emotion and musical intonation to communicate, creating picture languages, developing wonderful oral traditions and deploying innate logical structures in the use of words. Please take a look at an article by Fiona O'Connor entitled *How Studies in Neuroscience Can Inform Teaching and Learning* for an insight into working memory and how the brain works. We may have made the mistake of isolating literacy from this rich heritage, putting it in a bare room with only a blackboard or interactive whiteboard and some workbooks to keep it company. We need to reconnect literacy to all that has gone before it and that is still connected to it in the brain, by creating an environment where all of Gardner's multiple intelligences are nourished and by ensuring that all areas of the curriculum, including the arts, nature, music and sports are an integral part of the creative milieu.

I hope that the selection of articles in this year's edition of *Learn* is sufficiently eclectic and varied to appeal to all. Please remember that the publication of teacher research in *Learn* allows those of us who labour at the chalkface to impact on and to contribute to current educational discourse.

Learn is our annual journal and it is a publication that we are very proud of. Its status is beyond repute. However, please remember that *Learn* is **your** journal and it depends on you, our members, to continue to contribute by sending me your research papers and articles. I am now open for business for next year's edition. Start writing!

MATT REVILLE
Editor of *Learn*
August 2012

Learning to Draw / Drawing to Learn

Michael O'Reilly

For adults the word "drawing" implies the idea of representation. However children make drawings for a range of purposes, the key purpose being to communicate a message or meaning. All children draw from a very early age, or more accurately, make marks. Mark making emerges alongside verbal language and in it we can observe the child's struggle both to understand their world and to communicate their understanding of it. For children mark making/drawing is about

- helping to organise thoughts, feelings and ideas
- sharing thoughts, feelings and ideas with others
- developing these feelings, thoughts and ideas.

All children develop their mark making/drawing skills naturally – they do not need to be "taught" to draw. The role of the teacher is to engage children in talk and discussion about their drawings and to encourage active looking/ observation. Children proceed through clearly identifiable stages of development in their mark making/drawing, these stages having first been identified by Lowenfeld and Brittain in the 1950s. In general these stages are summarised as follows:

- the scribbling stage
- the schematic (symbol) stage
- the stage of dawning realism
- the stage of realism

Increasingly, however, teachers are reporting that children at a very young age are saying "I can't draw!" We can only assume that this is as a result of an over-emphasis on adult styles of drawing exemplified in "How to Draw" manuals, colouring-in books, replicating samples and clipart. The message being given to children by over-reliance on such forms is that their own drawings are no good and that there is a correct way to draw – this is not what is advocated in any visual arts curriculum, where the emphasis is always on process, rather than the mindless copying of drawings that have been drawn by someone else. If allowed

to make marks/draw regularly children naturally develop scale, perspective and dimension and all the skills necessary to draw well with a personal style.

Young children's drawings of themselves and their families/friends can be very revealing. These drawings reveal the child's developing consciousness and a growing awareness of his/her body. Such drawings frequently are used to assess a child's level of emotional and intellectual ability because they usually hint at how the child relates to others, to the outside world and how the child perceives him/herself. This is why drawing is often used as an assessment tool by various professionals such as psychologists and therapists.

In their drawings young children picture their own world, both real and imaginary. The dots, lines and squiggles of early mark making develop into more controlled bounded shapes that are used to represent the world and what is in it. Children create figure and ground (baseline) and invent personal symbols that are adaptable to representing different situations e.g. a schematic for showing the human form. What is most interesting is that many of these schemata seem to be universal and to exist in different cultures e.g. the cloud and sticks symbol that represents a tree.

Children also use drawing as a tool for investigating the world that is around them. Observational drawing encourages children to focus their attention and to actively look at what is being drawn. Drawing intensifies looking, is a wonderful way for children to record their discoveries and is therefore the ideal investigative learning tool. It can therefore be used in many subject areas. How much more would children learn about, for example, insects by closely observing them with a magnifying glass and drawing them, than if they merely read and wrote about them?

Drawing is also a means through which children can visualise as well as tell stories. Children will often naturally draw a series of narrative images and then proceed to tell or to write the narrative because the drawing helps to organise thoughts and ideas in a logical sequence. "When you are finished your story, draw a picture about it", is often the instruction heard in classrooms. Should we not at times reverse this sequence and give the children the opportunity to organise their story ideas through drawing. Personally I have found that the sequence of telling, drawing and then writing a story works
particularly well in learning support situations.

Emotional intelligence is also developed through drawing which focuses on the inner world of the child. Imagined worlds, fears, dreams, feelings and ideas can often be the subject matter of children's drawings. Drawing allows the child to engage with those things he/she loves or fears, allowing the child to celebrate happy events and to escape/confront events which are threatening or which cause anxiety. Emotional state can often be diagnosed by art therapists through the

examination of colour, size and placement in children's work. In the classroom therefore we need to present children with drawing themes that allow for the expression of personal feelings.

Drawing is furthermore a key tool in enabling children to remember and to reflect on experiences. Making drawings while on a field trip, for example, enables children to reconstruct the sequence of the trip and by focusing on individual images, to recall individual events. Drawings such as this help children both to recall and to reconstruct what they have seen or experienced. Drawing events on timelines aids the memory of historical events, making labelled diagrams of natural objects helps children to memorise details of those objects and drawing on maps helps in the memorisation of geographical information.

Drawing helps children to shape and to share what they imagine with others. In drawing children take their experiences, observations, memories, fantasies, dreams and nightmares and combine them into unique new combinations.

Finally drawing is a problem solving and designing tool for children. In a drawing a child can formulate a proposal about a possible solution to any problem posed. An example of this might be drawing a solution to a mathematical problem. By posing questions such as "I wonder what....." or "What would happen if....." the teacher can engage children in problem solving through drawing. A good example of this in visual arts education is the use of drawing to create a design for a possible construction.

The Primary School Curriculum outlines a programme in drawing that enables us as teachers to provide the opportunities for all children to develop and to use their drawing skills. The key objective in the curriculum, for all class levels, states that the child should be enabled to make marks/draw with a wide variety of drawing tools on a wide range of surfaces and to look at and respond to their own drawings, to the drawings of others and to drawings by artists. A summary of the other objectives suggests that at all class levels we should be providing opportunities for children to make drawings as follows

- drawings that allow them to explore and to experiment with different drawing tools and surfaces
- drawings based on their experiences
- drawings based on their imaginings
- drawings based on their observations

Opportunities for children to draw present themselves in all curricular areas at all class levels. Infants drawing a picture of Humpty Dumpty falling off his wall are making a drawing based on imagination while a sixth class making a drawing of a favourite scene from a novel is doing the same. A first class making a drawing

about a farm visit are making a drawing based on their experiences while a fifth class making a labelled diagram about an experiment in science are making a drawing based on observation. The key question though is, do we place enough value on these drawings? Do we recognise them as being a valuable learning tool? Do we realise that children not only learn to draw but that they also learn through drawing?

MICHAEL O'REILLY

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The inclusion of pupils with autistic spectrum disorder within the primary school: a comparative study of inclusive practice across four schools with two different models of provision

Michelle Dunleavy

Rationale

The researcher first encountered a pupil with ASD while working as a resource teacher and became captivated with the subject of ASD and in particular the inclusion of pupils with ASD in the mainstream school setting. It soon became apparent that these pupils had difficulty in the mainstream setting. Further postgraduate studies brought the realisation that pupils with ASD need to be taught skills, particularly social skills that typically developing peers learn intuitively. For this reason I became interested in the concept of including all pupils with ASD within a mainstream setting and where the concept of a continuum of provision fits within this.

When one examines education across the centuries it is evident that education for the masses is a relatively new phenomenon. How have we moved from the Elementary Education Act 1880 when the aim was to have compulsory education for all children up to the age of ten to a position where education for all within mainstream school appears to be the objective in 2011?

The Warnock Report (1978) in Britain appears to have been the catalyst for the inclusion debate, but more importantly, it was the first document where there was an obvious attempt to change the language used in categorising children with special needs. Whilst the Report does advocate inclusion within the education system for all persons of school age it also advocates a continuum of provision and did not support the notion of educating all pupils, regardless of ability or disability, within the mainstream class on a full-time basis. It was also the first document to admit the difficulty of neatly categorising children with special needs. This opened a debate on the wisdom of compiling lists of categories of special needs, as each person within the category will differ and therefore, may have different needs. This is true of pupils with autistic spectrum disorder (ASD), who each present differently within the spectrum.

The Government of Ireland (1980) White Paper on Educational Development, highlights what can be described as the dilemma of children who do not fit into the traditional categories of 'mild', 'moderate' and 'severely' handicapped. No clear explanation for this "disquieting phenomenon" was reached (White Paper, 1 980:31) but maybe this was the beginning of recognising syndromes such as ADHD and ASD that we are familiar with today.

The 1993 Report by the special education review committee (SERC) was the first comprehensive investigation into the education of pupils with special needs in Ireland. In order to investigate the education of pupils with special needs the committee had to first decide on definitions. The SERC Report used the World Health Organisation (WHO) terms of "impairment", "disability" and "handicap". The Report recognised that all children have a right to an education but stated that this must be appropriate and therefore should be based on the individual needs of the child. It goes on to state that there should be "as much integration as is appropriate and feasible, with as little segregation as is necessary. We therefore envisage a system in which there will be a place for both ordinary and special schools" (SERC, 1993:22): in other words a continuum of provision to take account of the continuum of need.

The Salamanca Statement (1994:6/7) states, "schools have to find ways of successfully educating all children, including those who have serious disadvantage and disabilities. There is an emerging consensus that children and youth with special educational needs should be included in the educational arrangements made for the majority of children. This has led to the concept of the inclusive school" … "A child- centred pedagogy is beneficial to all students". The Salamanca statement advocates action at national level to "achieve education for all" and the "practice of 'mainstreaming' children with disabilities should be an integral part of national plans for achieving **education for all".**

The Education Act 1998 states that the Act will "make provision in the interests of the common good for the education of every person in the state, including any person with a disability or who has other special educational needs (Education Act 1998:5). The Act does not stipulate where this education should take place but that there should be "a level and quality of education appropriate to meeting the needs and abilities of that person" {1998:10, 7 (1)(a)}

The Task Force Report on Autism (TFR) was published in 2001 and it uses the term autistic spectrum disorder (ASD) and makes a distinction between pupils with classic autism and Asperger's Syndrome (AS) or high functioning autism (HFA) (TFR, 2001:159). Like the SERC report (1993) the Task Force Report advocated a continuum of provision to take account of the continuum of need (2001:160).

The Education For Persons with Special Educational Needs Act 2004 (EPSEN) states "that the education of people with such needs shall, wherever possible, take place in an inclusive environment with those who do not have such needs, to provide that people with special educational needs shall have the same right to avail of, and benefit from, appropriate education as do their peers who do not have such needs unless that nature or degree of these needs of the child is such that to do so would be inconsistent with –

(a) The best interest of the child as determined in accordance with any assessment carried our under this Act, or
(b) The effective provision of education for children with whom the child is to be educated.

As with the Education Act 1998 this does not state that every child should be educated in the mainstream class, although this may be the preferred option.

An examination of these documents such as the Warnock Report (1978) and Salamanca Statement (1994) gives some indication as to why there may be a perception that inclusion corresponds to mainstream. The focus appears to be on the 'right' of every child to an education and the Salamanca Statement advocates that this should be within the mainstream setting for all pupils. However, the SERC Report (1993) and Task Force Report on Autism (2001), whilst supporting the concept of education for all, favoured a continuum of provision rather than mainstream for all.

The Education Act 1998 and Education for Persons with Special Educational Needs 2004 want inclusion where possible, but recognise that a continuum of provision may be needed. There appears to be a move towards 'rights' based inclusion resulting in schools enrolling pupils with ASD in mainstream without fully understanding the implications for the pupils, staff, supports or resources. However, a study of autistic spectrum disorder and how it may affect the child in the learning environment may give a greater appreciation of why a continuum of provision may be necessary. The debate on inclusion is ongoing. However, the interpretation of inclusion is causing confusion due in part to the lack of definition within legislation.

Inclusion/Integration

Inclusion and integration are terms that are used interchangeably but it can be argued that they have different meanings within the context of education. This has perhaps led to some uncertainty and misunderstanding of what is expected of schools with regards inclusion. An examination of these terms is therefore necessary to gain a working definition of inclusion for the purpose of this research.

> "over the past decade a commitment to promote a more inclusive education system can be seen to have exercised education policy makers across Europe and indeed many of the world's countries … yet it would appear that all the efforts made by policy makers campaigning organisations and teachers to provide fully inclusive schools have failed to achieve this ultimate goal" (Meijer, 2003; Kugelmass and Ainscow, 2004) REACH vol 19, No1, 2005: 3-15.

It can be argued that this quote sums up the journey of inclusion here in Ireland. I would suggest that one of the reasons we have "failed to achieve our ultimate goal" is that we have not adequately defined our "ultimate goal". Abbott (2007:394) suggests "the complexity of defining inclusion is resulting in continued misunderstanding of the term and what it entails"

Many definitions of inclusion and integration have been put forward and examined by the researcher. In summary there appears to be a general consensus that integration can be interpreted as placing pupils with SEN alongside their typically developing peers with little or no adaptation by the school; therefore the pupils must adapt to the environment in which they are placed. Inclusion on the other had can be interpreted as schools making changes to environment etc in order to assist the pupil. Drudy and Kinsella (2009:659) cite Aincow (1999) to suggest:

> Integration being making a limited number of additional arrangements, such as providing additional instruction, for individual pupils with SEN, while schools in essence change little overall. Integration thus involves the school in a process of assimilation where the onus is on the assimilating individual (whether the pupils with SEN or pupils with different cultural and linguistic backgrounds) to make changes so that they can 'fit in'. In contrast, inclusion implies the introduction of a more radical set of changes through which the schools restructure themselves in order to embrace all children, by adapting curricula, teaching methods, materials and procedures, and thus become more responsive to the diverse needs of their pupils"

If inclusion is to become a reality for pupils with ASD the radical changes Ainscow advocate will have to take place within a system where the segregation of pupils with ASD has been the norm. In order to understand what adaptations are needed to assist the inclusion of pupils with ASD one must have knowledge of ASD and how it affects the pupil in the learning environment.

History of autism

Leo Kanner, John Hopkins University, "identified a group of children who failed to develop normal social relationships, were upset by changes in their environments and showed abnormalities in speech and language" (TFR, 2001:16). Hans Asperger, a Viennese paediatrician, "presented a distinct syndrome which shares many of the characteristics noted by Kanner, but generally includes average intellectual and structural language abilities" (TFR, 2001:16).

Based on the research of Kanner and Aspreger in the 1940's, writers such as Jordan (1999), Jordan and Jones (1999), Wing (1996) and others indicate that, one of the main difficulties, for pupils with ASD is in the area of social skills and particularly social interaction. The triad of impairment impacts on the way the pupils' think, learn and relate to others. Therefore, this sets them apart from pupils with other special educational needs (SEN) (Jordan,2001). Although behaviour is not part of autism (Jordan, 2001) and "most behaviour is functional" Clements and Zarkowska (2000:38) the perception that all pupils with ASD have behaviour difficulties may be one of the factors influencing teachers' attitudes towards the inclusion of a pupil with ASD. Perhaps additional support to help teachers further their understanding of the 'triad of impairment' and to make adaptations advocated by researchers would help the inclusion process. For example, there are a number of approaches and strategies such as the use of visual cues, structuring the environment, the use of schedules etc that can be equated to good practice in the inclusion of pupils with ASD.

There are many psychological theories to explain why pupils with ASD have difficulty in these three areas, but the most commonly used are Theory of Mind, Executive Function and Central Coherence.

Theory of Mind
Theory of Mind helps us to sequence our day in our mind, helps us to understand that others' have their own thoughts and feelings, helps us to empathise with others, helps us to 'mind read'

Executive Function
Helps us with organisation, impulse control, and learn from past experience, monitoring actions, generating ideas and adapting responses to suit different situations.

Central Coherence
Helps us to see the bigger picture, and learn from past experience.

How does this affect the pupil in the learning environment? There can often be a mis-match between expressive and receptive language, with expressive language at a higher level of development than receptive language. This can be as a result of auditory processing difficulties. Although a pupil may have good expressive language this may be used to talk about a topic of interest with little understanding of language as a communication tool. The pupil may talk 'at' rather than 'to' people and not understand that conversation is a too way process. This makes it difficult for the pupil to work in groups due to the lack of understanding of social timing of conversations, body language etc. The poor understanding of social rules may result in inappropriate behaviour in class for example difficulty turn-taking, when responding to teachers questions. The poor development of social interaction skills is probably the most defining feature and

probably the most disabling for the pupil with ASD. The pupil may have difficulty with understanding and interpreting social behaviour, initiating and responding appropriately in social situations. For the pupil with AS this is particularly difficult as their social skills ability will not match their academic ability and the pupil may become more aware of this as they get older. Social skills may have to be taught as they are not learned intuitively as with the typically developing pupil.

Rigidity of thought and actions may result in play not being symbolic and the pupil may engage in isolated or parallel play rather than joining in with group play. The pupil may become obsessive about a certain topic or object and this makes it difficult to find a mutual topic of interest with other pupils. They may find change difficult, such as changing from one subject to another, one class to another. They may like routine and be unable to predict or visualise new situations, thus leading to anxiety. Stereotypical behaviour such as hand flapping may result from anxiety and they may try to control their environment as a means of creating security.

In addition to the 'triad of impairment' the child with ASD may have a sensory impairment meaning that they can be hyper or hypo sensitive in any of the senses. The child may have difficulty with fine and gross motor movements. S/he may engage in immediate or delayed echolalia, where the pupil repeats words, phrases or scripts used by others.

Methodology

Whilst I, as the researcher, may be perceived as an outsider, I do have insider knowledge of how schools operate, having worked within the system for a number of years. On the one hand this gives me an understanding of some of the challenges and rewards of working with children with ASD. On the other, hand I must be aware of my own bias and how this has the potential to corrupt the data. Perhaps, the researcher's knowledge and understanding of teaching strategies advocated for pupils with ASD should not be seen as bias but as a useful resource and "a valuable component of it" and for this reason should not be eliminated from the design (Maxwell, 1996, cited in Robson (2002:50).

The purpose of this research is to study individuals (teacher, SNA, principal, parent); group (four schools); and phenomenon (inclusion). Therefore, it meets the criteria for a case study (Bassey, 1999:26). A comparative study of the four schools will be achieved by taking each school as a separate 'case' thus using a multi-case approach, as an important consideration was the contextual setting (Yin, 2003). The criticism of 'lack of rigour' (Bassey, 1999:34) has been minimised through careful analysis and triangulation and every effort made to ensure that data is "gathered systematically and rigorously" (Cohen *et al* 2000:182). The issue of internal validity during the research design was managed through the choice of the sample population. Schools were selected on

the basis of educating pupils with ASD using the two different models of provision, one where pupils are taught in the mainstream class on a full-time basis and the other where pupils with ASD are taught in a special class with part-time inclusion in the mainstream class. External validity – using multi-case studies minimises the critique that a case study "provides no basis for generalizing to a wider population beyond that case" (de Vaus, 2001:237). However, in the sense that the case studies will assist the development of theories the generalization ability of the theory will be tested through comparative studies of the four cases within this study through the use of "logic of replication" (de Vaus, 2001:237).

The research design has incorporated checks for validity to maximise the quality of the research and findings that are judged by "trustworthiness, credibility, confirmability, and data dependability" (U.S. Government Accountability Office, 1990, cited in Yin 2009:40) Using the four tests, – construct validity; internal validity; external validity; and reliability, – throughout the research process will facilitate the establishment of the research's significance (Yin, 2009:40). An this research is an exploration of phenomena in the 'real world' qualitative data collection methods will be used to help explore how people manage their day-to-day responsibilities (Miles and Huberman,1994), in this case the inclusion of pupils with ASD in the mainstream educational setting. Within the postpositive paradigm the use of multiple methods of data collection, (Denzin and Lincloln, 2003:14)

The 'reality' this research wishes to reveal may be difficult to capture because it may vary with the perception of the observer. Due to the difficulty with definition one may find that "reality can never be fully apprehended, only approximated" (Guba, 1990, cited in Denzin and Lincoln, 2003:14). Nevertheless, this research will attempt to capture reality of inclusion as a 'snap-shot' of time. Qualitative researchers become more involved in the world they are studying and in this instance through the interview process and observations a better impression or awareness of what is happening in the world of the participants should be achieved. Tuckman (1972) cited by Cohen *et al* (2000:268) writes, "By providing access to what is "inside a person's head", [it] makes it possible to measure what a person knows (knowledge or information), what a person likes or dislikes (values and preferences), and what a person thinks (attitudes and beliefs)"

Interpretation of the data will seek to understand the inclusion experience from the point of view of pupil and staff. Gathering statistical information on the number of pupils with ASD being educated in mainstream setting would, on its own, tell us little about the experience. By visiting schools and personally interviewing the participants a greater understanding of their perspective will be gained. It will almost certainly question assumptions and perceptions of both the participant and researcher in an effort to examine ordinary experiences through a more objective and reflective lens.

Data analysis

The aim of this research is to examine practices that facilitate or impede the inclusion of pupils with ASD. It can be argued that it is not 'inclusion' *per se*, but the practicalities of including all children within an educational system with a history of segregation that creates the difficulty; this has been highlighted in the literature review by writers such as Tilstone, Florian and Rose (1998). The 'right' of every child not only to an education but an education within a mainstream school was enshrined in UNESCO's Salamanca statement (1994). Whilst subsequent legislation in Ireland appears to have upheld this right; it can be argued that much confusion surrounds the practicalities of how this can be achieved. I believe that inclusion i.e. being able to take part in education that 'celebrates diversity' can only be achieved by recognising a continuum of need and providing a corresponding continuum of support and provision. As Møller (2007:43) writes, a successful school is a school that succeeds in taking care of all children, regardless of social-economic or cultural background and abilities". Whilst the data suggests that all four schools are striving for this type of "success" it will also possibly reveal contradictions, dilemmas, conflicts and ambiguities. An analysis of the views of staff within each school will indicate that certain actions and views will appear inclusive while others will appear exclusionary (Dysone and Millward, 2000:17).

Levin and Fullan (2008:297-298) has drawn attention to the evidence in support of generating clear goals and visions and the importance of communicating these to employees whilst seeking contributions from staff during the process. This point is reiterated by Fullan (2001) cited in Glatter and Kydd (2003:234) who writes "visions need to be shared and emerge from experience rather than be imposed"; Clements and Vandenberghe (2001:45) also stress the importance of collegiality between principals and teachers for collective goal setting. How can this be achieved?

Writers such as Fullan (2006:3) believe that clear goals and visions, shared by all stakeholders, can be achieved through capacity building or what Clements and Vandenberghe (2001:44) terms "shared leadership". However, this indicates that the responsibility of managing the change to inclusion of pupils with ASD lies with the leadership team within the school. I would argue that while the leadership of the school does influence the success or failure of the inclusion process, more complex elements are at work within the school that may determine how the inclusion process evolves. Therefore, before examining the data that supports or refutes the use of capacity building or shared leadership in the schools, I will examine other factors that impact on the how goals and visions are created and communicated.

The goals and visions of each school will be examined, using deductive analysis, under the following three sub-headings:

1. Definition
2. Collective knowledge
3. Positives and negatives of inclusion

The ambiguity surrounding the definition of long-term goals and visions for the inclusion of pupils with ASD is apparent from the data. This is leading to uncertainty and confusion which in turn is leading to a multiplicity of interpretations. The apparent brevity with regards definition subsequently impacts on the ways goals and visions are communicated. The importance of generating clear goals and visions are well documented in the literature. Shared vision, where all stakeholders work together to achieve the same objective can best be realised when aims and objectives are clearly defined and created through collaboration.

Whilst there are a number of theories to explain why goals and visions are not clearly defined, the data indicates that it may be the culture of the school. Culture can be generated, changed and developed through social interaction, both informal and formal. An examination of factors that impact on social interaction highlights the effect school building design has on the level of informal interaction between colleagues throughout the school day. Other factors, such as scheduled formal and informal meetings and who attends indicates that when some members of staff are excluded from these, a sense of isolation can occur. Playground supervision creates another obstacle for social interaction amongst colleagues. With teachers supervising on rota basis and SNA's on supervision each day, break times cannot be synchronized and therefore do not provide opportunities for teachers and SNAs to meet.

Staff recruitment and influences on staff behaviour linked to movement between schools also affect the culture of schools. The higher proportion of women than men within the profession is evident in all sample schools, with Central P.S. having an all female staff. There is evidence to support the theory that teachers, for the most part, remain in a school once a permanent position is secured. The length of service of teachers supports this and comments such as "I'm in my fourth school, "I've moved around a bit" (Marie, Parklands P.S.), indicate some reluctance to change schools. Those with a POR are more likely to be longer serving members of staff rather than those with post graduate qualifications. The emphasis on seniority in the selection process, for posts of responsibility, encourage teachers to remain in the same school rather than gain experience within other schools or organisations.

All schools within the sample, regardless of model of provision, demonstrate a willingness to include pupils with ASD. There is some evidence of resistance from some teachers, but this appears to be linked to anxiety with regards changes to methodologies and pedagogy. The challenge to habitual practices and attempts to maintain the status quo is more evident in some schools and this may be linked to the time spent on discussing issues such as inclusion.

A change in some work practices is necessary for the inclusion of pupils with ASD. For example, teachers may find themselves, maybe for the first time in their career, having another adult in the classroom and concerns have been raised in connection with this.

Findings

The principals in all four schools give a broad definition of the schools' goals and visions in respect of the inclusion for pupils with ASD. Whilst these generalised definitions are linked to the schools' Mission Statements they are somewhat nebulous and may leave staff confused and uncertain as to what is expected of them. Clear, unambiguous goals and visions are imperative and their generation in consultation with existing staff and their communication to new staff will facilitate their attainment.

Why are goals and visions defined with such ambiguity? It is perhaps that the culture of the school has changed with the inclusion of pupils with ASD and that a sense of anomie now exists? Is there evidence to suggest that some staff members are struggling to manage a changing culture while others are attempting (perhaps unconsciously) to maintain the status quo? What is preventing schools from collectively shaping goals and visions? If, as writers such as Nias (1989), Emerson and Goddard (1993), Deal and Kennedy (1983) and others suggest, it is the culture that determines "the way we do things around here" an examination of factors that help create the culture is necessary.

From my own experience of teaching in a special class within a mainstream school and my work as an advisor on special needs, I believe that the goals and visions should be clearly defined and shared by at least the majority of stakeholders. The setting up of a special class with an assumption rather than a coherent plan for part- time inclusion in the mainstream can lead to anxiety, resentment, and fear among staff. I would recommend, when formulating a plan for inclusion, whole staff discussion to answer the following questions:

- Will pupil with ASD be included in the mainstream?
- Rationale for inclusion in the mainstream?
- What criteria will be used to decide which pupils will be included in mainstream?
- Who will decide which pupils will be included?
- What lessons will pupils with ASD attend in mainstream and why?
- Who will be involved in planning these lessons?
- How will differentiation and structuring the environment be organised?
- How will time for collaboration be organised?
- Who will co-ordinate the inclusion process?

Nias (1989:32) suggests that a number of elements, common to all schools, converge to shape the culture of schools, but nevertheless create a culture unique to the individual school. School buildings, organisational arrangements, staff, history of staff, history of school are elements that affect the school culture by influencing the type and degree of contact and communication amongst those working in the school. A list of elements/factors that influence and help to shape, maintain and/or create a new culture will be examined using an adaptation of the list produced by Nias (1989:32).

- School buildings: design and layout of building (office, staff room), facilities for resource/learning support, location of special class etc
- School history: amalgamations, growth, newly established
- Organisational arrangements: staff meetings, yard duty, organisation of break times for teachers and SNAs,
- Staff: gender balance, length of service, promotional structure
- Work practices: teachers and SNA's working together
- Model of provision for the inclusion of pupils with ASD

The **Coast Road P.S.** is a relatively new purpose built school therefore one would expect it to be 'fit for purpose'. Although built in 1993 space appears limited with some pupils with SEN being taught behind partitions in the lobby and the special class occupying a pre-fabricated building situated across the playground. Although the lobby has a notice board that provides what Nias (1989:33) describes as a "natural meeting place" this is somewhat impeded by the presence of teaching areas in close proximity. Whilst the pre-fabricated building is spacious and well equipped its physical detachment from the main school building may create both a physical and psychological division between those working in the special class and their colleagues in the main school building. In **Central P.S.** there is an absence of the "natural meeting place", on either Junior or Senior site that is present in Coast Road P.S. In Central P.S. the special class occupies a classroom within the main building on the Junior side and therefore is not completely isolated, as other classes pass by on their way to the PE/General purpose room. However, there is a sense that the special class is segregated by virtue of its physical position, away from mainstream classrooms, and is certainly isolated from pupils and staff on the senior side. The physical layout of both schools may be hindering the informal meeting and general conversation that is all important to the evolution of culture within schools. Of particular concern is the opportunity for social interaction between those working in the special class and their mainstream colleagues.

Parklands School has what might be called an optimum layout with the staff room acting as the interaction hub in the centre of the school. The pupils with ASD are included in the mainstream class and attend the special education teacher. Therefore, it is the situation of the special education teachers that is

important here. The special education rooms are alongside the mainstream classes off the main corridors. For this reason, it can be argued, their central location minimises the physical and psychological barriers between those working in special education and their colleagues in the mainstream. **Station Road P.S**. also includes pupils with ASD on a full-time basis within the mainstream classes. Whilst the special education classes are within the main school building they are small and cramped as they were not originally designed as classrooms. Social interaction with colleagues is hindered not by the layout of the main school building, but the number of pre-fabricated classrooms that limits opportunities for casual interaction on the corridors. The staff room appears to provide the "natural meeting place", but its location, within the main building, and its size does not encourage casual conversations among colleagues. Each pre-fabricated classroom is a separate entity standing disconnected from the main building; consequently there may be a feeling of isolation and disconnect between colleagues.

History of school

Coast Road P.S. is an Educate Together School and therefore has a different historical background to the other school in the sample. This is a newly established school opening in 1993 with a new staff, to provide an alternative to denominational schools that have dominated educational provision in Ireland. Central Road and Parklands have much in common as they are both the result of an amalgamation between the boys and girls schools within the town. Central P.S. maintained the two sites and split the school into Junior and Senior while Parklands gained a purpose built school on a green field site. However, both schools retained existing staff members and therefore two cultures had to merge following the amalgamation. Station Road P.S. is a school that has seen considerable growth in recent years due to changing demographics and the intake of pupils from diverse backgrounds and the increased number of teaching and ancillary staff will have impacted on the culture. The result being a change in culture but also result in some staff struggling to maintain the status quo.

Organisational arrangements

All four schools have scheduled staff meetings and according to the data, it is during these meetings goals and visions are discussed and communicated. Additionally, Coast Road P.S. has informal weekly meetings, where staff can discuss issues that may arise. In Coast Rd, Parklands and Station Road primary schools the SNA's attend staff meetings and one can assume therefore that they are *au fait* with changes or innovations being introduced. However, in Central P.S. the SNAs do not attend scheduled staff meetings and there does not appear to be a formal meeting that all SNA's attend for the purpose of discussion and dissemination of information. However, the SNA's working in the special class meet with the special class teacher on a weekly basis for the purpose of review and planning.

In all four schools teachers are involved in playground supervision on a rota basis and this also reduces the opportunity for informal social interaction. SNA's in all four schools provide supervision for pupils with SEN in the playground on a daily basis and consequently take their breaks at different times to teachers. As a result there are limited opportunities for informal social interaction between SNA's and of their teaching colleagues. Some SNA's may only interact with teaching colleagues when accompanying pupils into the mainstream class.

Staff

In each school, within the sample group, the majority of staff is female. Statistics indicate that whilst there are greater number of women entering the teaching profession they are "unrepresented in promotional positions" (INTO, 2004:6). This under-representation in promoted positions is not evident in the sample schools; the gender imbalance may impact in decision making and thus the culture of the school.

The length of service of staff members is another factor that may impact on school culture. If as Deal and Kennedy (1983:14) writes "culture is an informal understanding of the "way things are done around here" then the period of time staff have worked together must surely have an impact on the culture, the longer staff have worked together the more likely they are to have common norms and values.

Table 2 shows the number of year's service for each teacher interviewed, the average length of service for staff taking part in the study and the number of years the school has been including pupils with ASD. The literature indicates that school culture is generated by the staff. Therefore, it can be argued, that if the composition of staff remains the same changes or the evolution of culture within the school will be more difficult to achieve. The emphasis on seniority in the selection process for posts of responsibility can act as a disincentive for teachers to change schools and gain experience in different working environments. The data indicates that teachers with POR in the sample schools are the longer serving members of staff. The exception to this is Station Road School where the principal has shorter service than most of the post holders. The reason being that the principal was an outside candidate and joined the staff as a principal.

Table 2

School	Years teaching in school	Average length of service	Number of years pupils with ASD in school
Coast Road Primary School	4;5;5;8;9;3;8;4;8	6	7
Central Primary School	2;5;5;3;14;20;6;30;11;37	13.3	7
Parklands Primary School	17;26;3;6;8;6;4;26;28;12;35;35	17.1	4
Station Road Primary School	2;1;19;12;29;5;5;5;2;5;10;7	8.5	7

Model of provision

Does the model of provision influence the way teacher respond to the inclusion of pupils with ASD within the mainstream school? Coast Road P.S. and Central P.S. have special classes for pupils with ASD with part-time inclusion in the mainstream class. Parklands P.S. and Station Road P.S. include pupils with ASD within the mainstream class with the support of the special education teachers and SNA's. Analysis of data was completed to determine the level of resistance to change and schools' management of attempts, by some staff, to retain habitual practices and maintain the status quo.

In Coast Road P.S. the principal said "I can't recall any particular resistance. There may be concerns about training or resources … but I wouldn't describe it as resistance". Joan, a resource teacher said "don't think there is reluctance … it can be a bit lost in what system to put in place" or Simon, a class teacher said, "never experienced any reluctance, people are nervous alright but never reluctant to involve themselves". With regards attempts to maintain the status quo, Lucy a class teacher said, "I think the school is very good at always wanting to find better ways, better methods and always at staff meetings we are constantly trying to change, trying to better ourselves"; and Rosie, a class teacher said, "there is no way to stop change".

In Central P.S. the principal said, "I think there is a certain amount of resistance amongst staff members, more resistance among some people than others and it's just a case of sitting down and talking about it". Naomi, a class teacher with a POR, said, "there is [reluctance] I suppose myself would be one who would be hesitant about having a child with ASD … just suppose I'm not fully aware of it … a personal thing like having another adult in the room all the time … numbers too… curriculum so intense … pressure all the time so much to get done … text books finished … I feel they're so well catered for within their own environment". Charity, the special class teacher said "there is reluctance amongst staff members even though there has been progress there is still fear. I think some teachers who have been teaching for many years have a certain way of teaching and don't want to go outside a boundary and

open up a bit more". With regards attempts to maintain the status quo Melissa, a class teacher, said "[habitual practices] are challenged and again depending on the person, personalities, some people have a fear of change and others don't". Whilst not all teachers agree that they are 'challenged' Naomi, a class teacher with a POR said habitual practices are "discussed to a certain extent. It is very hard to challenge". While others maybe felt that the 'challenge' was more subtle, for example, Mellisa said "we are lucky in that we have a principal who, although teaching a long number of years, loves the challenge and loves the change and encourages quietly". Others tried to understand why there might be resistance to inclusion and an attempt to maintain the status quo for example, Alecia who said "teachers have frustrations when children can't perform as well as they might expect".

In Parklands P.S. the principal said "I suppose yes, when you have big classrooms and when you have pupils presenting with difficulty you will have some staff members saying you know there is another school". Marie, a class teacher said "Don't think there is any reluctance. There may be a certain amount of perhaps anxiety". Phillip, a class teacher, said "I think in the past we were all afraid of change and when we had children coming into our classrooms with special needs we were, maybe not traumatised but, we were intimidated in some way but I think we've learned to deal with change". With regard maintaining the status quo Susan, the principal said "in the past few years we've had to discuss them probably not quite formally. We've had to discuss and challenge some of the habitual practices". Phillip said "I think they are discussed, I think they are challenged … some people hate change and we all like our comfort zone". While others such as Sandra said "probably discussed but never challenged"

In Station Road P.S. the principal said, "I think reluctance would only arise in situations where we would feel that the child was not suitable for a mainstream setting". This view is supported by Grace a resource teacher with a POR when she said, "I suppose there is a certain amount of fear if you know there's a child with ASD coming into the school until you know what the level is. It's really a fear of not knowing how to deal with it as it is not being open to it". Maddie a class teacher with a POR said, "with children with ASD everyone would be hoping that it's not their class. That's being honest you know because it does you know, it is a big workload". With regard maintaining the status quo the principal said, "there would certainly be a rolling ball in that we would look at things and we'd try them and it they work we keep them if they don't we don't". Pauline a class teacher with a POR said "in this school there is predominantly a very young staff and they haven't really got entrenched and I think that they're up for every challenge". Helen, a class teacher said "I think if a school tries to stay the same and the processes and practices and the beliefs are always the same the school will never grow in itself, it has to change with the students and the teachers that are within the school".

Work practices

For the most part teachers work in classrooms where they are the only adult. As Nias (1989:34) writes, for most of the school day they are alone with a group of children, often enclosed in a classroom". With a tradition of being the only adult in the classroom changes, such as inclusion, that involves teachers working with another adult in the classroom may prove problematic.

The principal in Coast Road P.S. said, "Working with an SNA is a whole new skill, having another adult in your classroom, working as a team, providing guidance, learning about communication, interpersonal skills, people can't take it for granted, you can't just assume people know how to do that or take it that one has the confidence". Joan, a resource teacher said, "it's a different aspect to your teaching because you have to manage another adult"

The principal in Central P. S. said "I found it very difficult at first because I was so long teaching, it took a bit of getting used to … continuous professional development for working with SNA's would be good on exactly what the role of the SNA is and what the SNA can do in their classroom besides support one child". Mellissa, a class teacher said, "working with SNA continuous professional development would be very good. I think some teachers fear another adult in the classroom" Mellisa Central P.S.

In Parklands P.S. the principal said teachers "would benefit from training for working with SNA if there was any available". Marie a class teacher said "I know of people who have had issues; the biggest thing is the boundaries and their particular roles, where their duties start and finish". Sandra, a class teacher said, "I'm sure there are situations where teachers are uncomfortable probably feel that somebody is watching them all the time, I certainly am not fully aware of what is expected or not expected of an SNA".

In Station Road P.S. the principal said he would "talk to teachers about feeling uncomfortable with an adult in the classroom". Áine, a class teacher said, "I found it hard at first to know what the boundaries are or how to direct someone else". Grace, a resource teacher said, "working with an SNA can be a difficult situation".

Some SNAs are aware that teachers may have a certain amount of anxiety about having an SNA in the classroom, but for the most part they feel valued. Geraldine, an SNA in Coast Road P.S. said "overall teachers are very positive and SNA is welcome". Vanessa an SNA in Central P.S. said "I'm sure some teachers feel a bit nervous because having another adult in the class is not like having thirty children". Veronica an SNA in Parklands P.S. said "a lot of the young teachers haven't known anything different but in the beginning it was difficult for the senior members of staff". Petrina an SNA in Station Road P.S. said "once the teacher gets to know the SNA they're not bothered; some teachers maybe".

Conclusion

There are a number of factors that impact both positively and negatively on the inclusion process. However, from this research it can be argued that a lack of definition of inclusion is leading to a multiplicity of interpretations and thus confusion. There is also a struggle between the concept of children having a 'right' to mainstream education and providing a 'child-centred' education. Schools are educating pupils with ASD but there are a number of barriers such as those discussed here. Whilst legislation appears to advocate mainstream for all children, Reports commissioned by government advocate a continuum of support to reflect the continuum of need. It would appear that, in the case of pupils with ASD, there is no one model of provision suitable for all. Here I have looked at a number of factors that are impacting on inclusion and whilst schools

are in favour of inclusion the practicality of provision for pupils with ASD is proving problematic.

MICHELLE DUNLEAVY

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A Simple Measurement Task

Florence Gavin

The Observation

Separate from the language of mathematics children who have poor command of oral language have an extra burden to carry when it comes to solving a simple mathematical problem involving a unit of measurement and single digit number operations.

Introduction

All children except the mathematically able have a certain degree of difficulty with the language of Mathematics. It is a distinct language, different from the everyday conversational language of the classroom, containing words and symbols which the children rarely, with a few exceptions, meet outside the classroom. This vocabulary can be especially difficult for children who have short or indeed long-term memory problems in relation to language. However, what this task is concerned with is the difficulty a child can have trying to express a simple measurement problem. The language required for the social, albeit school setting, is everyday language. The problem does not contain any difficult terminology. Nor is it difficult to read. It is straightforward and unambiguous.

The Problem set was:

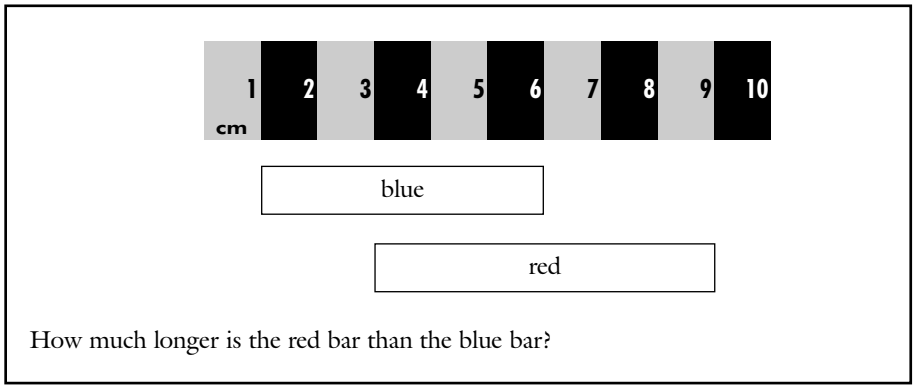

Fig. 1: Though in monochrome in this article, Fig. 1 was in colour in the worksheet given to the children.

The Subjects

The task was given to two fourth class girls. Child B was 10 years 10 months and registered at 14th percentile for Mathematics and at 10th percentile for reading. She attends Learning Support for reading and oral language development three times weekly. She does not qualify for Learning Support in Mathematics as she is above 10th percentile. She suffers from asthma and is frequently absent from school.

Child J is 10 years 5 months and registers at the 8th percentile in Mathematics and at 25th percentile in reading. Her oral language and reading are considered average. She attends Learning-Support three times weekly for Mathematics. Her attendance at school is very good.

The task set was similar to, though less difficult than those which children of a similar age meet in maths assessment tests.

Initial Conjectures

1. That the children would:

    (i) Confuse "metres" and "centimetres".
    (ii) Need constant reminding to focus on the problem.
    (iii) Proceed very slowly.
    (iv) Find flexibility of approach very difficult.

2. The two children would approach the task with difficulty both from a language and a cognitive standpoint and would not proceed effortlessly to accurately answer the question.

Method

In order to encourage more interaction the children were given just one pencil and one A4 sheet between them, on which the problem was written. A box of Dienes flats, rods and units was placed strategically on the table, bearing in mind Nunes' (1993) approach to give the children various pieces of apparatus to deepen their understanding of mathematical concepts. Getting children to talk about their thought processes and the reasons for selecting and carrying out certain strategies provides valuable insights for the teacher that would not be evident from simply examining their written work (Bottle, 2005). The lesson was audio-taped and transcribed. (The tape-recorder was unobtrusive).

Two other fourth class children both aged 10.5 years who had scored above the 90th percentile in their assessment tests were separately given the same task. Their responses were accurate, decisive and considered and written in a matter of seconds.

On being asked to explain their thoughts they were very brief and concise. "Well the blue's 5cm and the red's 6cm so the red is longer by 1cm", and "Well this one is 5cm and the red is 1, 2, 3, 4, 5, 6 cm (pointing) so it's 1, 1cm".

Discussion

On seeing the diagram initially as they were settling in and talking over the teacher, child J whispered "centimetres" to her companion. Almost immediately (l.17) child B engaged with the problem "well the blue bar just starts with the 1" and understood that the blue bar was aligned at the 1 cm graduation mark. However, she was easily knocked off course, thrown by child J's reply that the blue bar was 1m 6cm (L.19). Between lines 26 and 30 child B mentioned 2 cm "no … in the middle" and then "4 metres". Child J was not quite sure how long a metre was and child B jumped in quickly to demonstrate (L.68) "There … to … there … probably". (Indicating approximately one metre in length). A brief word about the metre stick in use in their classroom failed to have any significance for child J as (by l. 101) she returned to "I think it's 1m 6cm". Child B replied emphatically "But a metre's really long". From this point child B got to grips better with the problem while child J's response was to simply drop the word metre altogether so that the blue bar became 6 centimetres – behaviour reminiscent of the algebra class Lee (1989) talked about where the students arbitrarily changed algebraic formulae to suit the moment. At that juncture child J had no understanding of the significance attached to the alignment position of the blue bar, nor had she demonstrated that she had grasped the concept of 1 metre. She did not appear to see the printed ruler as a number line. Her concept of 1 metre was unsure. She had no doubt met problems not drawn to scale and did not realise the bars in figure 1 were actual items to be measured.

Hiebert & Lefevre (1986) point out that linking of mathematical concepts and relationships only becomes embedded if the holder recognises the connected web of discrete pieces of information

Having briefly referred to the metre stick in use in the classroom and having seen B demonstrate with her arm span the length of 1 metre child J found no contradiction in restating that the blue bar was 1m 6cm long (l. 101). At line 131 "between 6 and 7", at line 138 "it ends in the 9. I think … 9 or 10" and at line 259 it's "8". Any answer will do! It was obvious from the approach taken by child J that she had no strategies to help her estimate the length of the bar (Liebeck, 1984). Later, at lines 192 child J told us that "you wouldn't be sure that that's 6cm unless you had the bar … itself … on the table … and then had a ruler. And later, "If you had the bar on the table and just say if that was the bar and em if you had a ruler … you could measure it just to make sure" (l. 201).

We can understand from this that the symbolic representation of the ruler in *Fig. 1* did not have the same significance for the child as an actual piece of concrete

apparatus would. Yet what she stated was quite clear and unambiguous though laboured and lacking fluency. In this instance her difficulty was not with language but with cognition. Was she at the early stages of stage (3) in Piaget's four stages of cognitive development – concrete operations (7-11/12 years) that logical reasoning can only be applied to objects that are real or can be seen.

At line 138 child J adopted B's habit "in the" meaning "at the" or "on the 9". It "starts **in** the 4 and ends **in** the 9". By lines 156 something of significance begins to dawn on her, "that's 6 (red) and that's 9 so it's 1, 2, 3... it'd be 3 cm longer". She is seeing the significance of where each bar ends. Once again child J's language was adequate to explain her theory to us. Later, though as both children co-operated to improve on their free-hand line drawn in pencil earlier the red bar appears to them to be longer than 3 cm (l. 165). They took the Dienes flat placed strategically close by and despite the fact that they have used the apparatus previously, it did not occur to either of them to use it as a measurement tool. As Thompson (1992) suggests it is not enough to provide concrete materials to the child. To make the best use of mathematical apparatus the child must become very familiar with it using it in a variety of ways and situations.

The children collaborated successfully in using the apparatus to verify that the freehand line was straight – *Fig. 1* – traces could be seen (not reproduced in this article) where they re-adjusted the line. Obviously the precision a development of their present class work on cm. (l. 223). At line 276 child J's explanation of the problem began with "B says … " but it is obvious that she still does not grasp it and is on the spot and very uncomfortable. As Gray & Tall tell us though below-average children know a substantial number of facts, they make very little use of derived solutions – the same idea as quoted earlier from Liebeck – that connected web of discrete pieces of knowledge.

In contrast to child J child B had a better grasp of the problem but experienced greater difficulty "saying" it even when she "see's" it. Harley (2001) stresses that we take language for granted in most cases as it usually develops effortlessly and most of the time, accurately. It is only when we meet a child struggling so hard that we become aware of the many complexities involved. At line 116 child B tried to explain to child J that the blue bar started at 1 cm "you don't really count the one 'cos it's not really starting in it". Child J misunderstood so B (l. 133) tried to make it clearer and in so doing clarified it for herself. Child B took the initiative to pencil lines vertically from the ruler to the bars confidently but at the same time she felt the need to ask permission to write on the page … "could we draw a line down there?" The child obviously did not feel she could write on the page – another drawback for her. In many instances in the fourth class curriculum it would be an advantage to draw on the maths page – say square measure, fraction diagrams, or shape and space questions. This uncertainty was

noticed at line 49 also "Are you allowed to … can you have metres and centimetres ... or centimetres and …". What child B really wanted to know was the answer meant to be in m/cm or cm alone. Children who have been tutored in a certain way often ask this question. *Is this a plus or a minus sum? Is this a multiply or a divide?* Thompson in his hypothesis struck the same note stating that Fourth grade students who have had conventional mathematical teaching previously will not take the freedom to use notation creatively (Thompson, 1992). How much more strongly this applies to fourth class pupils who are in their sixth year in Irish Primary schools which by and large are formal, silent places. According to Gleason (1980) the best language acquisition model should take into account the specialized cognitive and linguistic capacities the child can bring to the task, the skills of the adults involved and the communication and interaction between the two.

As child B pencilled in the lines and established that the blue bar was 5 cm long, child J thought "it is between 6 and 7" (131) but was quite happy to leave the work to child B. Child B corrected her firmly with "it's on the 6". At line 163 child B stated "the blue starts there" when she meant "ends" and she has the same confusion at line 235 "that starts at the 6".

By line 246 child B had solved the problem and was quite definite about it. She had by then placed Dienes units in the centimetre slots on the ruler and checked the length of both bars. On being asked to "explain it all to J, how you worked it out" child B stated (lines 267-269) "Well, the blue bar's 5 'cos it's not in the one so it's 5. Then the red bar's 6 and there's 5 'cos there's only one missing to get to the 6". Child B clearly understood the problem herself but found it very difficult to process her thoughts and explain it to her companion. Later at lines 291-293 her attempt was more vigorous. She emphasized her meaning very directly using the diagram and pointing. "D'you see the one way is in the 1, you don't count the 1 because it's in the 2? Just like pretend the one isn't there you just could the 2 … 3, 4, 5 … 6 and then the bar … Look 1, 2, 3, 4, 5 … The bar's 5".

Saxton (2010) maintains that insufficient attention is paid by researchers to language development in older children.

> Vocabulary, morphology, syntax and pragmatics all develop during the school years. What we currently know about development in the school years is probably just a fraction of what remains to be discovered. The relative paucity of research effort focused on older children can be attributed, in part, to the long held and widespread belief that, for language acquisition it's all over, bar the shouting, by the age of four or five years (Nippold, 1998, provides a rare exception).

OVERVIEW

The Task

The task set for the children was difficult for them but provided a suitable challenge, to give the teacher some insight into their methods, level of engagement and concentration. It was similar to although easier than assessment questions given to children of similar ages. However, with children facing 50+ questions in assessment tests, it is not difficult to see how excruciating such tests must be for children in Learning Support. After 20-25 minutes child B eventually solved the problem – a problem which children in the same class should solve in seconds. Although taking the tortuous route (Gray & Tall, 1994) child J eventually "saw" the solution when it was explained but was somewhat out of her depth. But it is doubtful if she learned anything from the whole episode. Both children needed several prompts to prove their answer and it is unlikely that they would have succeeded without teacher interventions.

Conclusions

It has been shown based on the transcript that both of the children have major problems coping with a simple measurement task. Child B had greater difficulty expressing herself than child J. Child J had greater difficulty understanding the mathematics than child B.

Having witnessed the children's struggle to express themselves orally it is my conclusion that this task did provide a confirmatory example of the initial observation. Furthermore, all of the related conjectures stated were borne out. For the class and learning support teachers there are immediate and pressing implications in planning lessons on measurement for both of the children tested. They also both need urgent literacy programmes to develop their communication and comprehension skills.

One child answered the question after 25 minutes deliberation. The second child was still unsure. There is very little point in giving 50 + questions in assessment tests to children who struggle at this level.

TRANSCRIPT

T We've a little problem here on the page
child whispers (centimetres)
And won't you feel free to talk about it? I'd like you to talk about it, discuss it.

B Yeah.

T Don't jump in now. Think about it for a while. Listen to what each other has to say and try and figure out how you would solve it.

J O.K.

T Now there's no rush. You can have plenty of talk about it. Now first of all read out, what does the problem say?

J How much longer is the red bar than the blue bar?

B Well the blue bar just starts with the 1.

J One ... centimetre ... and ....ends... so its 1 metre 6 centimetres. The blue bar is 1m 6cm.

B It's not, cos it doesn't start there.

J Where?

B It doesnt start at the one. It starts at the 2. No it starts in the middle.

J Oh yeah you're right. So it'll be 2m.

B Oh ... (*counting*) ... 4 cm and 1 … oh 4 metres sorry 4m 1cm. (*whispering*).

T Would you like to move J and you can see it better? Just move down a little bit. (*child moves*)

T That's better now I think.

J Em ..... *pause*

T So what's the question asking you now again?

B How much longer is the blue than the red?

T O.K. So the green bar is extra not really needed.

B How much longer is the red than the blue …
J whispers (5 starts here)

B Are you allowed to ..... can you have metres and centimetres or cm and mm?

T What do you think now from looking at the picture?

J Em ... cm

T Is there any clue there that tells that you what it is? Is there any little thing written or anything? O.K?
Child points to cm on diagram

B Cm
(*Pause*)

T O.K. J a moment ago you mentioned metres didnt you?

J Yeah

T Have you any idea what size a metre is?

B Size around .... There. To ... there on to the table probably. *(Indicating approximately 1 metre in width).*

T O.K. Would you agree with that J?

J Yeah

T A metre. Does your teacher use anything ? ....

J&B Yeah, yeah.

J We're on ... we're learning about metres and cm.

T O.K. So what does the teacher use?

B A stick with a handle.

T Right. What does she call it?

B A metre stick.....

T A metre stick O.K. So the metre stick is a metre isn't it? Yeah? Now lets look back at our picture again so. This here stands for .... *(pointing to symbol cm on diagram)*

B&J cm

T Yes. O.K.
(Pause)

B Does that start at the one? *(Pointing to blue bar)*

T Yes.

J I think it's 1m and 6cm
(Pause)

B But a metre's really long!
(Jenny laughs)
(Pause)

J Em ... (*pause*) ... think its 6cm.

T Which one are you talking about there?

B&J We're talking about the blue one.

T The blue one

B I think its 5cm cos its not starting in the one. You don't really count the one cos, cos it's not starting in it.

J No its starting in the middle of the 2.

B Its starting just at the one there.

J Yeah. So I think ....

B Mrs. Gavin could we draw a line down there?

T Of course. You can do any writing you like.
(Children check that the line is straight using Dienes flat (Talking together - tape unclear))

J Between the 6 and the 7

B Its on the 6. Yeah that'd be 5 cos it's not in the one. It's not in the one cos it's probably 5 cos look. 1, 2, 3, 4, 5 *(counting at 2, 3, 4, 5, 6)*. Cos you don't count the one cos it's not in the one. So it's five

Now the reds. *(Straightens the line more accurately)*.

J Starts in the 4 *(imitating Bs language)* and ends in the 9. I think ... 9 or ... 10.

B ... it's 9 so ... *(counting)* .....

T So where does the red begin?

J Its 6cm longer ....

B Em 4 ... (pause).

T And it ends ... at the ...?

B ... 9 ... so 6cm longer ... Than the blue bar. So it's 6cm longer.

J Yeah it's 6cm longer ... than the blue bar.

T O.K. When ... you're looking at them there ...

J Oh no wait! D'you know the way the bar is 6cm it'd be 3cm longer ... because the bar is 6cm and thats 9 so 1, 2, 3 ... so it'd be 3cm longer.

B Yeah.

J You know it wouldn't be 6cm because then that'd be ... em

B The blue starts there.

J Cos the blue ends there and the red ends there so it'd be 3cm longer. Wouldn't be 6.

T Does it look 3cm longer do you think?

J Yeah.

B Cm don't look that ...

(Long pause)

T So is there anything else that you could do to ...

B Help ...

T Yes ... to help you to get ... to prove it to yourself ... (Diene's material is on the table).
(Interruption from Intercom System)

T O.K. girls now well continue after that. So now can you look at it again.

B I don't know how you prove it out. I think it's 3. I'm not sure. But I think it's 3.

J Yeah. I think it's definitely 3. O.K.

T OK

J But you see you wouldn't be sure that thats 6cm unless you had the bar ... itself ... on the table and then had a ruler.

T O.K. Well what about ...
(Interruption)

T O.K. girls away we go again. Now so what were you saying there about the problem we have?

J If you had the bar on the table and just say if that was the bar and em if you had a ruler ... you could measure it just to make sure.

T You could.
(Children speak together - unclear).

J You dont know if it's exactly 6cm or not.

T Right. O.K. What about using this here? Could you use that as a kind of ruler? (Diene's 'stick')

B Yeah! That tells you like ... but ... When we're making the line up we're not really making it a straight line.

T Uh huh ... could you use anything to make it a straight line?

J You could use one of these. (*Dienes Flat*).

T Yes.

J Just move it out.

B Just put it beside it to see if it's right first.

J Yeah. O.K.

B Yeah ... started at the red ... look ... start there.

T Maybe if one person did one side because ... em ... you need to be particular when you're drawing a line.

B Just ... that's right ... in it ... there in the 9 in the 9 just at it right in it.

J So it'd be 3cm. (*pause*)

B That's just after the 9 .... 3. That starts at the 1. That starts at the 6.

T O.K.

J So that's definitely 6cm

B Yeah that's 1, 2, 3, 4, 5 and thats' 1, 2, 3, 4, 5 6 cm.
(Counts 1, 2, 3, 4, 5 at 2nd, 3rd, 4th, 5th 6th cm marks).

J So it is 6 then. *(pause)*.

B So that's 1. One centimetre cos that's 6 and wha ... 5 ... and there's one in the middle.

T O.K. Which colour is 5 would you say? B?

B Which what? Length?

T Bar. Yes!

B Which length? That one's 5 ... the blue one's 5

T And the red is ...

J 8

T Was that what you said B?

B No the red's 6. (*counts*)

T So could you explain it all to J how you worked it out?

B Well the blue bar's 5 cos it's not in the one so it's 5. Then the red bar's 9, and that 5 no the red bar's, no sorry the red bar's 6. And there's 5 cos there's only one missing to get to the 6.

J Oh right.

T O.K. So can you explain it to me now , J.

J B said it starts off with the 5 ... the blue bar starts off with the 5 and ... this ...

T Youre pointing to the 6 there are you?

(Pause)

J Here ...

T I don't think she understands it still do you J?

J No not really.

T O.K. B could you explain it better to her?

B D'you see the one way is in the line is in the 1 you don't count the 1 because it's in the 2? Just like pretend the one isn't there and you just count the 2, ... 3, 4, 5 .... 6 .... and then the bar. Look 1, 2, 3, 4, 5. The bars .... 5.

J Cm

B So you just take that as one.

J Oh right ...
... you think that's
you think that
you start off with that so that's the 1. Oh now I get it.

'B You use that as 1
2, 3, 4, 5, 6
So there's only one square in between them that's missing.

J Right. B D'ya get it?

J Yeah.

T So how do you mean B there's only one square in between that's missing?

B 5 and 6 well there's only like 5 is before the 6 so all you need is one more number to get to the 6. So all you need is one more square to get to the 6.

T O.K. Very good girl. So supposing I gave you those little fellows ... what size are they? Theyr'e ... (*Dienes units*).

B Let me see ... Making cm and all that? *(Tape unclear)*.

T Well if you know

B Around a cm.

T So! Yes. O.K. So would you like to check out your answers now? How would you check out your answers?

J You'd put one down and then draw it all around.

T O.K. Well whatever way, who's going to do it now.

B You do it cos ... *(unclear ... children speaking together)*

T Now what are we checking first?

B Instead of drawing round ... just put them on the blocks ... it'd be quicker.

T Before we start there J now what are we checking now ... to be clear?

J To see if this is one cm.

T Is that what we said were going to check?

B No!

T Whatre we going to check now?

B If that ... em ... is ... in ... if em that's ... if em that's right in it ... if that's like a cm. *(checking)*.

T Well what I really wanted you to check was ...

B ... If the sum's right.

T Yeah, but what I wanted you to show me is that this is 5 and this is 6 ... so could you show me that?

B Instead of drawing them out you could just put the squares ... on them, the boxes ... them on them.

T D'you want to show me what you would do ... what <u>you</u> would do?
(Pause)

B Well that starts the line so .... *(pause)*. Well this is the way I'd do it (*counts out cm cubes whispering 1, 2, 3, 4, 5*). So that's and that's in between the two lines. One, two, three, four, five. So that one's right. That one there. So 2, 3, 4, 5, 6 and that's in between the two lines so theres 1, 2, 3, 4, 5, 6.

J So, they're right!

B Yeah! And there's 5.

T So which ones went on the first one?

B 5

T These ones here is it?

B Yeah.

T And these went on the 2nd one?

B The red one.

T Right. Very good. O.K. So what answer will you put in your box then?

B 1cm

T Good! That's very good.

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The Contribution of TEST *2r* to Assessment and Learning in the Early Years Classroom

Pauline Cogan

Abstract:
Over the past 8 years a number of key policy documents have stressed the importance of identifying learners who may be at risk of literacy difficulties at the earliest possible stage. This priority has been reinforced by the National Strategy to Improve Literacy and Numeracy among Children and Young people 2011-2020. A major barrier to realising this aspiration is the absence of an evidence-based and reliable classroom assessment tool for teachers in the first years of primary school which is firmly grounded in current theories of literacy acquisition.TEST 2r is a classroom- based early literacy assessment tool which has been developed in collaboration with 189 teachers in Irish primary schools and with the support of the Department of Education, ILSA, INTO and Education Support Centres throughout Ireland.The test was validated on a national sample of 1041 children between the ages of 4 and 6 years and was proved to significantly predict the literacy performance of a sub-sample of 861 of these children at 10 years of age.

TEST 2r helps teachers to gain an insight into the learning strengths and needs of young pre- literate stage children who may be at risk of difficulties in acquiring effective literacy skills. TEST 2r is now in the final phase of development which will produce a set of systematic interventions and supports that can be tailored to each young learner's needs, enhance its useability by hard- pressed teachers in a class setting and develop a set of norms and reliability statistics. When TEST 2r is fully deployed within schools the results of assessment will feed into a constantly updated set of norms.

Introduction

This article in intended to inform primary school teachers about the *Trinity Early Screening Test* (TEST *2r*). The test is intended to provide teachers of classes in the early years of primary education (4-6 years) with a tool that can identify those learners who might experience difficulties acquiring literacy skills. The experimental national study version of TEST *2r* is composed of 27 tasks, derived from an in-depth review of the theoretical and research literature in literacy acquisition. On the basis of factor analysis (n=1041 Irish 4-6 year olds), it has been determined that the subtests cluster around 7 factors. The factors and many

individual sub-tests were found to be significantly associated with literacy attainment 4 to 5 years later at the age of 10 years in a predictive validity study.

TEST *2r* provides the basis for a theoretically sound and evidence-based set of tools which can be used, by class teachers in Junior Infants, Senior Infants and First Class, to identify those children who are at risk of difficulties in acquiring literacy skills, and indicate the types of classroom interventions to resolve or compensate for weaknesses in the development of early or emergent literacy skills. It can be used with learners as young as 4 years of age at the very early stages of literacy acquisition.

This article describes how TEST *2r* can contribute to achieving the goals of the National Strategy to Improve Literacy and Numeracy among Children and Young people 2011-2020, explains the theories of literacy learning upon which TEST*2r* is based, outlines the steps taken in developing TEST *2r*, summarises how the theoretical and predictive validity of TEST *2r* was tested, provides a picture of what TEST *2r* will look like when it is deployed in the early years classroom and sets out the next steps in the development of TEST *2r*.

The policy context for TEST *2r*

Research evidence supports the view that normal class instruction without intervention is insufficient to assist learners with literacy difficulties to *catch up* with other children (Brooks, 2007). The early identification of learners who are experiencing difficulties can facilitate prevention programmes which have been shown to be more effective than remedial programmes at older age levels (Denton, Vaughn & Fletcher, 2003). Fuchs & Fuchs (2006) advocate a *multilayered* approach in the early school years as a means of strengthening literacy instruction for at-risk learners and combating persistent school failure.
Early assessment, before literacy tests are even applicable, is a prerequisite for early intervention for young learners at risk of literacy difficulties. Classroom assessment can increase the possibility of early intervention, which has been documented as more cost- effective. For example, in the UK, Nicolson, Fawcett, Moss, Nicolson and Reason (1999) demonstrated that early intervention maximised benefits per unit cost. Children who received just 10 hours over 10 weeks of individually adapted, small-group tuition showed significantly more progress than a control group. Furthermore, they found that it was just 10 per cent of the cost of using a proprietary reading scheme (Clay, 1985) to remediate later difficulties. MacLagan (2001) found similar results from her intervention in which participants needed just 8 weeks to attain peer levels similar to the Nicolson et al. (1999) participants.

Singleton, Horne, Thomas &Leesdale (2003) argue that early screening is more cost-effective than waiting until children have experienced years of failure and

have lagged so far behind their peers that very expensive specialist remediation must be provided. Muter (2003) argues that providing interventions 2 or 3 times a week over a 1-year period for a 6 year old is far less expensive than providing long-term interventions at a later stage when, in many instances, the learner's behaviour has become increasingly challenging. An evaluation (Hatcher, Hulme, Miles, Carroll, Gibbs, Smith, Bowyer-Crane & Snowling, 2006), of the Early Literacy Support Programme (ELS) and a modified reading intervention programmes in the UK, found that the 6-year-old participants made significant gains in letter identification, reading and spelling after a period of intervention of 12 weeks. The authors concluded that the ELS programme provided a cost-effective method of boosting 6-year-old children's reading to an average level. This is strong evidence that early intervention leads to a significant reduction on budgets at the level of second-stage intervention provided by learning support teaching. Savings are also made at the third stage of intervention by reducing the numbers referred to psycho-educational assessment (Fawcett & Nicolson, 1995).

Given the strong evidence for the cost effectiveness of early identification and intervention, it is not surprising that all key policy documents since the EPSEN Act (2004) set down the requirement for a continuum of assessment. The National Council for Special Education (NCSE) in their Implementation Report (2006) emphasised the importance of early intervention and recommended that learning resources be focused on the central responsibility of the class teacher in administering early screening measures and the use of further diagnostic testing and /or supplementary teaching carried out by the learning support teachers in the early stages. This approach to assessment reflects the Report of the Task Force on Dyslexia (2001) which proposed that assessment, identification and intervention in the area of special educational needs should be implemented in a staged manner. This approach is also underpinned by current policy of the Department of Education and Skills (DES) in its recommendation to schools (Guidelines on Learning Support, 2000; Sp. Ed. Circular 24/03) and is supported in the research literature. The principle is to *identify learners before they fail* and provide the support they need to progress.

A range of assessment approaches have been recommended by the National Council for Curriculum and Assessment (2005). This body recommends the use of diagnostic assessment to identify children with learning difficulties at the earliest possible stage with a view to early intervention. Early identification or the use of screening tests is recommended as one of a range of assessment approaches to help teachers make more informed decisions in relation to the teaching of literacy skills in young learners.

TEST *2r* has the potential to contribute significantly to the aspirations of the National Strategy to Improve Literacy and Numeracy among Children and

Young People 2011-2020. It is particularly relevant to a number of important elements including:

- The improvement of teachers' knowledge and understanding of early language and literacy development
- The identification of children's learning needs as early as possible through evidence- based assessment systems
- The earlier assessment of children at Junior Infant level
- The explicit teaching of the structure and function of written and oral language as well as the basic building blocks of reading: letter-symbol recognition such as letter-sound rules, phonemic awareness and phonological knowledge, whole-word recognition and ability to derive meaning from text.

The theoretical basis for TEST *2r*

TEST *2r* was developed on the basis of an in-depth review of the research literature on literacy acquisition. The review identified five core evidence-based explanations, in which there is some overlap, of why certain learners experience difficulties in coming to terms with written language when most of their peers seem to pick it up regardless of the way it is introduced. Each these theories are briefly described below.

Phonological Deficit Hypothesis (PDH)

One of the most widely accepted theories of what causes literacy difficulties was originally proposed by the Haskins Laboratory Team in the US (e.g. Liberman, 1973) who connected poor readers' lack of knowledge of explicit phonemic structure and their reading. Liberman&Shankweiler (1978) held that reading and writing required explicit knowledge of the phonetic structure of the spoken word. In the absence of such explicit knowledge children could not map alphabetic symbols to sound. The child needed the finest-grained (phonemic) explicit knowledge of word structure; s/he must know that a word can be segmented into its constituent phonemes and that alphabetic symbols represent these.

The course of normal phonological development extends over a number of years coinciding with the child's earliest years in the home and also coinciding with the early school years. Some children experience an enriched, early linguistic environment, where good language models surround them. Sentences are clearly spoken and are often accompanied by gestures, which allow the child to readily understand meaning. Importantly, words are clearly spoken, which in turn allows the child to begin thinking about language beyond its meaning. This is

thinking about language objectively in terms of the sounds of words or meta-linguistic processing. Meta-linguistic processing can occur at coarse-grained levels (at the levels of syllabic segmentation and rime). It can then progress to finer levels of phonological awareness development such as phonemic awareness. The finest level of phonological awareness, phonemic awareness, is necessary for literacy acquisition. The absence of such phonemic awareness skill is the cause of literacy failure in many individuals from an early age. Over the past 40 years many authors (e.g. Liberman, Shankweiler, Liberman, Fowler & Fischer, 1977; Bradley & Bryant, 1983; Bryant, MacLean, Bradley & Crossland, 1989) have provided evidence for the correlative and predictive nature of phonemic segmentation for reading performance.

The structure of TEST *2r* affords an important place to tests of phonological awareness at all levels of segmentation.

The Double Deficit Hypothesis (DDH)

Over the years evidence has been accumulated that individuals experiencing literacy failure have difficulty with visual to verbal representation of letters, words and drawings. For example Denckla & Rudel (1976a) found that naming speed for test items such as colours, digits, objects and letters is faster in normal readers than garden-variety poor readers, who in turn are faster than learners classified as having specific literacy difficulty. Denckla and Rudel (1976b) found that these latter learners made more naming errors than the other two categories of reader. When their errors were wrong names they were linguistic 'shadows' of the correct name (e.g. volcano for tornado). The authors concluded that errors were related to difficulty in linguistic retrieval. Importantly, Wolf, Bally & Morris (1986) found that when children were required to name a series of drawings on a card their continuous naming performance was a powerful predictor of reading groups and a powerful predictor of later reading performance.

TEST *2r* considers such evidence as vital for predicting which children may fail at reading. Consequently, tests of Rapid Automatised Naming (RAN) have an important place in TEST *2r*.

Researchers such as Bowers & Wolf noted that some poor readers had a single deficit in phonological decoding of unfamiliar words, or in naming speed. Other poor readers had both a phonological decoding deficit together with a serial naming speed deficit or RAN deficit. Wolf & Bowers (1999) view the phonological deficit as a core deficit which impedes acquisition of word recognition skills. They propose the naming speed deficit as a second core deficit in dyslexia. They present a case for the double deficit hypothesis for independent and combined roles of naming speed and phonological deficits in reading impairment which have profound implications for diagnosis and intervention. Their evidence led to the conclusion that both phonological and RAN test should both be included in the TEST *2r* battery.

The Working Memory Deficit (WMD) Hypothesis

Individuals who experience literacy difficulty may have working memory problems. Many authors hold that the quality of underlying phonological representations is important in verbal short-term memory (Fowler, 1991) while Elbro (1996) holds that low-level distinctiveness of phonological representations may hamper encoding and retrieval of material to be remembered. Researchers in the area of working memory have identified the components and sub-processes of working memory which may be at fault in literacy difficulties. For example, there is evidence that phonological coding in short-term memory is impaired in poor readers (e.g. Katz, Shankweiler & Liberman, 1981). One component of working memory is the phonological loop. This is of limited capacity and limited duration and is thought to be involved in language learning (Avons, Wragg, Cupples & Lovegrove, 1998) and syntax learning (Baddeley, Gathercole & Papagno, 1998). The capacity of the loop (short-term memory span) can be extended by rehearsal. Many poor readers do not rehearse or do so inefficiently. Therefore the amount of material held in short-term memory will suffer. Evidence such as this has ensured the presence of short-term memory tasks in TEST *2r*.

The Magnocellular Deficit Hypothesis (MDH)

There are several systems in the body such as the visual, auditory, somaesthetic and motor systems which are composed of different cell types such as parvocellular (or small) and magnocellular (or large) systems. Various authors have produced evidence that faulty magnocells (M-Cells) may be the cause of reading difficulties and have proposed the Magnocellular Deficit Hypothesis of reading failure. They argue that poor readers may have difficulties involving motor, visual, phonological, and speed of processing difficulties. Subtle or selective changes in the M-Cell systems can account for these (e.g. Stein & Talcott, 1999; Stein & Walsh, 1997). M-Cells are specialised to provide information about the timing of visual events and the motion of visual targets. This makes the M-system important for the guidance of eye and limb movements (Milner &Goodale,1972). A subtle anomaly in the visual M-system may account for the blurred vision and unstable print reported by some learners.

Many authors have provided evidence and argued for anomalous M-cell visual processing early in the M-cell pathway (Galaburda & Livingstone, 1993), in the MT area of the brain cortex (Eden, VanMeter, Rumsey, Maisog, Woods & Zeffiro, 1996) and in the Posterior Parietal Cortex (PPC) (Stein & Walsh, 1997). The PPC is important for normal eye movement control, visuospatial attention and peripheral vision, all of which are important components of reading (e.g. Olson, Connors & Rack, 1991). The PPC is also important for spatial localisation, spatial orientation of self, representation of body surface, spatial orientation of objects, item orientation such digits and letters, direction of visual attention, directed auditory attention, visuo-motor attention and coordination and visuo-verbal association. Stein & Walsh (1997) argue that

dysfunction in almost all of these areas can be evidenced in readers with specific difficulties.

Galaburda, Menard & Rosen (1994) demonstrated structural anomalies in the auditory M-Cell system of specifically impaired readers post mortem. These large neurons are particularly specialised for processing acoustic transient stimuli such as changes in frequency, amplitude and phase. Stein & Walsh (1997) suggest that problems with phonological analysis may arise from a deficit in low-level auditory processing which may compromise phoneme discrimination.

There is evidence of M-cell disturbance in the somaesthetic systems of poor readers. Grant, Zangaladze, Thiagarajah & Sathian (1999) found reduced tactile sensation in participants with specific literacy difficulties.

As a consequence of evidence of widespread anomalous functioning in poor readers, several subtests in the TEST *2r* battery are tests of M-Cell function in several modalities.

The Cerebellar Deficit Hypothesis (CDH)

Individuals who experience reading failure may also evidence a wide range of deficits and difficulties such as bi-manual clumsiness, motor incoordination, poor balance and walking and/or talking delays. There may also be fatigue and concentration difficulties, poor hand writing and difficulty copying shapes. Nicolson & Fawcett (1990) hypothesised that the nature of the specific deficit is not limited to reading and that the reading deficit is merely a symptom of a more general, more pervasive deficit in the acquisition of skill. Nicolson & Fawcett (1990) view reading development as skill development. They propose that individuals who experience specific reading difficulties do so because they have difficulty bringing any skill to automatic levels. They also hold that if these individuals really concentrate on the task they will eventually succeed.

Many authors have contributed to awareness of the cerebellum's role in cognition and language. For example Leiner, Leiner& Dow (1989) highlighted the information –processing contribution of the cerebellum in ameliorating all cerebral functions including cognition and language. The role of cerebellar-frontal networks was revealed in language processing, in word- finding and in articulation programming. Importantly, Fulbright, Jenner, Mencl, Pugh, Shaywitz, Shaywitz, Skudlarski, Constable, Lacadie, Marchione and Gore (1999) demonstrated with functional magnetic resonance imaging (fMRI) that the cerebellum is involved in reading and differentially activates according to the component processes of word identification in reading such as phonological assembly and semantic processing. Nicolson and Fawcett have proposed the Cerebellar Deficit Hypothesis (CDH) which holds that the range of problems associated with specific reading and spelling difficulties is caused by mild cerebellar impairments. Abnormalities in the language specialist circuits were

suggested to underlie difficulties with acquisition of automaticity in language expression and reception leading to phonological problems. Often, other non-language processes are implicated leading to attendant motor problems. In line with this, there is a great deal of evidence from behavioural (e.g. Fawcett, Nicolson & Dean, 1996), neuroanatomical (e.g. Finch, Nicolson, & Fawcett, 2002) and neuro-imaging studies (e.g. Jenkins, Brooks, Nixon, Frackowiak & Passingham, 1994; Nicolson & Fawcett, 2000) that the pattern of difficulty in such learners is consistent with the CDH.

There are a number of subtests which are thought to tap cerebellar function and may be predictive of future literacy difficulties.

The development of TEST *2r*

TEST *2r* has been developed through two distinct phases, the first of which evaluated its reliability and suitability for 4 to 6 year olds. The second phase, carried out when the children reached 10 year of age, evaluated the predictive power of the test in terms of success in literacy attainment.

In the early stages, Blackrock Education Centre provided funding from its own resources for the development of TEST *2r* and colleagues in education centres contributed to the teacher Continuous Professional Development programme. In a very generous gesture, the Irish Learning Support Association (ILSA) undertook to provide an annual grant for 3 years. Some financial assistance was also obtained from the INTO. The Department of Education and Skills (DES) came on board to fully fund Phase 2. Without this level of support at critical stages, TEST *2r*would never have come to fruition.

The project was overseen by a Steering Committee which included representatives from Blackrock Education Centre, Trinity College School of Psychology, ILSA, INTO, NEPS, the National Learning Network, the Dyslexia Association of Ireland, St. Patrick's College of Education, the Department of Education and Skills and a local school principal.

At various stages, consultations were held with interested parties including the National Educational Psychological Service (NEPS) and the National Council for Special Education (NCSE) as well as the Department of Education and Skills.

Phase 1 was implemented in collaboration with 189 committed primary school teachers who administered the initial battery of tests between 2004 and 2006. Each test in the battery was developed on the basis of evidence in the reading-related literature, in the phonological-awareness literature, in the neuropsychological literature, in the dyslexia research literature and in experimental tests. The tests were designed to elicit from learners between the ages of 4 and 6 years responses to visual, auditory, kinaesthetic, inter-sensory and linguistic cues.

A pilot phase was carried out on 100 children in 20 schools, in both advantaged and

disadvantaged areas, to evaluate the reliability of 36 sub-tests and to determine the suitability of the tests for children aged between 4 and 6 years of age. A refined battery of 27 sub-tests was selected for the national study. This involved a national sample of over 1,041 children, nationally distributed across urban and rural settings and representing advantaged and disadvantaged areas. The sample was randomly selected within each schooland consisted of both male and female learners between the ages of 4 and 6 years. The teachers were trained in the rationale of the test and its administration through the co-operation of Education Centres in Blackrock, Drumcondra, Sligo, Athlone, Limerick, Cork and Enniscorthy. The national study was carried out between January 2005 and October 2006.

Procedures

Sample

The Phase 1 sample was randomly selected by the 169 participating teachers, who were distributed nationally and from both DEIS and non-DEIS schools, in their own schools. After obtaining informed consent from parents, the teachers randomly selected between 2 and 6 children in their own schools. The overall sample of 1,041 was broken down by gender (546 males, 495 females) and by three age groups (141 four year olds 462 five year olds and 438 six year olds).

The Phase 2 sample was generated by the Principals of the participating schools who wrote out to the parents of the children who participated in Phase 1, explaining the nature of the Phase 2 study and inviting them to allow their children take part. The final sample in the Phase 2 study was 861 children, 445 boys and 416 girls. The sample was broken down by three levels of age based on when they had originally been assessed in Phase 1 (i.e. 4, 5 and 6 years). Before data analysis was carried out the sample was tested and found to approximate closely to a normal distribution.

Materials

The 27 sub-tests (consisting of 46 variables) in Phase 1were designed to test the sub-skills of learning indicated by the five theoretical models described above. Materials for each sub-test consisted of directions for administration, supporting materials and score sheets.Over 200 sets of materials were produced by hand. Phase 2 materials consisted of the Wechsler Intelligence Scale for Children Version IV – WISC IV (Wechsler, 2003); the Word Reading, Spelling and Reading Comprehension sub-tests of the Wechsler Individual Achievement Test II – WIAT II (Wechsler, 2005) and the Reading Comprehension sub-test of the Wide Range Achievement Test Version 4 – WRAT 4 (Wilkinson & Robertson, 2006).

Data Gathering

During Phase 1, the 169 teachers, were introduced to the theoretical basis for TEST *2r* (formerly TEST-D) and were trained in the administration of the

sub-tests in six sessions over a period of six months. The training took place in seven education centres throughout the country. The teachers returned to their schools after each training session and administered the sub-tests covered in that session to the selected students. Data collection began in January 2005 and was competed by October 2006. The completed hardcopy score sheets of the sub-tests covered in the pervious session were returned at each subsequent session. The final score sheets were returned by post or left at the participating education centres.

Phase 2 data collection was carried out over three years from 2008 to 2010 by a team of 22 psychologists who were recruited for the study. They were supervised by five highly experienced psychologists. The psychologists were brought together for a training session in Blackrock Education Centre and were assigned a case load to assess. The children were tested within three months of their tenth birthday. The scores from each assessment session were recorded anonymously in an Excel sheet which was returned to the researchers by email.

Data Analysis

The data for Phase 1 were entered into the Statistical Package for the Social Sciences (SPSS 16) and a series of Principal Component Analysis (PCA) were carried on the 46 variables derived from the 27 sub-tests to examine the factor structure of the data.

The Phase 2 data were transformed into a SPSS compatible format and a series of multivariate multiple regression analyses were carried out on the factor scores generated by the Principal Component Analyses from Phase 1. The TEST *2r* factors were treated as predictors, intelligence (Full Scale IQ or General Ability Index) was entered as a covariate and the attainment scores from the WIAT II and WRAT4 were the dependent variables. Gender and attendance at a DEIS school were tested as control variables. The analysis was replicated for those who were originally tested at age 5 years and 6 years. The analysis for those tested at 4 years involved entering the sub-test scores in blocks according to the factors to which they were assigned on the basis of the factor analysis loadings rather than the factor scores. This approach was adopted for those tested at 5 and 6 years in subsidiary analyses.

The results of Phase 2 were presented to a test development workshop that included academics, psychologist, teachers and researchers. On the basis of the findings the 27 sub- tests were reduced to form a more streamlined TEST *2r*battery.

RESULTS

Phase 1

The Principal Component Analysis (PCA) identified ten factors which explained a total 61.28% of the variance. Further analysis revealed that 5

factors accounted for 51.09%. While this was statistically adequate, the fifth factor included too many theoretically divergent variables to be useful in a classroom setting. Consequently, a 7 factor solution was forced which accounted for 57.17% of the variance. The factors identified in this solution also made sense from a theoretical perspective and provided a set of factors which could be put to practical use in the classroom.

The factors identified are described below.

1. **Visual-Verbal Correspondence:** This factor operates in the verbal-visual labelling direction. Learners may know what they want to say but are unable to map the sound onto the corresponding visual label (letter). Putting verbal labels onto symbols is a crucial building block of reading and spelling. It is essentially a paired-associate learning task. Difficulties in visual-verbal correspondence result in weak 'word-attack skills' and difficulty in decoding unfamiliar words.

2. **Rhyme & Memory:** Difficulties with rhyme and memory are frequently associated with literacy difficulties. Younger children who go on to experience difficulties with literacy do not seem to see the connection between rhymes and the rhyme pattern in word families. Effective spelling requires hearing the recurring sound pattern in words. Phonological memory skill in both long- and short-term memory are vital to the reading process, both from the point of view of decoding/encoding and full text comprehension.

3. **Phoneme Segmentation:** This factor relates to phonological awareness. It is about being able to understand how, or be able, to segment words into their smallest sounds in order to be able to spell what one wants to say. Weak readers or spellers are frequently unable to tell where sounds occur in a word and cannot segment their desired words into phonemes in order to engage in transcription of single phonemes to their corresponding graphemes.

4. **Phonemic Segmentation Speed**: This is a measure of the automaticity of phonemic segmentation skills. Automaticity brings skill to the procedural level of knowledge and information processing mean that attention is not engaged in decoding/encoding but is available for understanding. Many learners who experience specific difficulties in acquiring literacy skills process phonemic information slowly.

5. **Spatial Memory**: Problems in this domain impede the ability to localise and sequence all small targets, locate small objects within a small area or decide whether two lines are oriented at the same angle. As a result learners take longer to learn letter shapes and their letter names. Even when they are given letters to manipulate in a haptic way, they may fail to sense the size, edges, etc. of the letters.

6. **Motor Speed:** Performing motor tasks at a slower pace than normally developing children can impact on speech rate, rapid naming of objects and symbols, reading fluency, the volume of written work produced and dual-task processing i.e. listening with understanding while taking adequate notes or concentrating on both spelling and content when writing.

7. Balance:This is representative of a motor skill automatisation process. Young children who later turn out to have specific reading and spelling difficulties can be slow in meeting motor milestones.

Phase 2
The attainment scores of the sample were found to be distributed normally, indicating that the sample could be treated as a random sample and was amenable to parametric analysis. No significant gender effects were identified in another preliminary analysis.

The results of the multiple, multivariate regression analysis of 7 *TEST 2r* factors on the 4 dependent variables was significant. The pattern of prediction was altered by the inclusion of IQ as a covariate, but a strong prediction was identified which was independent of intelligence. An analysis of the additional variance accounted for by the *TEST 2r* factors confirmed that the *TEST 2r* factors added a significant contribution to the prediction equation independently of IQ mainly for reading and spelling.

Results of a multivariate analysis of variance using the DEIS/non-DEIS schools as the independent variable, indicated a significant effect. Learners in the DEIS schools included in the sample significantly underperformed on the literacy tests compared to their peers in non- DEIS schools. However, when the *TEST 2r* factor scores were included as covariates in the analysis this effect disappeared. The *TEST 2r* factors explained the majority of the variance accounted for in the prediction equation. This indicates that the *TEST 2r* is equally applicable to identifying those learners at risk of literacy problems in disadvantaged schools as it is in non-disadvantaged schools.

The main findings were:

- The 7 TEST *2r* factors, derived from subtests administered when the participants were 5 or 6 years old, significantly predicted literacy attainment in reading and spelling as measured by the *WIAT-II* and reading comprehension as measured by the *WRAT 4* at 10 years.

- The subtests of the TEST *2r* were grouped in blocks for those who were tested at 4 years of age. The pattern of results for the factor supported the contention that there was a strong relationship between TEST 2r performance at age 4 years and reading attainment at age 10,

with a slightly weaker prediction for spelling.

- For all age groups, the TEST *2r* performance was not significantly related to performance on the *WIAT-II* Reading Comprehension test. This is a very good indicator of the construct validity of TEST *2r*. It indicates that the skills being assessed are more closely related to reading and spelling and less to understanding language.

Table 1 presents the relationship between children's performance on TEST *2r* when tested at 4, 5 and 6 years of age and their reading and spelling attainment at 10 years of age for each of the 7 factors. Column 1 lists the 7 factors identified in Phase 1 and the remaining column indicted where a significant correlation was found with reading performance. It is evident that the pattern of prediction differs by age and by literacy domain.

Table 1: TEST *2r* Prediction of Literacy Difficulties at 10 years by Age of Testing.

	Reading			Spelling		
Age when tested	**4**	**5**	**6**	**4**	**5**	**6**
All Factors	**X**	**X**	**X**		**X**	**X**
Visual-Verbal Correspondence	**X**	**X**	**X**	**X**	**X**	**X**
Rhyme/ Memory	**X**	**X**	**X**	**X**	**X**	**X**
Phoneme Segmentation		**X**	**X**		**X**	**X**
Phonemic Segmentation Speed		**X**	**X**			**X**
Spatial Memory		**X**	**X**		**X**	**X**
Motor Speed	**X**	**X**	**X**	**X**	**X**	**X**
Balance	**X**				**X**	

While there appears to be a more scattered pattern for those tested at 4 years, it must be noted that children at this age level were not administered the Phonemic Segmentation tasks. The prediction performance of the TEST *2r* is presented in the first row of the main table (All Factors). This illustrates that the combined factors predicted reading regardless of the age of testing. They also predicted spelling attainment for 5 and 6 years olds. The factors that predicted both reading and spelling at all ages of testing were Visual-Verbal Correspondence, Rhyme/Memory and Motor Speed.

While the factor predictions were relatively strong, some of the individual sub-test within the factors were not predicative at all or had a weak correlation with attainment. Consequently, the number of sub-tests was reduced. Table 2 provides a list of the subtests in the reduced TEST *2r* battery. The left hand

column indicates the theoretical basis for each of the factors which are presented in the next column. The TEST *2r* sub-tests are listed in column 3. The right hand columns indicate the age level to which each of the sub-tests is relevant.

Table 2: The Reduced TEST 2*r* Battery of Subtests for 4, 5 and 6 year olds

Theory	Factor Structure	TEST *2r* Subtests	4 Years	5 & 6 Years
Phonological Magnocellular Working Memory	1. Visual-Verbal Correspondence	1. Letter Knowledge: Upper Case Letter: Total Letter Knowledge: Lower Case Letter: Total	X	X
		2. Letter Sound Array: Total No. Fully Correct	X	X
		3. Alliteration: Total Score	X	X
		4. Alliteration Oddity: Total Score		X
		5. Phonetic Spelling: Total Score		X
Phonological Cerebellar Working Memory	2. Rhyme/ Memory	6. Rhyme Recognition 1: Total Score	X	
		7. Timed Rhyme Generation: Average Number of Generated Items	X	X
		8. Digit Span Forward: Total Score	X	X
		9. Non-Word Repetition: Total Score	X	X
		10. Rhyme Recognition Oddity: Total Score		X
Phonological	3. Phoneme Segmentation	11. Non-Word Reading: Total Score		
		12. Phoneme Deletion Final Consonant: Real Word Remaining Number Correct Within Time*	X	X
		13. Initial Phoneme Deletion: Initial Consonant Cluster: Number Correct Within Time *		X
		14. Final Phoneme Deletion: Non-Word Remaining: Number Correct Within Time*		X
Phonological Cerebellar	4. Phonemic Segmentation Speed	12. Phoneme Deletion: Final Consonant: Real Word Remaining: Average Time*	X	X
		13. Initial Phoneme Deletion: Initial Consonant Cluster: Average Time*		X
		14. Final Phoneme Deletion Non-Word Remaining: Average Time*		X
Working Memory Magnocellular Cerebellar	5. Spatial Memory	15. Spatial Memory Test 1: Forward Total Score	X	X
		16. Finger Localisation: Hand Hidden Single Finger Touched	X	X
		Finger Localisation: Hand Hidden Two Fingers Touched		
		17. Copy Test: Total Score	X	X
		18. Squirrel Memory: Forward: Total Score For All Levels		
		Squirrel Memory: Reverse: Total Score For All Levels		X
Phonological Magnocellular Cerebellar Double Deficit	6. Motor Speed Factor	19. Dowel Placing Test 1: Speed of Dowel Placement	X	X
		20. RAN Objects 2: Total Score	X	X
		21. RAN Digits Test 2: Total Score	X	X
Cerebellar	7. Balance Factor	22. Balance Test Total One Foot: Dual Task Score Balance Test Total One Foot Balance Single Task	X	X

*** In the Phonemic Segmentation and Phonemic Segmentation Speed the numbering indicates that these derived from the same sub-test**

Conclusions

TEST *2r s*ignificantly predicted literacy difficulties up to 6 years post initial screening. It accounted for over 30% of the variance in literacy performance which means that at least a third who experienced difficulties in acquiring effective reading and spelling skills could have been identified 6 years earlier. The prediction of literacy performance was independent of intelligence which means that teachers can use this test to identify children who are at risk of literacy difficulties without the need for a psychological assessment. TEST *2r* explained all the variability in literacy performance associated with attendance in DEIS or non-DEIS schools which indicates that it is equally effective in all schools regardless of the social and economic circumstances of the school population.

By offering teachers a theoretically sound, evidence -based set of subtests which can be used in Junior and Senior Infants and First Class, TEST *2r* can play a key role in the National Literacy Strategy. Not only does it help teachers to identify those at risk of developing literacy difficulties, but itcan also indicate the types of interventions to be implemented to resolve the deficits in prerequisite skills for reading and spelling.

Plans are in train to develop TEST *2r*, in collaboration with further group of 350 early years teachers, into a classroom based Screening and In-depth Assessment for Learning Tool. The test will be evaluated for reliability on an Irish sample and validated against a complementary Irish literacy screening tool, the Drumcondra Test of Early Literacy – Screening (DTEL-S) (2010).Further it is intended to augment TEST *2r* with a Literacy Learning Support Resource Pack that can assist class teachers in intervening with at-risk learners.

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PAULINE COGAN

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The Impact of Context and Authenticity in Numerical and Mathematical Word Problems

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Contextualised or situated word problems, and the solving of the numerical and mathematical challenges that are contained in them, have evolved to become a staple and core component of the cultures of numeracy and mathematics instruction. Their universal popularity, longevity and pervasiveness, within the cultures of mathematics teaching and learning, can be explained by, and attributed to, their high-flexability, multi-functionality and legacy as an effective format and conduit for teaching new mathematical content and for re-visiting and consolidating prior learning in this domain. Fore-courting and incorporating situational, contextual and authentic features and dimensions into the teaching and learning of numeracy and mathematics is highly recommended and espoused by various national and international organisations and in many mathematical studies and reports. The National Mathematics Advisory Panel (U.S., 2008) advocates lesson-modelling and instruction which features real-world contexts and authentic problem-solving. The California State Department of Education (1985) made the following recommendation to enhance problem-solving in mathematics and in numeracy: "problem contexts should be selected that closely resemble real-life situations". The National Council of Teachers of Mathematics (U.S., 2000) highlights and stipulates, as an objective of mathematics teaching, contextualised and authentic learning opportunities that will develop understanding in students of the use and importance of mathematics and numeracy in everyday life and in the workplace. The "Programme for International Student Assessment" (PISA)(OECD, 2007) contained a mathematics literacy test which assessed students' abilities to apply their mathematical content knowledge and skills to a broad range of real-world problems. The "Trends in International Mathematics and Science Study" (TIMSS) (National Centre for Educational Statistics, 2009) investigated the skills and cognitive competencies of reasoning as applied and utilised by students in solving mathematical problems which are set in real life contexts. The indigenous "Project Maths" (DES / NCCA, 2000) innovation also emphasises and prioritises the use of connections to real-life contexts as a means of enhancing and supporting the teaching and learning of mathematics in second level mathematics classrooms. Its overall aim is "to teach mathematics in a way which promotes real understanding, where students can appreciate the relevance

of what they are learning and its application to everyday life" ("Report of the Project Maths Implementation Support Group – June 2010", NCCA).

To script this investigative essay, I sourced and trawled through a wealth of educational and mathematical research literature. Each of these research case studies used a distinct analytical scalpel to investigate the word problem genre and, specifically, the authentic, contextual and situational stimuli and nuances of numerical and mathematical word problems.

Verschaffel et al. (2000) define "word problems" in numeracy and mathematics as "verbal (or written) descriptions of problem situations wherein one or more questions are raised, the answer to which can be obtained by the application of mathematical operations to numerical data available in the problem statement". Gerofsky (2009) states that word problems involve the "use of language and story to pose mathematical conundrums – but the purposes of these conundrums, and their purported relationship to real-life have not remained stable over time". Gerofsky provides additional insights into word problems by stating that: "word problems constitute a written and pedagogical genre within mathematics education". Gerofsky also provides the following information on the dynamics and nature of word problems: "in pre-algebraic societies, mathematical word problems were the only way available to establish mathematical generality, through the heaping-up of numerous examples in story form". Gerofsky concludes that a primary function of numerical and mathematical word problems is "expressing generality through exemplification". Palm (2006) describes word problems as "textual descriptions of situations assumed to be comprehensible to the reader, within which mathematical questions can be contextualised". Palm also states that word problems "provide, in convenient form, a possible link between the abstractions of pure mathematics and its applications to real-world phenomena". Palm's latter interpretation portrays word problems as mathematical tasks "dressed up" in a real-world context and for their solution students must "undress" these tasks and solve them. The scenarios and contexts embedded in word problems may be of different genres and kinds - including vocational practice and everyday life. These categories are further described and parsed in the OECD's "Programme of International Student Assessment" (OECD, 1999) as "tasks that someone in an out-of-school setting is likely to be called upon to address". Gerofsky (2004) states that word problems are "closely related to ancestral or antecedent genres including parables and recreational mathematical puzzles". Greer et al. (2009) describe word problems as "story problems". Sakshaug et al. (2002) define a word problem in numeracy and mathematics as "a task that requires the learner to reason through a situation that will be challenging, but not impossible. In the infrastructure of a word problem, there is a hurdle that the learner cannot immediately see how to get over or round". Fox and Surtees (2010) state, that in order to solve a mathematical or numerical word problem, the student must

be challenged to "think differently", to "extend their thinking about a situation in a way that is new or different", to "think beyond the point from where he / she started" and "make decisions about which strategies to use". The dictionary defines "heuristics" as the art of problem-solving, involving the use of cognitive reasoning, prior knowledge and past experience in order to support the process of learning. In his seminal thesis on problem-solving, Pólya (1945), advocates providing the student with regular opportunities to engage with real and authentic problems. Pólya contends that "the independent solving of challenging problems will aid the learner far more than the aphorisms which follow, although as a start these can do him no harm". Pólya adds that: "A teacher of mathematics has a great opportunity. If he fills his allotted time with drilling his student in routine operations, he kills their interest, hampers their intellectual development, and misses his opportunity. But if he challenges the curiosity of his student by setting them problems proportionate to their knowledge, and helps them to solve their problems with stimulating questions, he may give them a taste for, and some means of, independent thinking".

The first references in research literature to "authenticity" and "authentic learning" date back to the beginning of the 20th century; however, Newmann et al. (1992) were among the first researchers to use the term "authentic" formally in the context of teaching and learning. Berge et al. (2004) locate the genesis and evolution of the seminal conceptualisation of authenticity within the specific domain of cognitive research that focused attention on the "holistic task" and the "gestalt" dimensions of a problem. Brown et al. (1989) locates the genesis of an alternative and rival conceptualization of authenticity in the realm of cognitive research and applied psychology which focused on the investigation and formulation of "situated theses of learning" This alternative thesis infers and states that learning occurs best – or perhaps only - within context and situation. According to this "situated" thesis, learning and performance are so closely related to context that the actual schema of the underpinning domain knowledge mutate and are different for different contexts. This "situated" thesis suggests that task performance, demonstrated in one context, may not be indicative of competence in another context. Cronin (1993) concludes that "authenticity is relative". Anderson et al. (1996) suggests that there is a continuum of theories of "situatedness". This continuum and constellation of "situated" theories include theories that posit and declare possibilities of transfer of learning across various contexts to those that argue complete contextual isolation and dependence. Complete contextual dependence means that the task could only be authentic if it accurately mirrored the specific context and location of the outside-of-school task. In this sub-thesis, generalisation or contextual simulation would not be possible or feasible. Other divergent sub-theses of authenticity refer to the permitted or desirable gradient of "fidelity" or "functional fidelity" that can be built into the word problem. "Functional fidelity" is defined as the degree to which a word problem statement imitates or mirrors the information,

detail and stimulus-response options that are present in the real world. Palm (2008) defined "authenticity" as: "the concordance between, on the one hand, a mathematical school task that includes a description of a real out-of-school situation and, on the other hand, the actual real-life situation". Vincente et al. (2007) claims that embedding a word problem in an authentic and realistic context can successfully activate and facilitate "germane processing which allows students to comprehend the presented information in a deeper and personal way". Greer et al. (2009) describe authenticity as "mathematizing situations and issues that connect with students' lived experience". Kenk and Kian (2010) describe authentic stimuli and variables in word problems as conduits which "connect mathematical concepts, skills and strategies to purposeful, relevant and meaningful contexts, therefore promoting a deeper level of understanding in the classroom". Schonfeld (1989) states that an authentic word problem presents the student with opportunities to engage with "a task in which the student is interested and engaged and for which he wishes to obtain a resolution". Niss (1992) describes "an authentic extra-mathematical situation as one which is embedded in a true existing practice or subject area outside mathematics, and which deals with objects, phenomena, issues or problems that are genuine to that area and are recognised as such by people working in it". PISA does not preclude the inclusion of virtual contexts to ensure authenticity in a problem construct, but the authors "emphasise the use of real-world problems with authentic contexts describing out-of-school settings and problems that someone in such settings would be called upon to address" (OECD, 1999). Oblinger (2007) states that with authentic word problems the concepts being applied and learned are always part of a much larger "learning event" and are directly linked in the learner's mind with social and personal circumstances and realities – the setting, the activities, the people. Oblinger concludes that the more encouragement and opportunities that the learner has "to become invested in material on a personal level, the easier it will be to assimilate the unfamiliar". Lowrie (2000) states that contextualised word problems provide opportunities for students to apply personal knowledge and social experiences to the problem context. Berge et al. (2004) use the following alternative terms for authentic learning, namely: "naturalistic learning" and "situated learning".

Verschaffel et al. (2000) contend that students need regular and consistent opportunities to engage with "really real" authentic word problems in numeracy and mathematics and not "pseudo-realistic" or frill-versions of the real world. Palm (2008) postulates that "the higher the representativeness of the simulation is, the larger will be the proportion of students that make proper use of their real-world knowledge, when working with the word problem, and that will not suspend the requirement that their solutions must make sense in relation to the out-of-school situation that is described in the task". Palm also claims that, when an authentic and real-life context is embedded in the word problem, these students have opportunities to practice and enhance their higher-level thinking

about abstract mathematical concepts, to practice and apply problem-solving skills and to experience mathematics in an out-of-school and simulated scenario. Fox and Surtees (2010) consider that the desired gradient and mix of authenticity, lived-reality, context and situation can be introduced into word problems in numeracy and mathematics by teachers ensuring that the context of the word problem is always connected to the student's "interests, environment and experiences". Gerofsky (2009) identifies the potential contained in authentic, situated and contextualised word problems, including offering memorable imagery that can act as a touchstone for teachers and learners in building and discussing abstract concepts in numeracy and mathematics. Research undertaken into the processes and dynamics of motivation, by Ryan and Deci (2000), indicates that the level of students' engagement in a task is enhanced when the students experience the task as being "authentic" and "meaningful". Pearse and Walton (2011) describe how the formulation of connections and linkages, across the conceptual landscape of numeracy and mathematics, and particularly when extended to connect with the real-world experiences of the students, can significantly support concept and knowledge development in students. Pearse and Walton consider that "building connections is at the heart of numeracy". Greer et al. (2009) claim that engagement with word problems, which depict and describe authentic and realistic scenarios from the students' lived-experiences, can support the development and enhancement of reasoning and problem-solving competencies in students. By being familiar with the presenting challenge and task, the student quickly begins to realise that he / she already possesses a memorised knowledge base, skills-set and experiential infrastructure that can significantly inform his / her cognitive and meta-cognitive processing and subsequent actions and computation which are required to arrive at a solution to this word problem. Encountering familiar and realistic stimuli - within the textual detail of the word problem, or accompanying graphics, can be the ideal catalyst for arousing the student's interest, motivation and curiosity in the specific problem statement. This activation of the affective and motivational domain can significantly support and sustain the student's cognitive processing, and subsequent action and computation.

Selter (1994) claims that, when opportunities are provided in classrooms for students to engage with realistic and authentic learning, participating students begin to recognise and appreciate the potential and importance of numeracy and mathematics as critical tools for interpreting and understanding the realities and nuances of society in which they live. Selter

describes the multiple opportunities for learning that are provided in this approach as "emergent modelling". Palm (2009) claims that engagement with authentic and realistic word problem-solving "facilitates the learning of necessary skills for being able to use – and critically examine the use of – mathematics outside the mathematics classroom" and, also, facilities the "development of an

experience of school mathematics as useful and powerful for solving meaningful task situations in life outside the mathematics classroom". Haylock (1991) identifies the potential for enhancing numeracy and mathematics teaching and learning that is contained in contextualised word problems because they provide the students with "purposeful activity" in a "meaningful context". Berge et al. (2004) state that, for students to perceive the task within the word problem as realistic or authentic, the problem must be grounded in their experiences and interests. Berge et al. also suggests that, even if the problem is not based on the student's current experiences, it may still be perceived as authentic if it somehow relates to the student's future plans or expected career. De Block et al. (2003) claim that, as long as they are meaningful, familiar and appealing to the students, "realistic contexts" do not necessarily – or always – have to refer to aspects of the "real", social or physical world of the student. These researchers conclude that it is not the level or amount of realism, in the literal sense, that is crucial or critical, but rather the extent to which it succeeds in getting students involved in the problem and in engaging them in situational and meaningful thinking and interaction. Cumming and Maxwell (1999) contend that, if the task is not of the kind that students would expect to undertake in life outside of school, either now or later, it is highly likely to be seen by students as being "contrived" and "unappealing".

Bruner (1960) states that students' understanding of the underlying structure of the numeracy or mathematics problem can be developed and enhanced by presenting students with "meaningful" and contextualised problems. Atkinson and Raynor (1974) state that "motivation to achieve" is a function of the individual student's desire for success, the expectancy of success and the quality of incentives provided. Well-designed and well- planned word problems in numeracy and mathematics can provide multiple opportunities for students to embrace success in learning and problem-solving. Norman and Schmidt (1992) suggest that matching and connecting students' prior knowledge and interests to the nuances of the word problem is necessary and essential to stimulate and motivate students to spend sufficient time on their problem-solving task. Wenger (1998) argues that learning increases and is enhanced when the student develops a "thirst for learning of the kind that engages one's identity on a meaningful trajectory and affords some ownership of meaning". Wenger suggests that, in order to establish such ownership, teachers should plan and design word problems that relate to real-life situations. Kaput (1994) correctly states that it is not the word problem in isolation that enhances teaching – rather it is the students' development of meaning which is activated through engagement with the word problem. Cleary and Chen (2009) state that students' motivation to engage with the specific word problem task is enhanced when they perceive the task to be "interesting or valuable". Greer et al. (2009) contend that the student who is learning numeracy and mathematics (or anything else) comes with an innate drive for sense-making that should not be violated and these researchers

believe that attention should be given in teaching mathematics to making connections with the students' interests and lived experiences. Greer et al. concludes that, as teachers, we need

to break away from traditional classroom cultures that state "this is how it has always been done". In his investigation of students' engagement with contextualised word problems, Barwell (2011), states that students predominantly focus on three key aspects or features of the contextualised word problem, namely: "scenario", "personal experience" and "mathematical structure" and states that these three aspects of students' attention are interrelated. Barwell also provides the following insights into this matrix of interrelationships: "personal experience is used to make the underlying mathematical structure meaningful and to interpret the scenario of the word problem" and "understanding the structure of word problems is necessary to successfully mathematize the scenario".

Greer et al. (2009) correctly state that what teachers think and do essentially govern whether and how students will encounter "real-world connections" ("rwc") for the mathematics and numeracy that they learn in school. Constructivist educators and researchers encourage and urge a fundamental change in the role of teacher, from deliverer of knowledge to facilitator of learning. By extension, these advocates of constructivism and socio-constructivism highly recommend and encourage the consistent provision of realistic and authentic learning opportunities for students because of the myriad of constructivist learning opportunities that this reality provides.

Bottge (1999) compared the impact on student performance of engagement with two types of numerical and mathematician word problems, namely word problems that were framed in realistic and authentic context and alternative versions which contained no contextual or situational stimuli. Results from this research support the contention that students' performance improves when they are provided with opportunities to engage with contextualised and situated word problems.

Schoenfeld (1992) suggests that, in the traditional classroom, most of the word problems presented in numeracy and mathematics were low-challenge, repetitious and routine exercises, which were used to provide reinforcement and practice on a particular mathematical technique, which had been previously demonstrated and modelled to the students by the teacher. In these traditional classrooms, priority was not ascribed to the requirement or practice of having authentic, situational and contextual stimuli in the text of word problems in numeracy and mathematics. Making real, relevant and rational connections between the word problem scenarios and the lived experiences and interests of the students was not common practice in these classrooms. On occasions,

lip-service was paid to authenticity, situation and context in the creation and scripting of word problems; however Cumming and Maxwell (1999) describe this practice as temporary and superficial "dressing up" and "camouflaging" of traditional forms of tasks to make them appear authentic and contextualised. Berge et al. (2004) declare that this artificial and superficial "camouflage" usually occurs within an underpinning epistemology and culture where curricular content is prioritised and supportive context and authenticity are conceived as being incidental and distracting. The underpinning epistemological and paradigmatic tenets, edicts and orientations, of these traditional classrooms, placed emphasis on the acquisition of numerical and mathematical knowledge; the process and "use and application" dimensions of numeracy and mathematics were, at that time, deemed to be of secondary importance to content, rules and fact acquisition of. Deliyianni et al. (2009) state that the recommended pedagogical approaches to teaching numeracy and mathematics were prescribed and determined not only by the stipulations of the underpinning epistemology but also by the matrix – or "didactical contract" – of implicit and explicit rules and conventions that operated within the cultures of teaching at that time.

Other empirical research studies (Schnitzer, 1993)(Newmann et al., 1996) (Ferretti et al., 1996)(Mc Robbie et al., 2001) have focused on the impact of authentic and contextual stimuli and variables, within word problems, on student performance – and other student related outcomes – in the numeracy and mathematics domains. These researchers list the following as observable outcomes in participating students' performance and behaviour:

- the student began to develop his / her own sense of authenticity by aligning the problem statement to his / her own personal experiences, interests and understandings
- levels of motivation and desire to learn increased
- an improvement in the students' numerical and mathematical literacy
- development of strategic thinking skills – including competencies in higher order thinking – and enhancement in modes of analysis and reasoning
- development of "portable" skills and competencies which facilitate and enable transfer of learning to new outside-of-school situations and across the curriculum
- positive impact on the affective and motivation domain: e.g. development of resilience and perseverance in students' engagement with word problems in numeracy and mathematics
- development of skills and competencies in knowing when and how to use mathematical knowledge for representing and solving problems in practical and realistic situations
- development of cognitive connections between reality and mathematics

Investigating Why Students Ignore Contextual Stimuli and Cues in Numerical and Mathematical Word Problems

Many researchers have investigated, and sought explanation for, the provision by some students of "non-sense", "unrealistic", "unreasonable" and "irrational" answers to numerical and mathematical word problems despite being provided with various contextual, authentic and situational stimuli and cues within the word problem statement. These contextual cues and stimuli are provided not only to make the word problem statement more authentic and interesting for the students, but also to stimulate and encourage a process of cross-checking and cross-referencing both their estimated and final calculated answers with their experiences and observations of engaging with similar scenarios and computations outside of school. When students fail to engage in a process of regular and consistent cross-checking and cross-referencing, they are not availing of – or activating – their critical reservoir of prior knowledge and experiential insights which can be used as a beacon in determining if their estimated and final calculated answers "make sense" relative to their real-life experiences. Determining that an answer makes sense, and is plausible, is one of the core sub-processes of numerical and mathematical computation; using contextual and situational knowledge and experience, to cross-reference and cross-check the plausibility and validity of the calculated answer, should also be conceptualised and encouraged as an integral and critical component of the computational processes.

Some of the foremost researchers, who investigated the problematic phenomenon in numerical and mathematical work problems of "students abandoning and suspending their sense making capabilities" and "not seriously considering familiar aspects of reality" include: Greer et al. (2009), Palm (2008), Cooper (1994), Berge et al. (2004) and Schoenfeld (1991). Reasons investigated and identified by these researchers for this high level of disconnect and dissonance between the out-of-school experiential knowledge of the students and the "unrealistic" and "nonsensical" responses and solutions, which they provide when engaging with formal word problem-solving, include:

- Sometimes the "everyday context" can be a hindrance rather than a support to learning by distracting the student and resulting in the student performing less well in this genre of problem-solving compared to his / her performance in solving problems that are presented in a non-textual mode and without context. Because of similarities to real-life experiences, the student may treat the word problem statement too realistically or literally and introduce considerations to his / her cognitive processing that are not appropriate to the given problem statement.
- Some students have been conditioned – by textbooks, classroom cultures and teachers' stated and inferred value-sets – to formulate and possess the following subliminal assumptions and generalisations: (a) The word

problem statement is always "self- contained" which means that there is always an inevitable and distinct connectivity and "linear relationship" between the variables that are presented in the problem statement. All that is required of the student is to identify the specific computational operation that is needed to solve this word problem. Unfortunately, this means that, once the required computational operation is superficially identified by the student, additional analysis of all the other contextual detail is ignored by the student. (b) Some students do not try to analyse and understand the entire dynamics and detail of the problem statement but simply engage in a "reflex-like" scanning and recognition of the keywords in the problem statement before "quickly jumping to the actual calculating work". Because some students perform "superficial analysis of the numbers and keywords provided in the problem text" followed by "unreflective calculations", they rarely give consideration, or practice fidelity, to the real-life aspects and variables of the scenario that are described in the word problem. In addition, some students may not possess the required level of real-world knowledge and detail that is necessary to activate and implement a process of cross-referencing between the final calculated answer and prior outside-of-school experiences.

- The students' current motivational threshold and readiness phase may result in un- willingness in some students to invest the mental effort, dedication and perseverance that is required to engage with the various variables and stimuli that are embedded within the word problem.
- Some students' approaches to solving word problems can be significantly determined and scripted by "routine expertise" rather than by the required and more comprehensive "adaptive expertise". Hatano (2003) defines "routine expertise "completing school mathematics exercises quickly and accurately without much understanding". Hatano also describes and documents the more holistic and comprehensive "adaptive expertise" as "the ability to apply meaningfully learned procedures flexibly and creatively". When students consistently ignore contextual stimuli and cues within word problems, they are opting to operate in "routine" mode and need to be encouraged to adjust to, and employ, "adaptive" mode.
- Some challenges that are embedded in word problems are "stereotypical" and mere "stylised representations of hypothetical experiences" which do not require the students to engage in any in-depth analysis, reasoning and reflection. In this reality and scenario, some students have a high tendency to ignore the contextual and situational stimuli in the word problem.
- Because the student does not possess adequate reading and comprehension skills, he / she as to focus predominantly on decoding the text and not on making sense of the problem statement.

Baruk (1985) investigated students' engagement with the following word problem that contained contextualised stimuli:

"On a boat there are 20 sheep and 6 goats. How old is the captain?"

Baruk's research involved the participation of students in senior classes in primary schools in France. His research findings indicated that many of these participating students made the subliminal and unreflective assumptions that connective linearity existed between the given variables of "20 sheep", "6 goats" and "captain's age" and, also, that the situation and scenario described in the text could be un-problematically solved by opting to use the most-likely mathematical operation, namely addition. Once the required operation was identified, no further or retrospective analysis of contextual detail was required. Consequently, a significant number of these primary students stated that the captain's age was "26 years".

Reed (1999) also cites the following as an example of an erroneous assumption and hypothesis: "it takes 10 times as much time to run a distance that is 10 times as long". Reed suggests that cross-referencing this assumption and statement with the student's prior knowledge and experiences from real-life may raise the student's awareness of the inevitability and reality that the runner will slow down over a longer distance because of the onset of fatigue and dissipation of stamina.

Greer et al. (2009) also investigated the trend and prevalence of "nonsense" responses in students' responses to numerical and mathematical word problems. These researchers compared students' (10-11 years old and 13-14 years old) attainment in "standard" contextualised word problems with performance in "problematic" contextualised word problems. These researchers defined "standard" contextualised word problems as problem statements in which the numerical or mathematical operation was reasonable and easily detectable because of the contextual cues that were provided. They also defined "problematic" contextualised word problems as involving problem statements that required consideration of more subtle aspects of the situation described. The following "standard" contextualised word problem was one of the problems presented to participating students in this research:

"Pete organised a birthday party for his tenth birthday. He invited 8 boy friends and 4 girl friends. How many friends did Pete invite for his birthday party?"

The following is an example of a "problematic" contextualised word problem where analysis of the contextual detail would reveal some problematic assumptions and hidden complexities between the contextual variables:

"If there are 14 balloons for 4 children at a party, how should they be shared out?"

The research findings indicated that participating students performed significantly better when engaging with "standard" contextualised word problems. The level of "realistic responses" – where students analysed and utilised contextual and physical logistics – in framing their responses, was extremely low and fell consistently within the range 5 - 20%.

Following on their research into the "nonsensical" dimension of students' responses in numerical and mathematical word problems, Verschaffel et al. (1999) contend that this tendency is prevalent in many classrooms.

Palm (2008) also investigated the rationale and explanation for students providing answers and solutions that are "inconsistent" with, and disconnected from, the real-world similarities end exemplars that are described in the word problems. Palm used interviews with participating students in order to acquire insights into this realm of inconsistent student behaviour. After completing his interviews, Palm concluded that there are two primary reasons why students provide nonsense answers to numerical and mathematical word problems, namely:

- There is a strong avoidance tendency in some students not to engage in the required in-depth analysis and linking with real-world scenarios to inform and validate their approaches to solving the word problem. The absence of this reflective, connective and analytical preparation – which could have activated a comprehensive decoding and investigation of the full range of presented stimuli, including contextual cues – means that some students were likely to select a computational strategy and approach which was incorrect and inappropriate and which would ultimately result in an incorrect solution to the word problem. Equally, in this scenario, no follow-up evaluation, validation and sense-checking of the computed answer is likely to be performed by the student.
- The other main reason for the student's provision of a non-sense answer was his / her beliefs and values set about school mathematics and the role of word problem-solving within the numeracy and mathematics domains. These beliefs and values and set of "implicit rules of didactical contracts", that operated in traditional classrooms, where it was inferred that when a student was engaged in solving word problems in numeracy and mathematics, he / she should exclusively and predominantly consider only what is written in the text and nothing else. This values set also inferred that any comprehensive analysis or consideration of real world applications or connections with the word problem statement, are not necessary to successfully solve a word problem in numeracy and mathematics.

Developing a Taxonomy and Index of Authenticity

Palm (2008) developed the following index or "framework of authenticity" to enable teachers to plan and incorporate the desired gradient and level of authenticity and "real-life fidelity" in the word problem text. Each of these documented variables and stimuli can be conduits and scaffolds for introducing the required gradient of authenticity and contextual reference into the word problem. Equally, this "framework of authenticity" can be used as an investigated lens to determine the precise levels of authenticity and contextual cues that exist within an externally-produced word problem. Palm listed the following variables and nuances as key indicators of authenticity:

(a) "Event" – for the event that is described in the word problem to be deemed authentic, it is a prerequisite that the event has taken place or has a fair chance of taking place.

(b) "Question" – the question posed in the word problem must be one that actually might be posed in a real-life event or situation.

(c) "Presentation" – refers to the way the textual message is conveyed to the students e.g. orally or in written form (using words, together with accompanying diagrams, graphics and/or tables). Since all students do not cope equally well with textual and written communication (Newman, 1977) or graphical representations or verbal interactions (Nathan and Kim, 2007), the preferred mode of representation can significantly and substantially influence student performance and attainment outcomes.

(d) "Language Use" – refers to the semantic, referential and stylistic aspects and conventions of numerical and mathematical texts.

(e) "Purpose of the Task" – the purpose of the task solving needs to be clear and make sense to the student.

(f) "Information and Data" – refers to the detail and information that is provided in the word problem and from which the solution to the problem can be identified.

(g) "Availability of Solution Strategies" – refers to the match and connection between the range of possible solution strategies that are available to the student and the suite of strategies that are available to the persons in out-of-school contexts use to solve corresponding or similar tasks.

(h) "Circumstances" – refers to the circumstances in the classroom or homework context under which the task is to be solved.

(i) "Availability of External Tools" – refers to the availability of suitable concrete

and experiential tools that can support cognitive processes e.g. calculator, map, ruler, Internet etc.

(j) "Guidance" – refers to guidance from an external agency (e.g. teacher) in the form of explicit or implicit hints.

(k) "Collaboration and Consultation" – refers to the opportunities and possibilities of peer- assistance being provided to the student.

(l) "Discussion Opportunities" – refers to the possibilities and opportunities for students to ask about and discuss the meaning and challenges of the task.

(m) "Time" – refers to time pressure and time constraints under which the student has to operate. It is important that time constraints are such that they will not cause significant or stressful difficulties for the students.

(n) "Consequences of Task Solving Success / Failure" – refers to the impact of success or failure – in engagement with this word problem – on the intrinsic and extrinsic motivational thresholds of the student.

(o) "Solution and Validation Requirements" – refers to the student's assessing and judging of the validity and accuracy of his / her final calculated answer to the word problem together with a follow-on discussion of the solution methodologies that were employed.

Palm used his taxonomy of authenticity to inform and script his subsequent research into the impact of authenticity on student performance in word problem-solving. In his research, Palm investigated and compared the target students' responses when engaging, firstly, with a "control" version of the word problem, which contains a "low or less" variant and rating of authenticity and, secondly, with a version of the word problem which contains a "higher" rating of authenticity, which included additional situational and contextual detail. The following examples illustrate Palm's dual investigative focus:

(1) "Anton has bought 4 planks of 2.5 m each. How many planks of 1m can he saw out of these planks?"

(2) "You were building a cabin and as walls you want to use planks that are 1m long. You are at the moment short of thirteen 1-meter planks. A friend says that she has found 4 planks, each 2.5 metres long. You were wondering if that is enough to finish the walls. How many 1-meter planks can you saw out of the planks she found?"

Students, who have encountered and experienced a similar genre and classification of problem in their experiences in-school or outside-of-school, are

more likely to be aware and understand that the entire length of each 2.5 metres plank cannot be used in these tasks, given the required measurements for the sawed lengths of planks. These students are also likely to be aware that "wastage" and "off-cuts" are inevitable outcomes in this scenario when each plank is sawed to the specified dimensions. Students, who do not possess – or who fail to activate – this prior knowledge or experience, face and encounter this word problem without possessing a critical, operational or experiential knowledge base which can be used as a beacon to script their planning, analysis and choice of action. In this "low or less authentic" variant and exemplar of the word problems, the description of a real-life task situation is kept to a minimum. The participating students are given very little information about the circumstances of the task situation, including an absence of detail on the purpose of the problem task. All of the "more authentic" task descriptors include a more thorough description of the task context so that the task can make sense to the student. The purpose of solving the task is also provided in the text of the word problem. For the word question and statement to be relevant to the student, and its purpose to be immediately apparent, the text in the more authentic task variant invokes the idea of "enough" planks and also includes information on the number of planks that is needed to complete the task of "building a cabin". Lengthy passages of text have been avoided in Palm's word problems in order to support and facilitate students with reading difficulties to understand and engage with the required tasks.

Following on an analysis of his research findings and results, Palm concluded that "increased task authenticity, even when it has to be accomplished solely by a modification of the task text, can increase students' tendencies to use their real-world knowledge in the solutions to word problems". Palm recommended that the situational and contextual stimuli be included in the planning and development of word problems that are to be used in the teaching and learning of numeracy and mathematics in the classroom.

Dapaepe et al. (2010) developed an alternative index of authenticity which identified and documented specific "entry" and "exit" approaches and strategies that teachers can use to activate and enhance the authentic, situational and contextual features and dimensions in word problems. The following strategies and approaches were documented and recommended in that research:

- Re-word the word problem. Get the student to re-read and restate the word problem in his / her own words.
- Seek to clarify and define the meaning of the situations, ideas, objects, persons and occupations that are mentioned in the word problem.
- Build on and activate the student's out-of-school experiences and knowledge. Link the word problem to a personal experience of the

student. Refer to a related event that has happened in the real world of the student's experiences.

- Take explicitly into account, and refer to, the realities of the public context from which the word problem is derived. Identify the conditions and assumptions of the real-world exemplar.
- Interpret and validate the problem outcome and solution by linking to real-life situations. Place the mathematical solution back into a real life context. Seek real-life explanations for the obtained computation solution.
- Try and identify corresponding real-life situations and scenarios. Refer to corresponding real-life applications and the practical relevance for learning and living that results from the student acquiring insights into, and familiarity with, the processes of solving this particular problem genre or class.

Oblinger (2007) also developed an additional index of authenticity by distilling the essence of the "authentic learning experience" down to its core elements. These include:

- Real-world relevance. The word problem at should mirror and be framed by authentic activities which match the real-world tasks in practice as nearly and genuinely as possible.
- Ill-defined or open problem. Authentic activities are relatively open to multiple interpretations, requiring students to identify for themselves the specific tasks and subtasks that are needed to successfully complete the holistic task requirements.
- Multiple perspectives. Authentic activities provide opportunities for students to examine the problem statement from a variety of conceptual and practical perspectives.
- Collaboration. Success is not always achievable by an individual learner working alone. Authentic activities can be used to facilitate cooperative learning.
- Reflection and meta-cognition. Authentic activities provide opportunities for learners to make choices and engage in reflection on their learning.
- Multiple interpretations and outcomes. Rather than yielding a single correct answer which can be obtained by the application of singular rules and procedures, authentic activities can allow for diverse interpretations and competing actions and solutions.

Berge et al. (2004) developed the following checklist of strategic questions and foci that can be used by teachers to plan, incorporate and evaluate the desired

gradient and density of authentic challenge and contextual situation into a word problem:

- How authentic is the word problem statement? To what extent is the problem statement in touch with the students' experiences and daily life? Is the problem that is presented a "personalised" one for the students? How familiar are the students with the problem type?
- Do the students consider the word problem statement to be realistic, interesting, genuine and worth finding a solution to? Does the task demand excessive effort and perseverance? Is the problem sufficiently challenging to motivate the students? Can the problem be solved with in the available time-frame? Are there any excessively-challenging or hidden aspects to the word problem?
- Is the word problem "open"? Some students consider authentic problems particularly challenging because they require flexible or multi-step approaches.

In their seminal study, Vicente et al. (2007) investigated the impact of "conceptual" and "situational" modification and adjustment, in the text of word problems on student performance in numeracy and mathematics. This research also identified a range of strategies and approaches that can be used by teachers to create the desired level of authenticity and

contextual reference within a word problem. In their research, Vicente et al. defined situational adjustment and enhancement as "personalising" the word problem so as to provide the students with "enriched" problem contexts which represent real-world situations and scenarios. These personalised numerical and mathematical word problems were defined by the degree of "ordo naturalis", realism and similarity that they had with the students' lived out-of-school experiences and interests. Equally, as part of situational modification and adjustment, additional pieces of information – such as making explicit the rationale, motives, settings, and temporal structure of the problem – were also frequently provided within a word problem statement. "Conceptual adjustment" was defined as – and attempted by – making more explicit and transparent the relationships that exist between the singular variables in the word problem and the underpinning conceptual and semantic infrastructures. Care was also taken not to alter or dilute the underlying semantic and mathematical structures of the problem statement.

In all three versions of the word problems – "situationally modified", "conceptually modified" and "standard and unmodified" – care was taken to ensure that excessive reading and comprehension demands were not placed on the learner by the readability level, syntactic requirements and complexity of the text. Care was also taking in ensuring that an equivalent level of decoding and

comprehension challenge was presented by all three versions of the word problem. No time restriction was placed on students' engagement with the word problems. The following is an example of the "unmodified and standard" version of a contextualised word problem that was used in the research:

"Peter has 37 metres of cable. He bought A metres of cable more. He used B metres of cable and he ended up with 11 metres of cable. How many metres of cable did he buy / use?"

The following version of the same word problem contains conceptual modification and reformulation; I have identified these modifications in italics:

"Peter has 37 metres of cable. He bought A metres of cable more *and joined them with those that he had. From the resulting total of metres of cable* he used B metres of cable and he ended up with 11 metres of cable. How many metres of cable did he buy / use?"

This third version of the word problem illustrates how situational rewording has been used to make the problem statement more user-friendly by highlighting the intentional, causally and temporal structure of the situation that is described in the word problem; I have again identified these modifications in italics:

"*Peter wants to renew his house's wiring. Peter still possesses* 37 metres of cable, *from a previous renovation. As Peter realises that these metres will not be enough cable for the whole installation,* he bought A metres of cable more. *After buying those metres of cable he began the renovation. While making the renovation* he has used B metres of cable, and *when he finishes he realises that* there remains 11 metres of cable. *Peter wonders:* how many metres of cable have I bought / used?"

Students' performance in engaging with modified and unmodified text was analysed and performance outcomes were compared. On completion of the research, Vincente and his team of research colleagues, concluded that conceptual rewording and adjustment had a more significant and "facilitating effect" on students' performance and attainment, in the domain of word problem-solving, than enhanced contextual and situational rewording and re-formulation. These researchers also noted that the nature and format of situational rewording and contextual embellishment often necessitated the use of extended and longer text passages. For some participating students, having to wade through longer- and often more linguistically-complex text, significantly increased the "fatigue effect" and simultaneously reduced the likelihood of these students persevering with the task and arriving at a successful solution. However, Vincente et al. suggested that "situational adjustment and enrichments" can be effectively and successfully embedded in the word problem framework by the use of supportive graphics and visuals.

Some Critiques

Contextualised word problems have been critiqued at many levels in research literature. Post- modernistic researchers contest and critique the contention of transparency and value- neutrality in the language that is used within contextualised word problems. Bakhtin (1981) claims that all language is value-laden and grounded in the specific "chronotype or simulacra" configuration from which it evolves. In Bakhtin's conceptualisation, any "neutral" representation or modelling of reality from secular society is impossible because every human expression operates within generic universes of time, space, storyline, intentions and meanings and these are inescapably linguistically framed and culturally mediated through dialogue and interpretation of language. Baudrillard (1988) agrees with Bakhtin's thesis and declares "the impossibility of any representation of the real" and further adds: "there is no equivalent of the world, no double, no representation, no mirror". Mason and Pimm (1984) also contend that mathematical models are necessarily neither transparent nor obvious matchings with, and reflections of, societal phenomena and must, by their nature, stress and ignore particular features of reality and live scenarios. Verschaffel et al. (2000) declare that some word problems are superficial and "pseudo-realistic" and are constructed as a mere veneer of real life. These researchers claim that: "rather than functioning as realistic and authentic contexts, inviting or even forcing pupils to use their commonsense knowledge and experience about the real world in the different stages of the process of solving mathematical- application problems, school arithmetic word problems are perceived as artificial, puzzle-like tasks that are unrelated to the real world". Bernstein (1990) also identifies some of the difficulties in planning and constructing appropriate word problems that are un-biased, politically-correct and value-neutral. Bernstein articulates some of these challenges by highlighting how social class and gender script, differentiate and inform students' constructions and interpretations of knowledge as presented in word problems. Palm (2009) advises that:, "different aspects of real-world situations affect students' behaviour differently and the way they affect them may also vary between situations". Palm also states that some contextual and situation aspects will be "more important for student behaviour than others and the degree of importance will also vary between situations". Lave (1988) states that developing connections between the students' out-of-school and classroom numeracy and mathematics is problematic and difficult to plan because the students' learning contexts and profiles are individualistic and differ significantly. Berge et al. (2004) state that the current and contemporary conceptualisations of authenticity and context might still be too generalised and not far enough developed to serve as a definitive guide in the planning of all numerical and mathematical word problems. Deliyianni et al. (2009) claim that some students have difficulty engaging with word problems because they place their focus on the syntactic and linguistic structures within the textual framework and ignore the real meaning of the facts and situations that are described in the problem

statement. Kajamies et al. (2010) and Vauras et al. (1999) agree that word problem-solving in numeracy and mathematics poses particular and specific challenges and difficulties for the low achieving student who regularly exhibits poor self-regulation competency and motivational vulnerability.

Despite these substantial and on-going criticisms and critiques, there appears to be a growing consensus among mathematics teachers and educational planners that the primacy and hegemony of word problems – and word problem solving – that currently exist within some cultures and strands of numeracy and mathematics need to be consolidated and extended so that they emerge as the status quo and will remain thus well into the foreseeable future. Tienken and Maher (2008) articulate a compelling case for the consolidation and expansion of word problem-solving as a core dynamic and orientation within all the cultures and strands of mathematics teaching and learning by reminding us that a key and fundamental objective of all formal education is "to help develop students who can think critically and solve authentic problems". As teachers, we need to re-discover the immense potential that lies within contextualised and authentic word problems to support and enhance the teaching and learning of numeracy and mathematics, not only in the mathematics class but across the curriculum. Dapaepe et al. (2010) also acknowledge the key position and potential of word problems, within the numerical and mathematical domains, and suggest that word problems present teachers with multiple opportunities to activate and incorporate a range of situational and contextual stimuli and cues which can encourage and facilitate sense-making in students. However, Dapaepe and his co-researchers lament the fact that some teachers do not always seize these available opportunities. Fox and Surtees (2010) warn us against reverting to the previous and constrained conceptualisation of word problems which defined the primary role and function of a word problem as providing practice in routine, mechanistic and repetitious computational operations.

It is important to provide opportunities for students to engage with word problems that are drawn from their own lives and, also, from contextualised situations and scenarios which arise in other subjects across the curriculum. The challenge for us, as teachers, is to continually establish inclusive learning environments in our classrooms that encourage students to "personalise learning" in ways that allow individual learners to extend, adapt, revise and adopt the formal numerical and mathematical ideas to a context in which they can place themselves. Barwell (2011) states when students are requested to write their own word problems in numeracy and mathematics, they are quite capable of "mathematizing" situations and scenarios, which are based on real-world insights and considerations. The on-going challenge for teachers is to draw on this reservoir of skills and competencies in students so that they can respond appropriately and successfully to word problems they have not seen before. As teachers, we want our students to become efficient and successful problem

solvers in numeracy and mathematics; consistent and regular engagement with contextualised and authentic word problems can be a critical scaffold and support on the journey to creating this reality.

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An analysis of Microsoft PowerPoint 2007 as a teaching and learning tool for mainstream and SEN pupils

'Even though the times have changed, the benefits of Powerpoint should always remain the same…'

John Phayer

This article discusses a study of primary school teachers' experience of using PowerPoint 2007 in their classroom. In particular the article will examine: teachers general usage of Powerpoint; the reasons why it is not used more often for teaching; examining the most useful / problematic features of PowerPoint; identifying how often they create their own customised teaching resources using Powerpoint; and finally investigating what impact PowerPoint has made on their teaching and student learning. The article discusses the reasons why Powerpoint should / should not be used and is followed by explaining how to design simple effective resources with it. Fourteen teachers consisting of Mainstream, Learning Support and Resource participated in this study. The most prominent findings demonstrate that the majority of them feel they lack the required competency, knowledge and skill to create simple teacher-student rich resources for teaching and learning. Many teachers also indicated their ambition to learn how to use PowerPoint to create resources for language development and for subjects like: S.E.S.E, Geography, Maths and also for use with an Interactive Whiteboard. PowerPoint 2007 consists of many versatile tools e.g. SmartArt graphics, Audio recording tool, Textbox tool to create Word Banks, which allow teachers create simple, effective resources for teaching. Better awareness promoting PowerPoint resource creation could be facilitated for teachers through Continuing Professional Development courses in Education Centres.

Introduction:

The medium through which messages have been communicated in a classroom setting has changed drastically from blackboards to using interactive whiteboards and other types of technology. Pupils and teachers are constantly being saturated by different applications for performing educational tasks and consequently, an onus is placed on them to acquire the appropriate skills and knowledge to develop content that is appealing but educational for the pupil. The debate still continues regarding the educational potential of using PowerPoint for teaching and identifying how teachers can make teaching and learning tasks more educationally enjoyable.

To use PowerPoint or not to use PowerPoint?

Craig and Amernic (2006: 149) state that any new way of communicating calls for new ways of 'thinking about communication processes'. PowerPoint is a type of Content Free software (N.C.T.E., 2000: 26) and has been described as a 'powerful and ubiquitous communications technology and aid to teaching' (Craig and Amernic, 2006: 147). Rowcliffe (2003: 75) states that PowerPoint acts as a powerful vehicle for introducing interactive multimedia that can create motivational and educational benefits for students who use it and describes PowerPoint as a 'powerful piece of presentation software' allowing reasonably competent users create sophisticated slides with ease (Rowcliffe, 2003: 69). To use this tool in a clever way, Beth-Doyle and Giangrecco (2009: 25) suggest teachers should adopt the UDL (Universal Design for Learning) concept, by using a mixture of sound, pictures, video and the written word to enhance the delivery of material which also assists SEN students with learning e.g. Dyslexia. Bremer *et al* (2006: 29) suggests that PowerPoint could be a useful medium for discussing an issue / concept within a classroom but is also useful in presenting text in a colourful way supporting recall (Bremer *et al*, 2006: 34). If it is being used, it needs to be segmented to promote concentration on one piece of information at a time. Bremer *et al* (2006: 35) stresses the importance of including elements of 'creativity' and 'surprise' in different types of PowerPoint media to assist students with engaging in listening activities should they find the art of listening difficult to sustain. This can be true for SEN students (e.g. Dyslexia), who can find it difficult to understand text appearing on several lines. Consequently, using spaces, indentation and having certain items in bold (Bremer *et al*, 2006: 35) or using colour coded words / phrases, Mindmapping features, Developer tab, Hyperlinks and Screentips to enrich a slide show (Phayer, 2011(a): 52-57), make it easier for students to navigate around text (Bremer *et al*, 2006: 35 and 42).

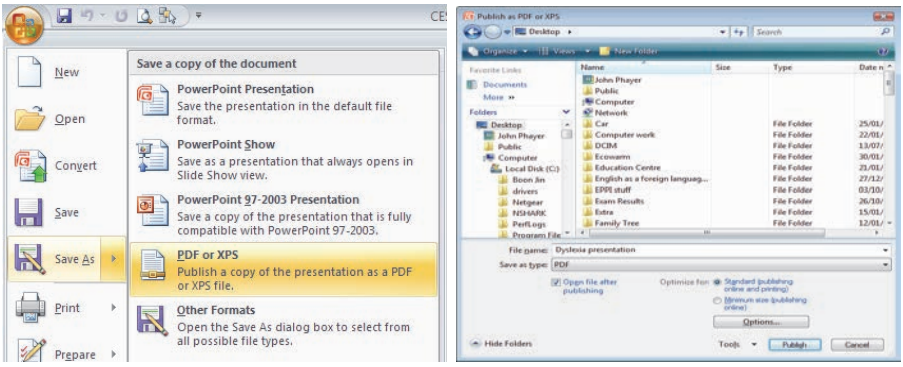
Alternatively, Szabo and Hastings (2000, cited in Rowcliffe, 2003: 70) stress that PowerPoint should not replace the blackboard but be used as an 'auxillary tool' to enhance learning. Rowcliffe (2003: 69) stresses that PowerPoint needs to be used thoroughly and methodically so that it is used well, but needs to accompany excellent teaching methods rather than replace them. Mason and Hlynka (1998, cited in Rowcliffe, 2003: 71) critically describe using PowerPoint within the primary school classroom as having led to a 'collapse of class atmosphere' due to fact that the teacher is required to remain at the front of the class as opposed to they being 'a mobile force for order around the classroom'. Parker (2001: 1, cited in Craig and Amernic, 2006: 148) describes PowerPoint as having turned users into 'bullet point dandies' and even Coursey (2003, cited in Craig and Amernic (2006: 148) suggests that PowerPoint has replaced clear thinking with pointless animations, serious ideas with ten word bullet points, substance with tacky, confusing style. Mason and Hlynka (1998, cited in Rowcliffe, 2003: 71) also argue that 'the tool is too teacher-centred and word

based to be useful for primary teaching' and that students should obtain a 'feel' for the application if they are going to use it while learning and also state their age is not suitable to learn successfully enough from slide presentations.

Educational uses of PowerPoint in teaching:
Teachers can use many simple tools of PowerPoint 2007 to create sophisticated resources. The following summarises how these can be created as follows:

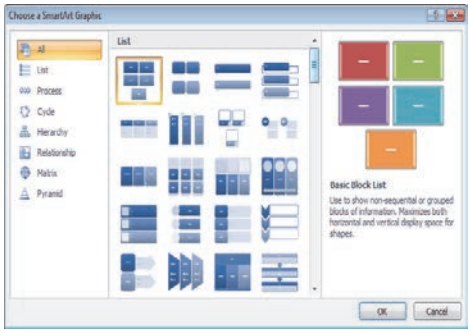
Conversion tool:
Bennett, Hewitt, Kraithman and Britton (2003: 120) favour using the conversion tool to create accessible presentations. Tyrrell (2007: 1) suggests PowerPoint allows screen readers to read text from it but can also be used with other Text-to-Speech software to assist S.E.N students (e.g. Dyslexia) with reading e.g. TextHelp R & W Gold (Phayer, 2007: 45-63), NaturalReader (Beth-Doyle and Giangreco, 2004: 29), Claroread (Phayer, 2010(a): 17), Kurzweil 3000 (Phayer, 2010(b): 001724-001736 and Phayer, 2010(c)). To save in PDF format, click **Office Button → Save As → PDF / XPS** and then use a Text to speech program to read the information (Phayer, 2011(a): 58) **(Fig's 1 – 2).**

Fig's. 1 – 2: Converting a .ppt file into a .pdf file



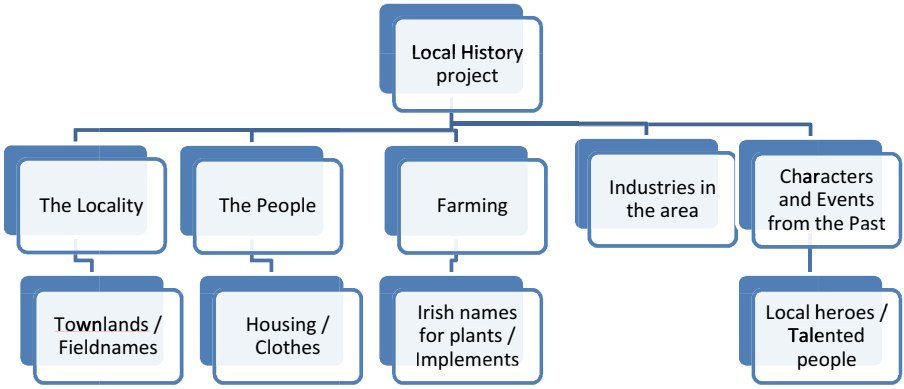
Mindmapping → SmartArt Graphic tool:
Kinchin (2006) promotes Mindmapping tools in PowerPoint to enrich learning by representing the links between ideas avoiding the creation of false hierarchies within lists of bullet points. The SmartArt tool allows teachers create and present information visually through charts and diagrams (Staehli, 2010: 37) and is accessed by clicking on the **Insert Tab → SmartArt button (Fig's. 2 – 3).** A new window appears allowing the user select from a list of graphics (Phayer, 2011(a): 52-53).

Fig's. 2 – 3: Choosing the SmartArt graphics tools



For mainstream teachers, the simplest choice might be using a 'hierarchy box' **(Fig. 4)** for (a) depicting the characteristics of 'An Madra' (Ní Mhúrchú, 2010: 22) or (b) brainstorming a local history project (Monaghan Ed. Centre, 2010: 27) e.g. examining local horse-coach building, (Phayer, 2011(b): 105-114).

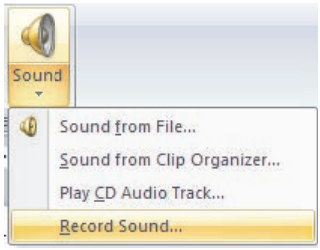
Fig. 4: A Mindmap depicting a local history project (Monaghan Ed. Centre, 2010: 27)



Adding Sound and Video in PowerPoint:

Bennett, Hewitt, Kraithman and Britton (2007: 120) state PowerPoint offers facilities for adding sound to slides, whilst Beth-Doyle and Giangreco (2004: 29) encourage using audio for S.E.N. students, including Dyslexia. This is achieved by clicking on the **Insert Tab → Click Sound → Record Sound** (Phayer(a), 2011: 57) **(Fig. 5)**

Fig. 5: Using the Record Sound tool



Phayer (2011(a): 57) proposes this feature may prove advantageous when used for creating Word Bank tables using different word endings for a class e.g. -at, -ot, -et, -it etc., followed by using suitable light and dark contrasting background colours (British Dyslexia Association, 2011). Then use the record button to record the word endings for each word and insert an audio icon where appropriate **(Table 1)**:

Table 1: Word Bank words with recording tool

-at	-et
C-a-t	L-e-t
M-a-t	M-e-t
B-a-t-	B-e-t
R-a-t	N-e-t

PowerPoint 2007 offers two ways of inserting Videos. The first method is by clicking on the **Insert Tab ➔ choose Movie ➔ Movie from File ➔ click Insert (Fig. 6)** (Lipera, 2007: 1). The user decides if the video should play 'automatically' or 'when clicked' **(Fig. 7)**.

Fig. 6: Movie insertion

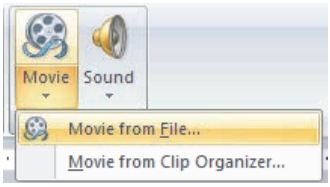
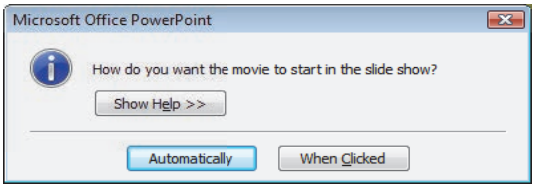


Fig. 7: Choosing 'automatically' or 'when clicked' option



The second method of inserting a video, ideally < 1 minute, in PowerPoint is by embedding. This can be achieved by inserting a **New PowerPoint Slide ➔ select the Developer Tab ➔ choose More Controls ➔ select Windows Media Player ➔ draw Action button.** An 'embedded window' appears **(Fig. 8)** ➔ choose **Properties Button** ➔ Under **URL,** type in the exact address where movie is stored ➔ Press **F5 key** to view the 'embedded video' in slideshow **(Fig. 9)** (Phayer, 2011(c)).

Fig. 8: Windows Media Player control

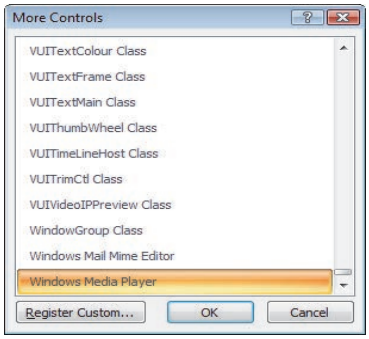
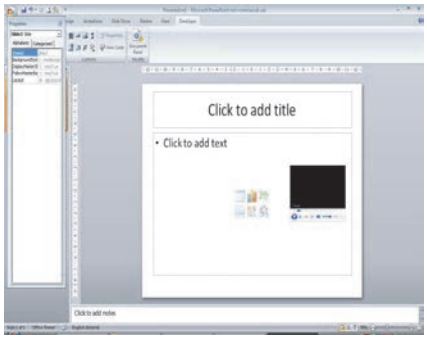


Fig. 9: Embedded movie



Animation:

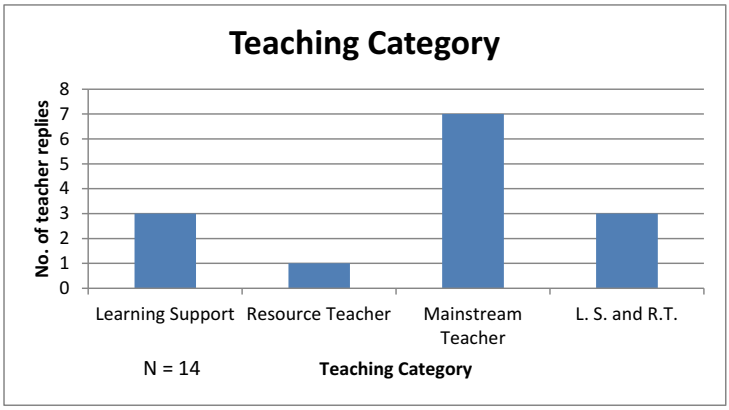
Animation adds emphasis to a presentation (Tyrrell, 2007: 27) but should be used sparingly. For mainstream teachers, this tool may be helpful to produce simple moving animations for a class e.g. constructing simple 2D objects that move like drawing a moving ball for Science / Maths. If one wishes to draw a moving Oval, choose **Oval Shape** on the **Drawing toolbar** ➔ Hold down **Shift key** as it is being drawn to form a circle; choose **Animation ➔ Custom Animation ➔ Add Effect ➔ Motion Paths ➔ Draw Custom Path** (to draw a path with cursor) ➔ choose **Line**. Press **F5** to view slideshow (Tyrrell, 2007: 27).

Findings

This article examined primary school learning support, resource and mainstream teachers use of Microsoft PowerPoint 2007 in a classroom setting and to debate the educational uses of using it and investigate why it is not used more often for teaching and learning. Fourteen teachers participated in this study and the data was obtained by an in-class questionnaire survey and informal interviews.

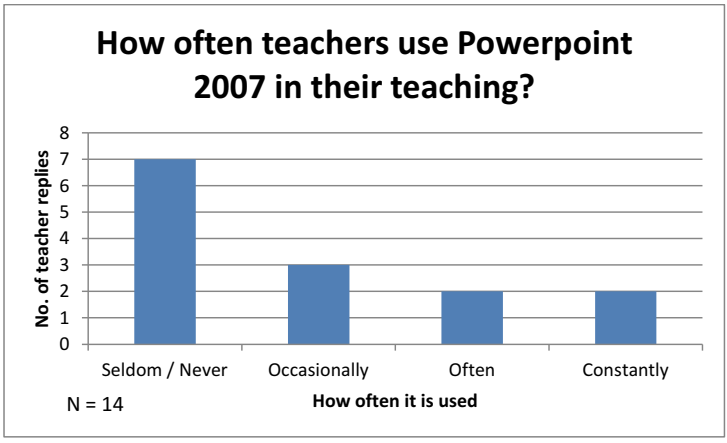
The study commenced by asking teachers whether they were male / female and to indicate their teaching category. The findings indicated that 21.42% indicated 'Male' and 78.57% indicated 'Female' while **Fig. 10** shows the teachers teaching category:

Fig. 10: Teaching category



From the findings, 21.42% indicated 'Learning Support', 7.14% indicated 'Resource', 50% indicated 'Mainstream' while 21.42% indicated 'Learning Support and Resource'. The next question identified how often teachers use Microsoft PowerPoint 2007 in their teaching? **(Fig. 12)**

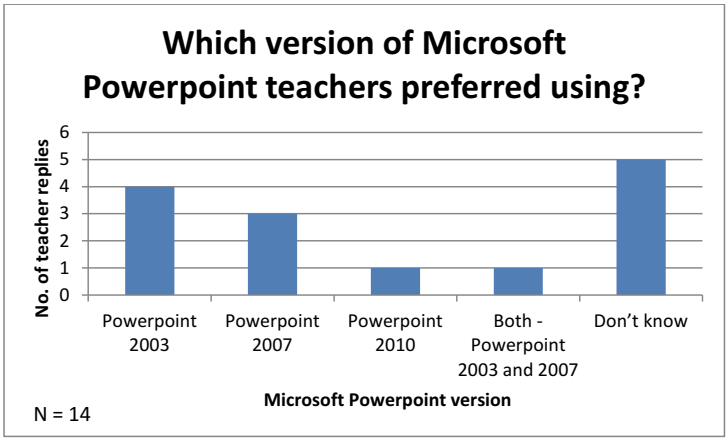
Fig. 12: How often teachers use PowerPoint 2007 in their teaching



From the findings, 50% indicated 'Seldom or Never', 21.42% indicated 'Occasionally', 14.28% indicated 'Often', while 14.28% indicated 'Constantly'. A study carried out by Franklin (2005: 15) examined elementary teachers usage of ICT in the classroom, of which PowerPoint usage formed one element of the survey. The findings revealed that 22% of teachers used PowerPoint in their teaching, while student use of PowerPoint was in terms of individual student presentations and for voice-recorded animated PowerPoint presentations

(Franklin, 2005: 15-16). The questionnaire then examined which version of PowerPoint teachers preferred using? **(Fig. 13)**

Fig. 13: Which version of Microsoft Powerpont teachers preferred using?



From the findings, 28.57% indicated 'PowerPoint 2003', 21.42% indicated 'PowerPoint 2007', 7.14% indicated 'PowerPoint 2010', 7.14% indicated 'both PowerPoint 2003 and 2007', while 35.71% indicated 'Don't know'.

The kernel part of this study was to ascertain what features teachers found useful / non-useful and establish why they do not use more PowerPoint in their teaching **(Table 2).**

Table 2: Most useful / non-useful features of PowerPoint 2007

Microsoft PowerPoint Feature	Extremely Useful	Very Useful	Moderately Useful	Vaguely Useful	Not at all useful	Never used
Spelling Check	28.57%	21.42%	7.14%	0	0	42.85%
Grammar Check	21.42%	0	28.57%	0	0	50%
Thesaurus	14.28%	7.14%	7.14%	7.14%	0	64.28%
Help facility	0	0	21.42%	14.28%		64.28%

Fonts, Font Size, Fonts Selection	21.42%	35.71%	0	7.14%	0	35.71%
Autocorrect	14.28%	14.28%	14.28%	14.28%	0	42.85%
Zoom tool	21.42%	21.42%	14.28%	7.14%	0	35.71%
Print Preview	35.71%	21.42%	7.14%	7.14%	0	28.57%
Line Spacing	21.42%	14.28%	14.28%	0	0	50%
Paragraph Spacing	14.28%	7.14%	14.28%	14.28%	0	50%
Keyboard Shortcuts	14.28%	21.42%	7.14%	0	0	57.14%
Toolbar Icons	14.28%	14.28%	35.71%	0	0	35.71%
Normal View, Slide Sorter View, Slide Show View	21.42%	28.57%	7.14%	7.14%	0	35.71%
Notes Page tool	7.14%	14.28%	7.14%	7.14%	0	64.28%
Header and Footer	21.42%	14.28%	14.28%	0	0	50%
Chart / Graph tool	14.28%	7.14%	14.28%	7.14%	0	57.14
Alignment facility	14.28%	14.28%	21.42%	14.28%	0	35.71%
Slide design, Slide Background & Layout tool	21.42%	28.57%	14.28%	0	0	35.71%
Macro tool	7.14%	7.14%	0	7.14%	0	78.57%
Animation Schemes	7.14%	7.14%	35.71%	7.14%	0	42.85
Custom Animation	7.14%	28.57%	21.42%	7.14%	0	35.71%
Slide	14.28%	28.57%	21.42%	7.14%	0	28.57%

Transition						
Record Narrations tool	7.14%	14.28%	0	0	0	78.57%
Action Buttons e.g. Creating Text Boxes, (Developer Tab)	21.42%	21.42%	7.14%	0	0	50%

From the data in **Table 2**, it is quite clear that the most useful features of PowerPoint 2007 found by teachers were: Spelling Check (28.57%) and Print Preview (35.71%) followed by: Grammar check, Fonts selection, Zoom tool, Line spacing, Slide View mode, Header and Footer and Action Buttons, reaching values of 21.42% each. The findings presented do not really indicate appalling lack of usage of facilities but do suggest a lack of appropriate knowledge and awareness as to the facilities location and how they are used.

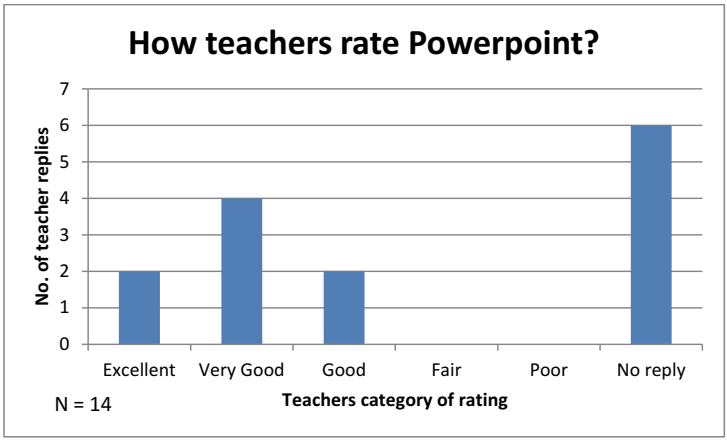
As a follow-up question, teachers were asked which PowerPoint tool they found most helpful with their teaching. C.C. (Questionnaire, 4/07/2011) indicated the 'Thesaurus' and stated 'it incorporates spelling with language development and usage'. G.S., (Questionnaire, 04/07/2011) indicated 'inserting pictures / captions' due to it being 'quick and colourful'. C.D. (Questionnaire, 5/07/2011) indicated 'Visual Display' due to 'the combination of Textbox and inserting of images'. S.S. (Interview, 05/07/2011) indicated 'slideshows' due to 'creation of single slide show depicting images along with written information acts as a valuable visual aid'. One teacher, A.C. (Questionnaire, 4/07/2011) indicated 'zero usage'. Teachers were asked 'what feature did they find most difficult to use in their teaching'. C.C. (Questionnaire, 05/07/2011) Indicated 'the possessive apostrophe in spell check'. G.S. (Interview, 07/07/2011) indicated 'I don't know how to add Movie and Sound Clips'. This could suggest that C.P.D. courses focusing on PowerPoint resource creation could be rolled-out by Education Centres. Phayer (2010(c): 75 – 87) examined the impact of Education Centres that delivered ICT in SEN courses for teachers and was found that they continuously play a highly imperative part in the roll-out of these courses and act as a central focal point where teachers obtain information.

The next question identified 'what types of resources would teachers like to create for their classroom using PowerPoint'? A broad range of responses emerged. (A.C., Questionnaire, 05/07/2011) indicated 'Maths games for addition, subtraction, SESE, Oral language' whilst S.S. (Questionnaire, 05/07/2011) indicated 'Mathematical resources for addition and subtraction and creating grammar worksheets'. D.C. (Interview, 07/07/2011) also indicated

'Maths skills' and G.S. (Questionnaire, 05/07/2011) indicated 'English grammar, Gaeilge – scéal, Maths examples covering themes like sharing and dividing'. C.C. (Questionnaire, 07/07/2011) indicated creating sophisticated resources for 'language development – classification – nouns, adjectives, alternative verbs'. C.C. (Interview, 07/07/2011) stated about creating an 'image resource bank' but was unsure. R.O'N (Questionnaire, 07/07/2011) stated 'creating interactive resources where the children not only have a picture of the item being discussed, but there is also sound and possibly a game to go with it.' P.C. (Questionnaire, 05/07/2011) indicated 'creative writing, story boards, prompts, scaffolds'. S.K. (Questionnaire, 05/07/2011) indicated 'Quiz's, Maths resources – e.g. Bar graphs, Pie charts'. M.F. (Questionnaire, 04/07/2011) indicated 'create PowerPoint presentations that can be used for the whiteboard'.

The next part of the questionnaire sought to identify 'what are the greatest difficulties in creating their own resources using Microsoft PowerPoint for their teaching?' The largest cohort of responses, 28.57% indicated 'the biggest problem was time' (Questionnaire, 04/07/2011) while S.K., M.F., and C.D. (Interview and Questionnaire, 06/07/2011) further indicated 'software compatibility', 'knowing how to use PowerPoint' and 'creating bar graphs in Maths'. Teachers were also asked to rate Microsoft PowerPoint in relation to their teaching' **(Fig. 14).**

Fig. 14: How teachers rate PowerPoint?



From the findings, 14.28% indicated 'Excellent', 28.57% indicated 'Very Good', 14.28%% indicated 'Good' while 42.85% indicated 'No reply'. The next question examined what impact PowerPoint made on **teachers teaching?** 50% of responses indicated 'Positive', 14.28% of responses indicated they 'Didn't know', while 35.71% indicated 'No reply'. A variety of commentary emerged

like M.F. (Questionnaire, 06/07/2011) indicated being 'Impressed by the use of PowerPoint in presentations that I have received', while P.R. (Questionnaire, 07/07/2011) stated 'higher interest level'. Important commentaries came from S.S. (Interview, 07/072011) who stated 'PowerPoint offers an alternative way of teaching and learning. It is more visual and can create active lessons' and N.N. (Interview, 07/07/2011) stated 'it makes the learning more realistic for the children and also enables them to retain visual images'. Rankin and Joaas (2001, cited in Craig and Amernic, 2006: 150) examined PowerPoint usage in the primary school classroom and found it had no major effect on student performance.

The final question identified what impact PowerPoint made on **pupils learning?** 35.71% of responses indicated 'Positive', 21.42% indicated 'Don't know', while 42.85% indicated 'No reply'. N.N. (Questionnaire, 04/07/2011) claimed 'children are more interested in the topic. Information is taught so they are using a variety of media'. S.S. (Questionnaire, 04/07/2011) was positive about the effect of PowerPoint on pupils learning but added 'despite some children being easily distracted by animations and images'. Finally, G.S. (Interview, 07/07/2011) indicated 'positive I hope – they (i.e. the children) seem attentive and interested'.

Conclusion:

PowerPoint 2007 is a highly versatile tool but its widespread adoption and usage in the primary school classroom is minimal and quite poor. From this study, it is apparent that teachers could lack sufficient knowledge and skills to create simple customised resources for teaching. The benefits of PowerPoint should always remain the same but it is important to identify where, when and how it will be used to benefit student learning. Consequently, enrolling in more C.P.D. courses focusing on PowerPoint resource creation in Education Centres could assist teachers to overcome this issue. The study is limited in terms of the number of participants who engaged in it. A nationwide survey could be performed focusing on examining how other teachers create customised teaching resources with PowerPoint and to identify the problems / solutions which they have encountered using them with their teaching. Further research could address this issue in more depth.

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JOHN PHAYER

John Phayer completed a Research Masters in Education at Mary Immaculate College, Limerick which focused upon the various types of Assistive Technology (both software and hardware) that are used by third level Dyslexic students. One aspect of his thesis investigated the various difficulties experienced by these students at third level, identifying the most suitable technology in addressing their problems. John works as an Assistive Technology tutor in a third level institution and can be contacted at johnphayer@yahoo.co.uk for further correspondence.

Some Thoughts on the Professional Development of Learning-Support/ Rescource Teachers…

Anne English

Background

Learning – including the professional learning of learning-support/resource teachers – is not the preserve of educational institutions. It is an integral part of our everyday lives. Current thinking about lifelong learning is placing greater emphasis on the workplace as a site of learning. In order that workplace learning might occur in an effective manner, workplaces must be developed which develop opportunities for continuing learning.

If we understand how teachers learn, and if we identify the factors or conditions that enhance or restrain their professional learning, then we can be better poised to promote and facilitate such learning. Typically, the school is regarded as a site of learning for the pupils but a large amount of learning also takes place on the part of teachers and others as they go about their school-related work. The school as a workplace is the site and catalyst for much lifelong learning that is work-related – by maximising the capacity for workplace learning of learning-support/resource teachers we can greatly enhance their CPD opportunities to the ultimate benefit of children with SEN/learning difficulties with whom they work. While acknowledging the key role that formally accredited courses and formal CPD events play in our learning as teachers, this article aims to prompt our thinking around the potential of workplace learning of teachers, specifically learning-support/resource teachers.

Introduction

Recent years have seen rapid expansion in professional knowledge relating to teaching and learning in general and special educational needs (SEN) in particular. In the past, learning was predominantly regarded as something which prepared people for entry to the workplace. However, it is widely acknowledged that it is not possible to address all issues pertaining to teaching during Initial Teacher Education (ITE). The complexity of current times means that all employees, including teachers, need to continue to learn and improve their effectiveness throughout their working lives. The demands on schools and teachers are becoming increasingly complex (OECD, 2005) and groups such as the the Irish National Teachers' Organisation (INTO) acknowledge the

importance of lifelong learning for members of the teaching profession (INTO, 2006).

James (2005: p.105) emphasises that teacher learning "is a necessary condition for pupil learning" and asserts that innovations in teaching can only occur if teachers themselves have learned. In its consultative document, "School Self Evaluation Draft Guidelines for Primary Schools" the Department of Education and Skills (DES) highlights the importance of teacher learning when it states that the key principles of effective school self-evaluation include "making a positive, measurable and significant difference to the quality of teaching in the school" (DES, 2012: p.8). Indeed, in many parts of the world, improving the performance of teachers has become a high priority in educational policy, and improving the job-related learning of teachers is seen as one of the main ways of achieving this improvement (Hodkinson and Hodkinson, 2005: pp.109-110). The National Council for Special Education (NCSE, 2011: p.5) speaks of "how far the *(Irish)* educational system has come in the last 10 years", specifically in terms of the education of children with special educational needs (SEN). Such rapid change has presented considerable challenges with regard to teacher Continuing Professional Development (CPD), specifically the CPD of LS/RTs. In response to their diverse caseloads, both newly-appointed and practising LS/RTs need to constantly learn about complex learning disabilities of which they may have had minimal if any professional experience in the past.

Workplace learning of LS/RTs is a key channel through which new and emerging CPD needs of teachers can be addressed to a significant degree. Accordingly, it is timely to consider the workplace learning of LS/RTs i.e. what it is that LS/RTs learn in, through, and for the workplace; how this learning takes place; and how such learning might be maximised.

Research for my thesis (M.St.) involved carrying out a small-scale study of the workplace learning of LS/RTs in mainstream primary schools. The research was qualitative in nature – research data was collected through semi-structured interviews with LS/RTs. Although the informal learning of the LS/RTs constituted the key area of interest, formal learning that is associated with the workplace was also considered. Through considering some of the findings of this research and through drawing on some of my own general reading and experiences – both as a practising teacher and through my involvement in facilitating professional development of teachers in various contexts – I hope to prompt our thinking on some means through which we might advance the professional learning of LS/RTs on an ongoing basis.

The Irish Context

The Teaching Council (2011: p.7) indicates that

> "the emergence of new knowledge, understandings and insights into curriculum, pedagogy, assessment and teacher learning, together with the accelerating pace of societal, legislative and educational reform and the increasingly complex role of teachers"

provides a context for its policy on the Continuum of Teacher Education. It is imperative that teachers continually learn so that they can meet the challenge to keep up with changes in work practices and expectations. In very recent years, many of the developments in Irish education have impacted specifically on provision for children with various educational needs – for example, the Education Act (1998) and the EPSEN Act (2004). Developments such as these, together with the changing nature of mainstream education and increased emphasis on inclusive education and differentiation of learning programmes have presented many new challenges to LS/RTs.

Many LS/RTs have not had the opportunity to engage in teacher education modules that specifically address special educational needs (SEN) at undergraduate level. Even those who have done so or who have qualifications and previous teaching experience related to SEN will need to augment their professional learning on a continuing basis so that they will optimally meet the emerging needs of the children with whom they work right throughout their teaching career. Professional development of LS/RTs can take many forms, the most obvious of which may include courses, conferences, workshops and professional reading. The focus of this article will be on the workplace learning of LS/RTs, however – a facet of teacher professional life which may include and draw on those forms of learning but which has the possibility to augment teacher professional learning in a meaningful and powerful way through broad-based learning that is centred on the school as a workplace.

Learning

"Tidy images of knowledge and learning are usually deceptive" (Eraut, 2000: p.28). Nevertheless, prior to probing the workplace learning of LS/RTs, it is important to be clear about what it is that we mean by 'learning'... because what we think about learning will impact on our perception of what needs to be done when we want to enhance the workplace learning of teachers. What we think about learning influences where we recognize learning, as well as what we do when we decide that we must do something about it – as individuals, as communities, and as organizations (Wenger, 1998: p.9). Hager (2004) refers to a perception of learning which views the mind as a "container" and "knowledge as a type of substance". This perception of learning portrays the learner as someone who has yet to acquire all the products or mental items that are required in order to carry out the work in question. To be a learner under these

terms has negative connotations. It implies that the 'learner' has a deficit, and has a need to leave behind the role of 'learner' as quickly as possible. Hager refers to this view of learning as the 'L plate' syndrome (2004: p.26).

However, if we focus more on learning as a process rather than as a product, it can have a hugely positive effect on how we view lifelong learning. Much current thinking on workplace learning centres on learning through active participation in social communities. And, in reality, while we do learn a lot on an individual basis, and through attendance at lectures and formal 'upskilling' events, much teacher learning comes about through our collaboration with colleagues or co-professionals or other persons – as we seek to confront and address unique and complex problems and challenges that don't always fit in with the solution offered in a teacher's manual or in the pack of notes that we received on a course. We're not just learning from others – we are also learning with others and co-creating knowledge with our peers, as we respond to and engage with the new and evolving challenges of our work.

Workplace Learning

Policy discourse about education and training tends to focus mainly on 'formalistic' aspects of provision and achievement (Eraut et al., 2000: p.231). This formalistic paradigm relates to provision being defined in terms of qualifications and credits. Considerably less attention is paid to gains in knowledge, skills or capability which escape formal assessment. However,

> "it is now recognised that by far the greatest proportion – perhaps as much as 90% – of organisational learning actually occurs incidentally or adventitiously, including through exposure to the opinions and practices of others also working in the same context". (Matthews and Candy, 1999: p.49)

Barnett poses questions about the nature of the relationship between learning and work (1999). Is learning prior to effective work, or is it the case that we learn through our work? Or does learning occur simultaneously with work? Barnett goes on to say that although learning and work "can be understood as separate activities… they are rapidly converging" (1999, p.29). It is becoming more apparent that while we engage in the processes that are integral to our working lives, including teaching, we are simultaneously presented with a range of possibilities through which our professional learning can be extended.

It is appropriate at this point to clarify what is mean by the workplace. For the purpose of this article, I will adopt the definition of workplace learning, as employed by the Workplace Learning Task Group: "learning which derives its purpose from the context of employment" (cited by Evans et al., 2006: p.7). Learning that is work-based or work-related will be regarded as workplace learning. It will include learning **in**, **for**, and **through** the school context, and will embrace formal, informal, and incidental learning. Accordingly, it will

include learning through special and formal development events and also informal learning which takes place as part and parcel of the work of LS/RTs and as part and parcel of formal development programmes or formal interactions. Incidental learning will be understood as "learning that is unintentional" (Marsick and Watkins, cited by Garrick, 1999: pp.218-219). Incidental, unintentional and implicit learning taking place as a side effect of work forms a major part of workplace learning (Eraut, cited by Collin and Tynjälä, 2003: p.338). While acknowledging the hugely important role that formal programmes such those leading to a Postgraduate Diploma in Special Educational Needs, for example, play in teacher CPD, I would now like to focus more so on the non-accredited professional learning that is rooted in the school as a workplace, with a view to prompting thinking on how the possibilities therein might be optimised.

Workplace Learning of Teachers

Hodkinson and Hodkinson (2005) carried out a longitudinal research project involving the workplace learning of practising and experienced English secondary school teachers between 2000 and 2003. On foot of this, they described some of the main ways in which experienced teachers learn. (This study is of particular relevance to consideration of the workplace learning of LS/RTs since the DES advocates that LS/RTs are experienced teachers.) Their research indicates that one of the key means of fostering teachers' learning is through creating and encouraging more expansive features of teachers' learning environments.

The concept of Expansive and Restrictive Learning Environments for Teachers that was central to their research highlights a range of possibilities through which teacher learning can fruitfully co-exist with pupil learning.

> "An expansive learning environment is one that presents wide-ranging and diverse opportunities to learn, in a culture that values and support learning".
> (Hodkinson & Hodkinson, 2005: p.123)

This concept of expansive and restrictive learning environments was initially developed by Fuller and Unwin (Hodkinson and Hodkinson, 2005: p.123). Fig. 1 sets out the chief features of expansive and restrictive learning environments for teachers, as presented diagrammatically by Hodkinson and Hodkinson (2005). The diagram is more appropriately understood as a series of continua, rather than opposing ideal-types.

<<<EXPANSIVE	RESTRICTIVE>>>
Close collaborative working with colleagues	Isolated, individualist working
Out-of-school educational opportunities, including opportunities to reflect and think differently	No out-of-school educational time to stand back, only narrow, short training programmes
An explicit focus on teacher learning, as a dimension of normal working practices	No explicit focus on teacher learning except to meet crises or imposed initiatives
Supported opportunities for personal development that goes beyond school or government priorities	Teacher learning dominated by government and school agendas
Colleagues are mutually supportive in enhancing teacher learning	Colleagues obstruct or do not support each other's learning
Opportunities to engage with other working groups, inside and outside the school	Work restricted to home departmental teams, within one school
Opportunity to extend professional identity through boundary-crossing into other departments, school activities, and schools	The only opportunities for boundary-crossing come with a major change of job
Support for variations in ways of working and learning, for different teachers and departments	Standardized approaches to teaching and teacher learning are prescribed and imposed
Teachers use a wide range of learning approaches	Teachers use a narrow range of learning approaches

Fig. 1: Continuum of expansive-restrictive learning environments for teachers (Hodkinson & Hodkinson, 2005, p.124)

Even though the table appears to represent two contrasting scenarios, it more accurately represents a series of continua. Of course, it would not be possible to be completely expansive in a working school, as teacher learning priorities can come into conflict with other school priorities – the aim is, rather, to maximise expansion as far as possible.

It is not feasible within the confines of an article such as this to *fully* explore the expansive learning environment's relevance to the professional learning of LS/RTs – rather, a number of aspects of it will be probed with a view to provoking thought around the possibilities for LS/RT learning that are rooted therein.

Hodkinson and Hodkinson highlight close collaborative working with colleagues as a medium through which professional learning can be advanced. Indeed, if one examines Fig.1, it will be obvious that collaboration is a subtheme that runs through a number of the headings. The importance of such collaboration, as a means of sharing and advancing professional knowledge, is acknowledged in the Code of Professional Conduct for Teachers (The Teaching Council, 2012; p.8) when it states that teachers should

> "work with teaching colleagues and student teachers in the interests of sharing, developing and supporting good practice and maintaining the highest quality of educational experiences for pupils/students"

Collaboration can assume a range of guises – it may involve, for example, joint planning, joint review of work or of test results, team-teaching or a combination of these elements. Anecdotally, it would appear that team-teaching is taking place in Irish primary schools to a greater extent than had been the case some years ago. Similarly, with the growing numbers of personnel involved in SEN in mainstream schools, there is greater scope for LS/RTs to plan together or to collectively tease out difficulties and challenges. Such planning or 'conferencing' can generate rich professional learning – probing the "messy, confusing problems" (Beckett and Hager, 2002: p.3) which are part of daily work life can lead to powerful learning.

However, attitudes to collaboration can be tempered by the perceptions of teachers and management regarding how time thus spent might detract from the efforts they could put into their existing teaching commitments. Thus, a dilemma emerges – how does one factor in time for collaboration during an already heavily-timetabled day? The central purpose of the school is the teaching of children and all activities in the school ultimately revolve around this. Nevertheless, enhanced opportunities for collaboration on the part of the teachers are likely to improve the quality of the learning experiences which the children are afforded. Schools may find it worthwhile to schedule LS/RT team meetings on an intermittent basis so that practices can be shared and reviewed. Croke Park hours (the 36 additional non-teaching hours per year that all primary teachers are obliged to work) could include time for teachers to work together – planning, sharing knowledge, and co-creating professional learning that reflects the needs of the unique local context in which they work. Often, when planning for CPD sessions in Croke Park hours or other contexts, schools can feel the need to bring in outside 'expertise'. While drawing on expertise and experience beyond the school staff has obvious merits, it is important not to overlook the professional synergy that can exist when teachers within a staff are allocated the time and space to share, discuss and build on their own collective wisdom. Team teaching is worthy of particular mention here – apart from its impact on pupil learning, carefully-planned and reviewed team-teaching can be an efficient means through which to enhance teacher learning via collaborative activity.

> "Team-teaching involves two or more teachers whose primary concern is the sharing of teaching experiences in the classroom, and co-generative dialoguing with each other. They take collective responsibility for maximising learning to teach, or becoming better at learning, while providing enhanced opportunities for their children to learn". (Jang, 2006: p.177)

Team-teaching may afford LS/RTs the opportunity to engage in joint planning and reflection and to informally observe peers at work. The benefits of joint planning are highlighted by the DES (DES, 2006). The merits of using time for this purpose would need to be considered at local level, weighing up the pros and cons with regard to teacher and pupil learning. Team-teaching, by virtue of its characteristics, might do much to counterbalance the three environmental factors that inhibit teachers from engaging in informal learning activities, as identified by Lohman: "lack of time, lack of proximity to colleagues' work areas, and insufficient funds" (2006, p.141).

Teachers are more likely to engage in dialogue around professional matters, or to collaboratively address challenges – even on a relatively informal basis – if they cross paths on a regular basis. Locating LS/RTs' base rooms within easy access of each other, where possible, can be a simple way of prompting dialogue and sharing of ideas that will, in effect, feed into the CPD of those teachers. It has also the potential to facilitate an informal type of mentoring, a process through which both the mentoring teacher and the teacher who is mentored can learn. Indeed, depending on the nature of the prior experience of the respective teachers, the roles of mentor and mentee can be floating ones, with a high level of two-way learning.

Reflection is a means by which teachers can learn from practical experiences and extend and deepen practical knowledge in a conscious and purposeful way (Korthagen, cited by Mansvelder-Longayroux et al., 2007: p.131). Allowing time at staff meetings for LS/RTs and mainstream teachers to collaboratively review the strengths and challenges with which pupils with SEN present and the possibilities for advancing the learning of these children can enable teachers to not only meet the needs of those pupils but to build up professional knowledge that can be applied in other contexts in the future. Officially scheduling such time is a powerful signal that such collaboration is valued and can, in itself, be a stimulus for further collaborative work. Such reflection is unlikely to happen in a collaborative sense without prior planning for same. Simple measures such as careful management of the staff meeting agenda e.g. using circulars and memos to circulate routine information that would otherwise erode much of the valuable staff meeting time, can free staff-meeting time and allow for opportunities for teachers to reflect on the central concerns of teaching and learning.

Hodkinson and Hodkinson cite opportunities to extend professional identity through boundary-crossing into other departments, school activities, and schools as having the potential to enhance teacher professional learning. The nature of the LS/RT's work is such that, depending on the specific challenges and disabilities of the pupils with whom one works, potential may exist for liaising with psychologists, therapists and various other co-professionals. Allowing time to confer with such co-professionals and to have professional conversations with them is a useful way of building up expertise that is highly relevant to the local context and that can also have much transfer value to the bank of professional knowledge that is available to all professionals who work with pupils with SEN. Engaging in joint initiatives with teachers from other schools, and interactions with various other personnel have the potential to advance our collective learning as we share our ideas and co-create knowledge in response to new and emerging challenges. Again, this needs to be carefully managed so that a balance will be struck that will not unduly erode teaching time.

Having an explicit focus on teacher learning, as a dimension of normal working practices can do much to augment the potential of teacher workplace learning. This ideal can be translated into action in many forms. For example, having a well-stocked library of professional books in the school – on topics relevant to SEN – or having a positive attitude towards the attendance of teachers at some professional courses or conferences can make professional knowledge more accessible to the teaching staff. It can also serve to embed the notion and practice that professional learning is part and parcel of school life. Simply having such resources, however, is not in itself enough. Cataloguing and ready accessibility are essential so that teachers will be in a position to source them when needed.

Openness to innovation in a school allows for much teacher learning to take place. Hodkinson and Hodkinson note that 'support for variations in ways of working and learning, for different teachers and departments can create opportunities for teacher learning. Of course, one is not advocating a haphazard approach here – the importance of continuity in a child's learning is well documented. However, each change in the way the school functions can generate opportunities for learning new ways of doing things. By exploring new methodologies and reviewing their efficacy, teachers can refine their practice and, over time, respond more effectively to the unique needs within their pupil caseloads. A positive attitude to innovation in a school can do much to energise a staff and can prompt teachers to extend their professional 'know-how'. While national policy level has a clear effect on the nature and direction of teachers' learning, variations in local circumstances and in the life experience, teaching experience, and personal dispositions of teachers have an impact on the nature and degree of workplace learning that takes place. Allowing some 'wriggle-room' for teachers to adapt their teaching methodologies can help to override the

constraints that a 'one-size-fits-all' approach to teacher learning (and pupil learning) would impose.

The findings of my research around the workplace learning of LS/RTs suggested that a teacher's caseload can significantly shape the professional learning of the LS/RT. The nature of learning difficulties and syndromes with which the children with whom a teacher works can prompt the teacher to research those difficulties or syndromes e.g. through networking with co-professionals, attending courses or reading. Exposure to new challenges can be energising and can stimulate learning. Similarly, ongoing exposure to challenges of a similar kind can lead the LS/RT to build up a vast bank of expertise in that particular area. The impact of pupil caseload on LS/RT learning needs to be borne in mind at school-level when LS/RT caseloads are being determined. While the needs of the children will always be at the forefront, striking a balance between new and more familiar challenges in various caseloads can be a powerful catalyst for professional learning and reflection – this can boost professional learning not only for the individual LS/RT but for the body of teachers within – and indeed beyond – the school.

It is important to note that none of the above is proposed as a replacement for more formal CPD events for LS/RTs – such as courses, conferences and workshops – but is rather presented as a means of complementing the learning that derives from such events. Indeed, attendance at courses and such events will be a feature of worklife in a school in which teacher learning is highly valued. Formal courses do have a clear value – while the immediacy of the school environment can prompt much learning specific to that context, exclusive reliance on learning through a specific context can lead to one becoming somewhat insular in professional terms, although this can be counterbalanced, to a degree, by engaging in forms of boundary crossing as mentioned above. It is possible that an over-reliance on self-directed learning might be seen as limiting, insofar as it might restrict the learning to that about which the learner was previously aware. Courses which challenge the participants' thinking in new and possibly uncomfortable ways may well prompt valuable learning. Participation in courses may also be necessary so that expertise may be built up, for example, in new initiatives/strategies that are rolled out at national level. Of course, the secondary benefits of courses need also to be recognised – the generation of possibilities for networking and further collaboration with peers beyond the formal content of the course itself. Fellow-learners on a course are a valid component in the overall learning process, insofar as they share ideas and stimulate reflection in others.

Conclusion

Greater focus on workplace learning has the potential to do much to enhance our individual and collective professional learning as teachers. It is important that we

give due consideration and recognition to this key aspect of CPD as we engage in the current debate on the nature and direction of future CPD. A concept of CPD which includes, yet extends beyond, formal opportunities for teacher learning could serve to greatly enhance opportunities for teachers to develop and generate professional knowledge. Taking steps to structure the school as a workplace in a way that LS/RTS are prompted to co-create professional knowledge as well as to apply it, has the potential to unleash and expand a vast reservoir of teacher professional learning. To ignore the avenues for professional learning that are rooted in the day-to-day practice of LS/RTs is to devalue the richness of 'know-how' that teachers can potentially develop and refine throughout their teaching careers, and to limit the bank of professional expertise on which the teaching body can draw.

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ANNE ENGLISH

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Developing Numeracy and Problem-Solving Skills – A Balanced Approach

Catherine Flanagan

'Numeracy is the capacity, confidence and disposition to use mathematics to meet the demands of learning, school, home, work, community and civic life. This perspective on numeracy emphasises the key role of applications and utility in learning the discipline of mathematics, and illustrates the way that mathematics contributes to the study of other disciplines.'

(DES 2011: The National Strategy to Improve Literacy and Numeracy among Children and Young People, 2011-2020)

> *'In striving for educational excellence and higher standards we must provide students with disabilities with instruction to help them become problem-solvers and move beyond rote application of basic skills.'* (Parmar, Cawley and Frazita 1996:427)

Numeracy is not limited to the ability to use numbers to add, subtract, multiply and divide. It encompasses the ability to use mathematical understanding and skills to solve problems and meet the demands of day-to-day living in complex social settings. The focus of instruction in mathematics has moved increasingly toward developing skills and strategies needed for solving problems, rather than emphasising the rote memorisation of computational tricks and procedures. In the past, an algorithmic approach to mathematics education had become an end in itself, with 'numeracy' being interpreted rather narrowly as competence in basic arithmetic. The current concept of numeracy is much broader. It embraces knowing how, when and where to apply number skills for everyday functional purposes (Steen, 1999).

The rationale for Project maths is closely aligned to this understanding of numeracy. Objectives of the New Junior Certificate mathematics syllabus include developing:

- the ability to recall relevant mathematical facts.
- instrumental understanding ('knowing how').
- relational understanding ('knowing why').

- the ability to apply mathematical knowledge and skill to solve problems in familiar and unfamiliar contexts.
- an appreciation of and positive disposition towards mathematics.

Many students with learning difficulties experience considerable difficulty in acquiring number concepts and coping with the demands of calculation and problem solving. This paper explores some of the evidence that supports a balanced approach to the teaching of numeracy and problem-solving skills.

Improving Numeracy: general teaching principles and practices
According to the Program for International Student Assessment (PISA, 2007) key characteristics of a numerate individual are:

- the ability to use mathematics in everyday life.
- the ability to understand and appreciate information presented in mathematical terms.

Two paramount criteria for the effective teaching of numeracy are the development of conceptual understanding and engagement in a critical analysis and evaluation of how numbers affect our everyday lives (Pearse and Walton, 2011). Westwood (2004) believes that good-quality teaching of numeracy involves a very skilful blend of explicit teaching, student-centred activity, enquiry, discovery, discussion, relevant practice and meaningful application.

The general principles of effective intervention according to Chinn and Ashcroft (2006:33) are based on the following:

- using what the student knows to take him to what he can know.
- recognising the student's learning style and teaching him in a manner appropriate to that style.
- making mathematics developmental so that in building on what he does know, he constantly revisits it and thus it provides an increasingly secure base on which to build further new learning.
- use language that communicates the idea to the student and back up that language with appropriate visual images whenever possible
- acknowledge that 'one method' does not teach every student – as teachers we need to be responsively flexible in our presentation of methods yet keep in mind that, although some students will need the alternative method, others may be confused by it.
- Teaching 'Why' as well as 'How'.

Clarity in instructing, explaining and questioning appears to be a vital ingredient of good teaching. Sotto (1994) suggests that clarity seems to stem from the teacher's thorough grasp of the subject matter, ability to see the subject from the learners' point of view, ability to explain in simple terms and ability to relate new concepts to students' own experiences. While some constructivists regard explanation as a form of transmission teaching, Pressley and McCormick (1995:7) emphasise that 'direct explanation is a decidedly constructivist approach... students do not passively learn from the explanation but rather actively learn from them'. A good, clear explanation can be just what learners require in order to assimilate and accommodate new information into the relevant schema, and to link prior knowledge to their understandings. A well-timed, clear explanation provides the necessary amount of scaffolding for the students to make meaning (Westwood, 2004).

Kauchak and Eggen (1998) cite research to indicate that teachers' frequent use of questioning is positively correlated with higher achievement. Although teachers need to ask some challenging questions in order to develop higher-order thinking, not all questions should be of this type, particularly for students with learning difficulties. It has been demonstrated that students with poor learning skills and lack of confidence seem to benefit most from instruction that includes a high percentage of simple, direct questions that focus on the core content of the lesson (Westwood, 2004). If students are struggling to assimilate basic information, it is usually wise to ask more questions from the lower-order category. Asking too many difficult questions can cause feelings of failure and frustration. Success can be a powerful motivator for students unaccustomed to the sensation. In general, Clopton's (1992: 30) advice is the guiding principle: 'Ask questions that build confidence.'

Too much group activity in mathematics lessons can result in poorer achievement levels, but the strategic use of some group work is essential in an effective, balanced approach to mathematics teaching. Studies have shown that lessons involving a measure of cooperative group work can facilitate student learning and increase motivation (Westwood, 2004). Group work that involves discussion and sharing ideas has been shown to help individuals arrive at a better understanding of key concepts and strategies.

Peer and cross-age tutoring have been widely used to enhance literacy skills development and Baroody (1993) also reports positive outcomes from establishing classroom situations where one student assists another in mathematics. Some advantages of peer assistance include:

- it can be less threatening for the student being helped than if the teacher singles him/her out for extra attention in class.
- the peer may be able to see the difficulty or the subject matter more easily from the learner's viewpoint.

- the peer may be able to explain in language more easily understood by the learner and to use examples to which the learner can relate.

Tutoring another student has benefits for the tutor as well as for the learner. Having to teach something to someone else helps to deepen one's own understanding of the subject and to reveal one's own area of weakness (Ploetzner et al., 1999).

The teacher needs to acknowledge the student's learning style and be flexible in ways of teaching and doing maths. 'It is only effective to teach by talking if you have a pupil who learns by listening' (Hannell, 2005:40). In the simplest of terms, differentiation can be defined as '...teaching things differently according to observed differences among learners' (Westwood, 2001:5). To achieve a personalised approach it is necessary to respond to individual differences among students by for example:

- modifying lesson content to match more closely the cognitive level of the students – use differentiated resources and worksheets
- varying time allocation for classroom assignments to take account of students' different rates of working and learning
- encouraging students to produce their work in different forms or through different media
- tailoring homework assignments (content and quantity) to students' capabilities. Emphasis on success through achieving attainable targets. 'Confidence grows from the belief that you can succeed' (Hannell, 2005:49)

There is evidence to suggest that playing maths games is beneficial in the acquisition of numeracy skills. It indicates that students learn through social interaction, by talking, listening and actively exploring concepts with their peers in whole class, small group or individual activities (Trafton and Bloom, 1990). Booker (1996) stated an advantage of playing games with peers is the immediate feedback students receive. Discussion occurs when problems arise. There are no delays waiting for the teacher to reconcile difficulties. Games allow repetition for consolidation while avoiding tedium. Success or failure is self- evident so they are self-correcting. The element of chance enables students of all abilities to be involved and all have an equal likelihood of success. The inherent enjoyment and success can foster positive attitudes to self and mathematics (Topping and Bamford, 1998).

Developing problem–solving skills and strategies

Lampert (2001:3) observes: 'Teaching with problems is an approach to instruction that has gone in and out of favour with education reformers.'

Currently, the emphasis in mathematics teaching from the earliest years is to use a problem-based approach. According to Enright and Choate (1997:280):

> *'Problem solving is the primary function of mathematics education. Students must learn how and when to use the computational and fact skills they develop, or these skills will be of no use at all. Solving problems involve the application of reading, computation, and a host of other skills specific to the process.'*

A student's attempts to solve a problem require him to call on many abilities and skills – decoding the words and maths symbols, understanding the maths vocabulary, understanding the task itself, transformation into operation, accurate computation, organisation, relating answer to question and recording the answer. It is generally accepted that there are recognisable and teachable stages that an individual passes when solving maths problems. These stages are summarised (Westwood, 2004) as:

- interpretation of the problem to be solved.
- identification of processes and steps needed.
- translation of the information into an appropriate algorithm (or algorithms).
- Calculation.
- evaluation of the result.

It is also accepted that in addition to the cognitive skills involved in the above five stages there are also significant meta-cognitive components. These components include the self-monitoring, evaluating and self-correcting questions the learner needs to use when approaching a problem. For example:

- What needs to be solved in this problem? (identify the task)
- How will it be achieved? (select a strategy)
- 'Can I picture this problem?' (visualise)
- Is it working out? (self-monitoring)
- 'How can I check my answer?' (evaluation)

Problems can be classified in many ways. They can be presented concretely, diagrammatically or in written form. They can be opened or closed. They can relate to one particular content area or include elements from more than one strand. A written problem may be difficult to solve because of readability or because it has multiple steps to the solution procedure. Large and awkward numbers often discourage students from attempting a problem. It is as if they cannot relate these large numbers to common-sense processes they use

confidently every day to deal with smaller amounts in similar contexts (Enright and Choate, 1997). If the information is not presented in the sequence in which it is to be used some students just give up trying. Many students with learning difficulties appear confused when faced with a problem to be solved. Their recall of basic number facts may be slow and inaccurate. This slowness reduces the number of problems they can complete in the lesson, and thus results in less practice for the very students who need it most. These students may fail to generalise and transfer a successful problem-solving strategy to another situation simply because they have acquired an understanding of the strategy only at an instrumental level rather than a relational level.

Students with learning difficulties need to be taught effective cognitive strategies for approaching any problem – a mental plan of action that enables him/her to approach a task in a reasonable systematic manner while at the same time monitoring the effectiveness of that strategy. Students need to be taught how to sift the relevant from the irrelevant information, how to identify exactly what the problem requires, and how to determine the best way of obtaining and checking their result. In effect, they need to be taught the very things that other students who are efficient and confident problem-solvers already know and do (Westwood, 2004). To achieve this outcome direct teaching in the early stage is a necessary step towards greater autonomy later.

Much of what we already know about effective teaching (Harris, 1999) has an important role here. When teaching a problem-solving strategy, the teacher needs to:

- model and demonstrate effective use of the strategy for solving routine (straightforward) and non-routine (more complex) problems 'think aloud' as various aspects of the problem are analysed and possible procedures for solution identified
- reflect upon the effectiveness of the procedure used

Once students have been exposed to an effective strategy they may be afforded the opportunity to apply the strategy themselves under teacher guidance and feedback. With ample practice, they should be able to use the strategy independently and generalise it to other problem contexts (Westwood, 2004).

Since research indicates that students can be helped to become more proficient at solving problems, it is advisable for teachers of students with learning difficulties to devote more time to this area of work. Students' use of calculators enables teachers to spend more time on meaningful tasks. Time formerly spent carrying out awkward calculations can be given to developing concepts and analysing and solving realistic problems. However, students need to be taught to use calculators appropriately, accurately and efficiently.

Because discussion and collaboration are so valuable in developing and enhancing problem-solving strategies, classroom approaches such as 'reciprocal teaching' are useful (Brown and Palinscar, 1989). In reciprocal teaching the teacher and student take it in turns to lead discussion and raise questions about a problem. The teacher models, through thinking aloud, task appropriate processes such as clarifying, identifying key information, predicting, planning an approach, attempting a solution and reflecting on the outcome (Sabornie & deBettencourt, 1997). Students participate at whatever level they can, with the teacher providing guidance and feedback. The students take turns as discussion leader and guide their peers through the activities, with an emphasis on making meaning and collaborating on ways of approaching the task.

Additional teaching points to consider when improving the problem-solving abilities of students with learning difficulties include:

- pre-teaching any difficult vocabulary (key words) associated with specific word problems so that comprehension is enhanced
- encourage estimation – 'Taking the time to teach estimation is invaluable and will empower your students to become critical thinkers for life' (Pearse and Walton, 2011)
- linking problems to the students' own life experiences
- providing cues (such as directional arrows) to indicate where to begin calculations and in which direction to proceed
- giving students the opportunity to set their own problems for others to solve
- stressing self-checking and praising self-correction

There are a number of common strategies for solving both routine and non-routine problems:

- **Use a model or concrete materials:** for students not yet at an abstract level of thinking and reasoning, this type of problem-solving approach is essential (Clayton, 1999).
- **Make a drawing or diagram:** Sternberg (1999) suggests that differences in students' ability to represent problems mentally can mean the difference between success and failure in mathematics. It is argued that the diagrams provide an intermediate stage of representation, helping to bridge students' understanding from the semi-concrete level to more abstract use of symbols. As students do not automatically use the strategy of drawing or making a diagram, encouraging them to do so requires explicit instruction, teacher demonstration and practice. It is the discussion and questioning that

can be focused on the picture that will help students make connections (Xin & Jitendra, 1999).

- **Act it out:** The act-it-out (solving by doing) strategy is very helpful for those who are developmentally delayed. Acting out a problem using real or substitute objects helps to place the problem at a very real and concrete level. Examples of shopping activities with buying and giving change are solved easily by acting them out.
- Removing irrelevant detail from the problem: Students should be encouraged to underline (highlight) only the relevant detail needed to answer the question. This strategy is particularly useful for students with reading comprehension difficulties.
- **Construct a table and/or graph:** this strategy helps with the organisation of relevant information and at the same time makes relationships between the various components of the task more visual (Kennedy & Tipps, 1994).
- **Guess, try then check:** it is often suggested that this is the most commonly used strategy in many everyday mathematics situations. 'Guessing' should not be random, but based on some attempt at estimating and approximating (rounding-up or rounding-down numbers).
- **Account for all possibilities:** efficient problem solvers will not jump to conclusions or seek the easiest answer but will explore all possibilities. Brainstorming for ideas can be useful. The teacher's role is to stimulate investigation through appropriate questioning, such as 'Could we do it a different way also?'
- **Work backwards:** some students apply this strategy through necessity when confronted with a difficult problem – they look at the answer in the back of the textbook and think, 'If this is the answer, how do I get that result from these figures?'
- **Acronyms and mnemonics:** several writers describe specific strategies with acronyms and mnemonics to help students remember a strategy and its steps. Examples of such cued strategies include:

➢ The **'ROSE'** strategy (Enright and Choate, 1997)
R = Read the question
O = Organise the facts
S = Select the operation and solve
E = Evaluate the answer

- **'RAVE CCC'** (Westwood, 2003)
  R = Read the problem carefully
  A = attend to any words that may suggest the process
  V = Visualise the problem (or draw)
  E = Estimate a possible answer
  C = Choose the appropriate numbers
  C = Calculate
  C = Check your result against your estimate

Conclusion

In the past mathematics was taught at all age levels through predominantly didactic methods, with too much emphasis placed on rote memorisation of rules and 'tricks' to obtain the 'right' answers. The students' learning was much too procedural rather than conceptual. The more recent emphasis is on constructivist, student-centred, enquiry-based approaches, in the belief that students understand best the knowledge they acquire through their own activity and exploration. Research evidence indicates that for effective acquisition of numeracy skills, a balanced approach is required, combining the best of new knowledge of students' learning with the best of traditional pedagogy.

The research further suggests the use of visual representations (e.g. drawing a picture or a diagram), explicit strategy training and meta-cognitive training (e.g. teaching the students to self-question and self-instruct using previously taught steps) all proved to be helpful in advancing students' problem-solving skills-students become more self-directed and regulate their own learning. Some students respond differently to an intervention, suggesting that prior knowledge and existing skill level influence response. Westwood (2001) argues that effective interventions need to be based on a careful appraisal of the students' existing knowledge and skills.

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Safeguarding Inclusive Education in a Time of Austerity

Joseph Travers

Keynote address given by Dr Joseph Travers at the ILSA Regional Conference March 23rd, Gorey, 2012 which was co-hosted by the Special Education Department, St. Patrick's College, Drumcondra, as part of celebrations marking the 50th anniversary of the Graduate Diploma in Special Education in the College.

Introduction

We in the Special Education Department in St Patrick's are delighted to be given the opportunity to present to you today, as part of our celebrations to mark the 50th anniversary of the first Graduate Diploma in Special Education. I want to particularly acknowledge the executive of ILSA and Catherine and Florence who have been so supportive and Paula Carolan and the Wexford Education Centre. I want to thank my colleagues in the Special Education department and former colleagues now in the Education Department in St Pats for embracing the idea. A particular thanks is due to Ann Marie Farrell, who as chair of our 50th anniversary committee was the instigator of the idea.

Changed policy context

The title for the keynote today is "Safeguarding inclusive education in a time of austerity". I want to take a step back and look at the new context in which we are working and tease out some of implications of the changes. It will focus on some of the new challenges that have emerged, but also, on some of the new opportunities that are arising which can help us mitigate some of the negative impacts of the cuts.

To understand the present we need to remind ourselves where we came from. It is widely acknowledged that 1998 marked a watershed in the expansion of special education services in Ireland. In what has become known as the automatic entitlement speech, Micheál Martin as Minister for Education, instigated a new policy direction which guaranteed a minimum level of support for inclusive education in the form of resource teaching hours and special needs assistants, and recognised autism as a distinct category of special educational need. It is fair to say that this led to an explosion in resource provision over the

next decade, albeit from a very low base. Prior to this, resources were distributed through extensive political lobbying and posts only became available where pupil numbers decreased in a process that was known as the demographic dividend. The new policy of entitlement transformed the provision of resources.

From a policy perspective one of the most serious consequences of the austerity era is the change in policy from entitlement to a certain level of resources present since November 1998, to the distribution of a set amount of resources to an expanding student population. To quote the CEO of the National Council for Special Education (NCSE, 2011a, p.1) in May 2011: "The Department of Education and Skills has advised the NCSE that we may no longer allocate resource teaching and special needs assistant posts on a demand-driven basis." That was the end of the 1998 policy.

The reality is that in the context of a rapidly expanding student population, and the birth rate has been rising over the last decade, maintaining the same number of resources with extra students is a severe cut in services. It means that existing resources will be diluted further and spread more thinly than heretofore for the foreseeable future.

This represents a huge challenge to schools and to the system in devising an equitable system of resource allocation. Where there was certainty with the 1998 policy, there is now much uncertainty, for schools and parents.

In schools, it will mean re-examining resource allocation and how the staged approach is implemented. It will mean establishing principles to guide the process. At a system level, the recent reform of the general allocation model (GAM) does not auger well for creating an equitable system. Because a system is transparent doesn't mean it is equitable. In relation to the GAM changes, there was no discussion with the wider education community, no background paper, no review of the evidence, no publication of the review of the GAM and no discussion of prevalence estimates, or actual needs in schools, and seeking to match these with resources.

We have now moved from one inequitable system to another. Under the guise of equal treatment most schools will receive resources based on the same formula. However, not all schools are equal and we know that there is nothing as unequal as the equal treatment of unequals. The data on literacy and numeracy levels clearly show huge discrepancies between schools in disadvantaged contexts and those that are not; the data clearly show large discrepancies between disadvantaged schools themselves with some having very critically low levels of attainment. These realities are not reflected in the allocation process. Secondly we know that up to twice as many boys are assessed as having special educational needs than girls and this is not reflected in the allocation where all-boys schools receive the same allocation as mixed schools. The presence of a high number of

traveller children in schools is not taken into account in these allocations. This allocation process is crude and not sophisticated enough to allow scarce resources to be deployed in an equitable fashion, where schools with the greatest needs receive the level of support required to addressing those needs. There is a strong case to be made for taking DEIS schools out of the GAM and matching resources with needs on a school by school basis for this group.

There are consequences to the major changes in resource allocation and I think while all children will be affected by these, I want to highlight two groups of children who I feel are at a huge risk of losing out in the current context. The first group was traditionally one of the largest groups in special education, children with mild general learning disabilities.

Impact of policy changes on children with mild general learning disability

In 2004 a child with a mild general learning disability had at least three placement options in the Irish education system: placement in a mainstream class with guaranteed resource teaching hours of 2.5 hours per week by a resource teacher with a caseload of between 8-11 children; placement in a special class with a ratio of 1-11 or less, or placement in a special school which would serve the child up to 18 and involve no transfer or transition issues from primary to post primary. In 2011 all of those options have disappeared for such children.

They are now part of the GAM at primary level and their support needs are met by learning support /resource teachers who are responsible for all children with high incidence special educational needs, those with milder difficulties under the 12 percentile, Traveller education and since the budget, children with English language needs.

Options for placement have been reduced so the onus on the mainstream class teacher and learning support teacher is even higher for this group. Children with mild general learning disabilities can have very great social skills, oral language and life skills needs that can easily be overlooked, in the drive to cover curriculum content in many text book-driven classrooms. The available research, for example, Stevens and O Moore (2009) suggests that their needs are not being met by current provision. While there are advantages under the GAM in access to resources without a label there are also disadvantages as without identification such children's needs can become hidden and forgotten and it doesn't mean that their needs are any less critical.

It is vital that schools have assessment structures in place that can pick up these children and prioritise support within the GAM for them. Remember, this is a group of children which you will find have no lobbyists, interest or PR pressure groups, no celebrity backed fundraising, coffee mornings, gala dinners, balls, campaigns and marches. They depend on us to speak up and safeguard their needs.

The other group I want to mention is Traveller children. These children have lost two very important advocates in the system at school level and beyond. The cutting of the resource teacher for traveller posts and the visiting teacher service were particularly disappointing. The cultural challenges these children face are immense and they need you to advocate for them, build relationships with them, follow them up, track their progress, and support the families where you can.

Building these relationships is vital. The research is very clear on early school leaving, where students feel they have a caring relationship with a teacher, even one, it is less likely to occur. That investment of time will pay off. Active care and emotional support are so important. The findings for 9 year-olds in the *Growing Up in Ireland* study, report that there was significant disengagement levels found among children with special educational needs, raising issues for policies around inclusion at primary level (McCoy, Smyth and Banks, 2012).

There are many causes of disengagement. But we know that relationships are vital in building engagement and participation; how well are their needs being met in the class? Who is looking out for these children's interests? Often they will depend on you.

Social Inclusion

When proponents of inclusion first suggested this approach, the benefits were seen in terms of the social area with some concerns about meeting the children's cognitive needs. However, the research now suggests that it is in the area of social development and making friends in school that the real concerns now lie (Frostad and Pijl, 2007). This has been confirmed this month with the latest publication of the *Growing Up in Ireland* longitudinal study. Children with special educational needs had an elevated risk of developing emotional and social problems (McCoy, Smyth and Banks, 2012). In *The National Survey of Public Attitudes to Disability in Ireland 2012* (NDA, 2012) across all of the disabilities listed, and in comparison with 2006, the current survey recorded higher levels of objection to inclusive education with the greatest difference relating to intellectual disability or autism (up 13 percentage points from 8% to 21%).

This presents a challenge to schools because left to their own devices many children with special educational needs can become isolated in school. In making friends, the research evidence suggests that on the whole, but not exclusively, birds of a feather flock together (Frostad and Pijl, 2007). To counteract this requires intervention policies and practices in schools that focus on understanding learning disability, making friends and including everyone in games.

At second level this also is a major challenge and part of the rationale for the retention of special classes that are under threat is that they provide a vehicle for friendships that can support young people with special educational needs

remaining in mainstream schools rather than transferring to a special school. Their role in this regard has often been ignored and they have been criticised unfairly in my view as a vehicle of exclusion.

ESRI research for the NCSE suggests prevalence estimates of up to 25% for special educational needs (Banks and McCoy, 2011). This represents huge challenges for class teachers and support policies in schools. However, the distribution of this 25% varies widely across schools.

The mixing of GAM and EAL posts will present further challenges. It is very important that gains made by more flexible allocation of combining GAM and resource hours are not lost and that special education teams can continue to operate in larger schools. It is vital that schools are empowered to make a distinction between the allocation process and the deployment process, so as to have a coherent support system in place, which allows the teachers with most expertise to work with children with the most complex needs.

EPSEN Act

Another highly regrettable consequence of austerity has been the deferral of the implementation of the remaining sections of the EPSEN Act (Ireland, 2004). The EPSEN Act was really important ground breaking legislation that has been deferred indefinitely. The present hiatus should be used constructively to address anomalies between it and the Disability Act, to clarify who has special educational needs under the Act, and once and for all, design systems and structures which would promote the coordination of health and education services for children and young people on an equitable basis. We need to move to a situation where at the inputs, processes and outcomes level there is coherence and coordination. This would mean a single assessment process incorporating the education, health and social care areas, a shared implementation plan and agreed outcome measures and review. The present situation also allows time to address the contradictions and anomalies in the special needs assistants' support service. There is a disconnect between the stated, actual and ideal role of the SNA. The stated role totally undermines the potential of having a second adult in the room while at the same time an SNA is not a substitute for a teacher or a means of differentiation and children with special education needs should not be denied access to the specialist skills of the teacher.

I would now like to focus on some opportunities within the system for improvement. The first issue I want to focus on is continuing professional development (CPD).

Specialist teachers need specialist qualifications

Your attendance here today is testament to your commitment to learning support and professional development in the knowledge that it is the quality of teaching and learning that makes the key difference in children's lives.

The context and environment for CPD has changed radically. Teachers now embrace more collaborative approaches and the development of professional learning communities is a very positive step. There are more support systems in NEPs, SESS and NCSE. Collaboration is a

sine qua non, an essential element of our response to the challenges we face. The Teaching Council's new policy on CPD is also very welcome. It states the CPD is a right and a responsibility. Professional development opportunities have increased in the area of special education through the establishment of the Special Education Support Service and the provision of online learning. However, most of these courses are short and unaccredited.

Páid McGee (2004, p.78) the former director of special education in St Patrick's College in an overview of developments in special education in Ireland argues that "the learning of the pupil with special educational needs depends, to an exceptional degree, on relevant teacher expertise… Skilled and conscientious teaching in this area is highly demanding work but the logic of the situation is that the pupils concerned cannot afford less." He goes on to advocate effective sharing within schools of specialist knowledge and study groups of teachers having access to specialist literature. Inclusive education is intellectually, emotionally and personally taxing and complex work (Sapon-Shevin, 2007). Mittler (2000) highlights the importance of the personal commitment of each teacher to inclusion and an institutional obligation to facilitate, enable and support teachers to meet that commitment.

We do not have a requirement for mandatory qualifications in Ireland to teach children with the most complex and demanding special educational needs. As a profession seeking to guarantee the highest possible standards for such children, I think we need to ask if this is acceptable.

As part of the process of researching for the NCSE report on the future role of special schools and classes in Ireland (Ware et al. 2009), I was interviewing a parent who had made the difficult decision to move her son out of a mainstream school and into a special school. She looked at me at one stage and said: "You could not imagine the shock I got when I found out that my son's teacher in the special school did not have a specialist qualification. You must think that I'm a fool that I didn't know this."

We went on to find out that between a third and quarter of teachers in special schools has accredited specialist qualifications. We have no reason to believe that the situation is any better for learning support/resource teachers in mainstream schools. At primary level and in special schools in Ireland, there is no requirement on teachers to attain specialist qualifications to be appointed as learning support/resource, or special school or class teachers or to attain such

qualifications to remain in the position. In many countries, special education is a different teaching pathway at preservice level. We favour a system where teachers can specialise at post-graduate level once they have a basic teaching qualification. However, this is not mandatory.

The research evidence is very clear that regardless of setting, the main factor in enhancing educational achievement in special education, is the quality of teaching that the child receives and this has been linked to access to specialist provision (Ofsted, 2006). If we are serious about utilising the major resource that is our teachers, we need to invest in their professional development through accredited programmes.

It is quite remarkable to think that 50 years ago how enlightened the decision was, to offer a one year course on paid release with substitute cover and fees paid, for teachers in special education. The programme in that format in St Patrick's College continued until 2003 when a 16 week version was introduced across seven colleges and also the development of the SESS. With the cutbacks, that has since been reduced to eight weeks face-to-face, alongside online and weekend lectures. Perhaps it is now time to think of a new qualitative leap and to ask the question, if in the interests of ensuring the best provision for children and young people with special educational needs, of safeguarding services, of professionalising learning and special education support and of giving greater status to the area, that we seek to have mandatory accredited CPD for all specialist positions over a reasonable period of time? The biggest beneficiaries of this would be the children. This has been the case in the US for decades and currently in the UK mandatory qualifications are required for all SENCOs. It makes all the more sense in Ireland because, as I have said, unlike a lot of countries, we don't have undergraduate degrees in special and inclusive education. Therefore, the onus on post graduate qualifications is crucial.

We in the Colleges of Education and Universities would make the case for the importance of accredited CPD as an essential part of the rich menu of CPD options. To sum up this point, specialist teachers should have specialist qualifications and be supported to attain them.

The next opportunity I want to focus on is the potential benefit of research to special education in Ireland.

Research

Teachers love practical ideas, but it is important that these ideas are evidence based. It is vital to engage with educational research; to understand what counts as evidence and what is suspect. It is crucial that we can distinguish between the quantity of supporting voices and the quality of supporting evidence. One of the functions of the NCSE is to conduct research in special education in Ireland.

From a very low base we now have many very worthwhile reports on the NSCE website and I would urge you to read them, as many have very practical implications for policy and practice in our schools. NCSE research now include reports on inclusion, the role of special schools and classes, autism, deaf education, EBD and assessment; excellent reviews of the evidence that are accessible to all. It also includes a research database with all research in special and inclusive education detailed by theme, year and author since 2000 in Ireland (Travers, Butler and O'Donnell, 2011).

The level of teacher research in special education is truly heartening. In compiling the research database for the NSCE we found 1,693 publications on the island of Ireland related to special education (Travers, Butler and O Donnell, 2011). Of these there were 554 masters and doctoral theses in the area. The dissemination of this research is vital. One of the recommendations we made in the report on the database was that all theses would be available online. A second recommendation was that universities would publish edited books of the best research. With this in mind I want to give you advance notice of a publication of the work of students on the St Patrick's masters and doctoral programmes in special educational needs on research, completed in Irish schools and relevant to your own contexts. This will be published in October (Day and Travers, 2012).

Apart from the NSCE research there are notable research projects and findings with direct relevance to your work in schools. One such project alluded to earlier is the *Growing up in Ireland* study (Williams et al. 2009).

Evidence

Many were surprised by the recent findings of the *Growing Up in Ireland* study that there was up to a two hour difference per week between teachers in the time spent on primary mathematics (McCoy, Smyth and Banks, 2012). We know that time on task is related to achievement levels. Do you know the situation in your school?

We know that in terms of teaching, learning and assessment there are greater differences within schools than between schools; that within school factors are more important than between school factors. An implication of this is the importance of whole school planning and the room for improvement within each school.

There are more opportunities to further the cause of students with special educational needs within your school by using the research evidence that is available. For second level teachers I would direct your attention to a recently published excellent synopsis of this evidence by the ESRI (2011) entitled *Improving second level education: using evidence for policy development* which is available online.

The case to challenge streaming is very well made and the negative effect it has on students in the lower streams. It gives you ammunition to tackle attitudes and practices which hinder the full development of many students in the system.

Recently we in the special education department completed a study on addressing the barriers and challenges to inclusion for the research and development unit in the DES (Travers et al. 2010). A key finding of this study was the importance of the relationship between the coordinator of special educational needs and the principal in facilitating inclusion in schools. In all of the inclusive schools studied, the team work between the principal and coordinator of SEN was exemplary in driving the inclusion agenda forward.

New opportunities

I would now like to turn to another new opportunity. As you know next September 2012 will mark the start of the new four year B.Ed. degree. We have known for a long time that newly qualified teachers can be uncertain about how to respond to difficulties and may lack confidence in making adaptations (Florian and Linklater, 2010). In a positive development there will be a bigger emphasis on special education and inclusion in the new B.Ed. programme. It will be informed by "an ethic of everybody" (Hart, et al. 2004) replacing the ideas of "most and some" learners. It will be based on the view that "teachers have both the opportunity and responsibility to work to enhance the learning of *all*" (Florian and Linklater, 2010, p.372). It will challenge teachers to create "a rich learning environment characterised by lessons and learning opportunities that are sufficiently made available to everyone so that all are able to participate in classroom life" (p.370). It will aim to change thinking about inclusion to "view difficulties in learning as problems for teachers to solve rather than problems within learners" (p.371). Teachers will be empowered to work with their colleagues to address these issues. In the St Patrick's College model there will be discrete input in special education and inclusion in 1st year and 4th year; integrated input within the curriculum areas in 2nd and 3rd year and a special education placement for all. In addition there will be a major elective specialism (replacing the former academic subjects) in special and inclusive education across the four years. We would urge you to work in partnership with the teacher education providers in this exciting development and become involved in supporting the student teachers in the special education placement.

Literacy and numeracy strategy

The Literacy and Numeracy strategy (DES, 2011) also presents us with an opportunity to look again at provision. I would like to commend the ILSA executive on their submission to the DES on the draft strategy and for securing many desirable changes to it. The strategy prompts questions for each school such as: How good are our early intervention strategies? How coherent is our policy throughout the school? What assessment approaches do we use? How much and how well do we use assessment for learning approaches?

One particularly disappointing aspect of the Literacy and Numeracy strategy (DES, 2011) is the privileging of standardised tests as the sole measure of achievement levels. Unfortunately the emphasis in the recent literacy and numeracy strategy has been disproportionately on standardised assessments and there are serious concerns about this approach as these tests are unsuitable for many children with SEN and do not capture their achievements. The ironic thing is that the evidence is very clear that assessment for learning approaches, criterion referenced tests, diagnostic assessment and ipsative assessment offer far more promise in eliciting the key information that facilitates the raising of standards for children with special educational needs (Black and Wiliam, 1998). You will need to lead that debate in your schools and make sure these children are included in assessments that are appropriate and inclusive and capture their progress in ways that standardised tests cannot.

As you know from this year the strategy states that the results of the national standardised tests of literacy and numeracy are to be communicated in aggregated fashion to the Board of Management and the DES with the number of exclusions from the tests outlined (DES, 2012). I would urge you not to accept a situation where the performance of many children with special educational needs is recorded for the Board of Management and DES as a number among those excluded from standardised tests. We should insist on a separate record which acknowledges their achievements if we are serious about inclusion.

Collaboration

In the context of shrinking resources collaboration with colleagues will become even more crucial. It will be vital to ensure coherence between what you do and class and subject teachers; it may present opportunities to further develop inclass support. There have been many noticeable changes in school cultures in relation to collaboration in recent years. In a research project entitled *Addressing the Barriers and Challenges to Inclusion in Irish Schools* which I mentioned earlier we explored six Irish schools (3 Primary and 3 post primary) which were striving to become more inclusive (Travers et al. 2010). In one of these schools we found evidence of three practices which could be called counter cultural and would not be the norm in Irish schools. Firstly, they operated a peer review system where teachers observed each other teaching to help improve practice. Secondly, they met in class groups to plan each week after school and thirdly, they shared all resources with each other through the school intranet. None of these practices required additional resources; all would help to enhance your daily experience as a teacher. When we were commissioned to research around the future role of special schools and classes the minister had highlighted the area of special schools becoming centres of excellence and supporting mainstream schools. What we found was a realisation that the level of expertise in the system was dispersed across all schools and the special schools had as much to learn from mainstream

schools as vice versa and that the flow of support should be both ways (Ware et al. 2009). There is a wealth of professional knowledge and expertise in all schools that is not shared and we need to use our new technologies in a more strategic fashion to enable this sharing to take place. For a long number of years the issue of the lack of time for teacher collaboration has featured as a barrier in the research. One positive feature of the Croke Park hours is the opportunity it presents for collaborative planning. Again it is important that this time is used to some degree in relation to learning support and improving teaching and learning. Staff development around issues such as the potential benefits of assessment for learning could be systematically built on using this time. There are opportunities within the IEP process for further collaboration, to involve students more, to monitor the achievement of targets and to build transition planning into the process. The recently published NCSE *Inclusive Education Framework* could also be used to promote more whole school approaches (NCSE, 2011b).

Another opportunity presenting itself is the proposed reforms at junior cycle level. The new level 2 qualification on the National Qualifications Framework has the potential to radically transform the curriculum for students with SEN in post primary schools (NCCA, 2011). Again it is vital that schools embrace these changes. Opportunities to stay in education can be limited for children and young people with a disability. Just over half (50.8%) of people with disabilities aged 15 64 years have no formal second level education – the corresponding figure for people without a disability is 18.8%. Age at completion of full time education is an important indicator of future life chances. People with disabilities finish their education earlier than the non disabled population, with 31% ceasing before the age of 15 years compared to 13% of the non-disabled population (Keogh, 2011).

Another key opportunity for development is in the area of ICT and special education and many exciting developments are taking place which were well captured by Tony Sweeney and others in the recent ILSA newsletter. As with any resource it is vital that it is critically evaluated. As paper doesn't refuse ink, iPads don't refuse apps and they range from the quite brilliant to many of very dubious value in the classroom.

Future challenge

In coming years in the context of the Croke Park agreement, increased pressure will come on the pupil teacher ratios, there may well be calls from school management to use learning support teachers as class teachers to reduce the ratio in schools. I would urge you to resist these attempts as they will lead to a dilution of the targeted nature of the support you provide and those with greatest need will lose out. There are very strong economic arguments for having a dedicated learning/resource support service with a focus on raising achievement levels. The

OECD (2010) publication *The high cost of low educational performance* presents evidence using economic modelling of the effects of improving PISA outcomes. It concludes the analysis by stating that:

> *The implications for the OECD countries as a whole are dramatic. A modest goal of having all OECD countries boost their average PISA scores by 25 points over the next 20 years – which is less than the most rapidly improving education system in the OECD, Poland, achieved between 2000 and 2006 alone – implies an aggregate gain of OECD GDP of USD 115 trillion over the lifetime of the generation born in 2010* (OECD, 2010, p.27).

Of that figure the amount estimated for Ireland was 870 billion. In other words investment in education that is focused on raising achievement levels has a rich return. Interestingly, in Finland, the highest achieving country in PISA, about 28% students receive special education/learning support during their school years (Itkonen and Jahnukainen, 2010).

What's worth fighting for?

To safeguard inclusive education we need to be able to articulate what is unique and adds value in what we do. Heward (2003) outlines the defining features of special education as that which is individually planned, uses specialised teaching approaches that are sometimes unique or adapted or intensive. It is goal directed, uses research-based methods and is guided by student learning. Such an approach to learning support and special education is worth fighting for. Quality teaching can make the biggest difference in these children's lives.

Arising from the present crisis the agenda of the future will be more on outcomes rather than inputs. The emphasis will be on demonstrating accountability for the use of resources and time. Look how important the review of the DEIS scheme has been in rowing back the budget measures. We need to be prepared and this will mean paying more attention to recording your successes. It will mean establishing baselines and showing improvements and this will require a sophisticated understanding of assessment, its purposes and functions.

We must remember that a lot can be changed without additional resources such as policies, practices and attitudes. One important role we can play is as advocates.

Advocacy

There are many areas where we, as professionals, are called on to make ethical decisions; some of these are made by school management but we need to make our voices heard when we see the best interests of children with SEN not being served. I would like to give you a few examples which give cause for concern:

Firstly there is evidence from the National Induction Programme for Teachers

that Newly Qualified Teachers (NQTs) have been placed in ASD units and as resource teachers with children with very complex SENs in their first year teaching (Burke, 2012). Is this fair to the children, their parents and the young teachers themselves? Would this happen if the EPSEN Act was implemented and IEPs were mandatory?

Secondly, teaching principals for years have lobbied for a change in policy which would allow them to take up LS/RT roles. They have been successful in overturning this policy. This raises a number of questions: In whose interest does this policy change serve? Is it the children? Why in announcing the policy change did the DES say it will have to issue guidelines on its implementation? Why do Principals want to take up the role? Could it be for some that they feel it will free them up more to do school business? Will teachers with specialist qualifications be asked to step aside to facilitate principals in this regard?

I would urge you to continue to advocate for children with special educational needs in your school by asking the hard questions:

Have their needs been identified? Is the teaching and learning they engage in appropriate to addressing their needs? Is their progress being monitored and records kept up to date? Have they an IEP that is relevant, measurable, monitored and collaboratively implemented by class teacher, support teacher and home? Are those with greatest needs being served by teachers with most expertise and experience? Is there an early intervention strategy in place? Is the staged approach being implemented? Is there a transition plan in place? What principles inform allocation of resources in the school? Is it those with greatest need who get most support or those with perceived capacity to benefit more? It is important that school management are held to account for provision of special education in their school.

Partnership with parents is also crucial. Parents need to feel that you are on their side and that you will help them to fully access their entitlements. I hope you get benefit today from the conference and leave a little bit more knowledgeable, hopeful and energised.

The work you do is vital and has the potential to make the greatest difference in the quality of children's lives. Continue to value it, invest in it and record your successes.

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How Studies in Neuroscience Can Inform Teaching and Learning

Why Educators Are Interested in Executive Function

Fiona O'Connor

Today's science-based understanding of the brain is already beginning to filter into to the field of education, learning support and special educational needs (Van der Sluis, De Jong & Van der Leij, 2007). Perhaps neuroscience, dietetics, immunology and genetics will finally debunk some of the more nebulous and archaic concepts around theories of learning that most teachers intuitively know are flawed but can't prove. How many children consistently scoring at or below the 10th percentile are doing so, because they simply are not getting sufficient sleep every night?(Curcio, Ferrara, & De Gennaro, 2006). The use of evidence based scientific approaches to inform teaching and learning might be the next frontier in education.

One way in which brain science may have a very direct application in teaching is in our understanding of a student's executive functions. Executive functions are high-level abilities that influence more basic abilities like attention, memory and motor skills. A growing body of research by psychologists and neuroscientists indicate that the development of these cognitive processes predict an increase in early literacy and numeracy skills (Welsh, Nix et al, 2010). Further evidence suggests that these processes are responsive to training.

Depending on the professional remit of the researcher, EF can be referred to in the singular or plural and shortened to (EF). This can denote executive functioning or executive function. In some cases it is called Executive Control Function (ECF) and in others it is known as the Central Executive (Van der Sluis, De Jong & Van der Leij, 2007). Whilst EF can be referred to in the singular or plural, for the purposes of this brief discourse, it will be referred to in the singular – EF

What is Executive Function?

The following definitions of Executive Function are 'working definitions' because they reflect a congruence and consistency of ideas with the body of

research hitherto associated with executive functions. As we will see, the models and theories connected to EF are in a constant state of flux due to scientific innovations and novel studies in the area. One good working definition is provided by Royall, D. Lauterback, E. et al. EF is said here to "broadly encompass a set of cognitive skills responsible for the planning, initiation, sequencing and monitoring of complex goal directed behavior" (2002, p. 378).

Welsh, Nix et al (2010) identified EF skills as encompassing working memory and attentional control and that the growth of these cognitive processes predicted a growth in early literacy and numeracy skills. Caine and Caine (2006, P.56) cites Goldberg (2001) who "compares the executive functions to the role that an orchestra conductor plays." The conductor oversees and modulates the manner in which the whole piece of music is assembled and performed. This is similar to the role of the executive functions. "They combine elements of affect, self-regulation, working memory and inhibition" (Caine and Caine, 2006, P.56). Another useful definition is that EF encompasses "general purpose control mechanisms that modulate the operation of various cognitive sub-processes and thereby regulate the dynamics of human cognition" (Miyake et al., 2000, P.50). EF includes the skills of attention, working memory, planning and flexibility.

Why Would Educators Be Interested in EF?

> "…It would be helpful for educators to know which aspects of executive functions are most relevant for learning and school readiness "(Welsh, Nix et al., 2010, P.51).

Many studies have explored the relationship between executive functioning and scholastic achievement in children. It is widely acknowledged that executive functioning plays a very significant part in childhood learning (St Clair-Thompson & Gathercole, 2006). Of particular interest to researchers is the isolation of the components of EF associated with learning attainments (Bull & Scerif, 2001) and (Lehto, Juujarvi, Kooistra, & Pulkkinen, 2003). St Clair-Thompson and Gathercole (2006) showed that there were relationships between the EF components of inhibition, shifting and updating and scholastic attainment.

EF play a key role in supporting children's learning throughout their school years and beyond into adulthood. Furthermore, EF are at the core of reading and mathematical attainments (Andersson, 2008), written maths skills (Bull, Espy et al., 2008) and oral language and behaviour (Wilson & Swanson, 2001).

EF Predicts Arithmetic Skills

Andersson (2008) and Welsh, Nix et al., (2010) sought to understand the connection between working memory and written arithmetical skills in relation to children with a particular focus on central executive functions. The study

found that the EF measures of verbal fluency, trail making and counting span were predictors of arithmetical performance. The conclusions were that 'working memory, in general, and the central executive, in particular, contribute to children's arithmetical skills' (Andersson, 2008). It further proposed that the most important components of EF for arithmetic performance were the ability to monitor and co-ordinate multiple processes and to access long term memory containing arithmetical knowledge.

EF and Brain Training

One particularly interesting insight into the value of developing EF was the suggestion that academic growth can be promoted by interventions targeting EF and that educators would find knowing the point at which to intervene to be useful (Welsh, Nix et al., 2010, P.51).

Brain Training is another word for cognitive training (Jaeggi, Buschkuehl et al. 2011). Teachers are already exploring the idea of using evidence based computer based cognitive training programmes. Many of these brain training programmes are targeted at developing working memory, for example with programmes such as Cogmed (www.cogmed.com), Jungle Memory http://junglememory.com) and Luminosity (www.luminosity.com). Working memory is one type of EF which can be developed by computerised working memory training (Thorell et al., 2009). Research indicates that extended and adapted training can result in improvements in working memory. These changes are evident in the parietal and frontal cortices, the basal ganglia and within alterations in the density of dopamine receptors (Klingberg, 2010).

What should a teacher bear in mind when using computerized brain training programmes? It seems brain training effectiveness depends on dosage and training performance. How often did the child train? How high did the student progress in the memory training game, was it to level 3, 4 or 5? "Only children who considerably improved on the training task showed a performance increase on untrained fluid intelligence tasks" (Jaeggi, Buschkuehl et al., 2011).

Training and Transfer

Does training EF transfer into general learning? Evidence has shown that by training the executive function one can see an increase in performance on the specific task, but does the impact of training, however, generalize into an increased performance in measures of non-specific tasks? Thorell, Lindqvist et al (2009) studied the effect of computerised executive function training on children and showed increase performance on trained tasks and transfer on non-trained tests of attention and verbal and spatial working memory.

Chein and Morrison (2010) conducted study to determine the transferability of cognitive training and found that the benefits can be far-reaching. Participants

engaged in four weeks cognitive training. The study found that the training "generalized to performance on the Stroop task and … promoted significant increases in reading comprehension", (Chein and Morrison, 2010, P.1).

In 2008 (Dahlin, Neely, Larsson, Backman, & Nyberg, 2008) showed a transfer after 5 weeks of training in updating in a 3 back test of working memory. Training induced alterations were mapped using functional magnetic resonance imaging (fMRI). The study found that "process-specific training can improve performance on untrained tasks, but the magnitude of gain is variable…" (Dahlin, Neely, Larsson, Backman, & Nyberg, 2008 P.1). Recent neuroscience studies have shown changes in brain activity after subjects learned to perform a spatial working memory task (Qi, Meyer, Stanford, & Constantinidis, 2011).

Countering the Yo-Yo Effect for Students in the General Allocation Model
Special Education Circular 02/05 explicitly details how resources and learning support are to be organised in the mainstream school. The general allocation system provides supplemental teaching resources to help schools accommodate the following:

- Students who meet the criteria for learning-support (those experiencing low academic achievement)
- Students who have learning difficulties (e.g. mild difficulties, attention problems, social and emotional, speech and language linked to previously identified conditions like ADD and dyspraxia. These pupils fall into the high incidence category. If an assessment determines that their condition is in the low incidence category, they are entitled to one-to-one support.)
- Students who have special needs due to high incidence disabilities (e.g. specific learning disability, borderline-mild general learning disability and mild general learning disability).

Resources for high incidence needs are deployed at the discretion of the school. Supplemental teaching can take place in-class or in a small group. Some children can receive individual teaching for an agreed amount of time. Primary schools need to apply on an individual basis for resource teaching time in order to meet the needs of pupils who have 'low incidence' needs e.g. hearing impairment or autistic spectrum disorders. Such applications are made to the National Council for Special Education (NCSE). Both learning support and resource teachers work to meet the educational needs of pupils who fall into the general allocation model. Resource teachers offer support, usually on an individual basis to those children with low incidence disabilities.

Whilst the current model is functional in some respects, there are clearly problems at a systemic level with pupils who cannot access or maintain an

appropriate level of support. For example pupils who enter the system at or below the 10th percentile and, if targeted intervention is successful, the child's standardised score may go up. Their score may even reach average and in some cases well beyond average levels. The Learning Support Guidelines (2000) discourages 'the practice of including pupils of average attainments in the case-loads of learning support teachers' but this presents a systemic problem in the provision of support if the child's scores and learning attainments drop the following year.

While the guidelines and circulars place a significant emphasis on standardised scores, the NCCA (2007 P.61) advise teachers against being overly reliant on a single test score and that other factors must be considered. This was welcome advice, as the 10th percentile seemed like an arbitrary cut-off point for pupils whose test scores were neither indicative of their overall ability nor their learning needs. The fact remains, however, that even with increased flexibility with regard to qualifying criteria for learning support, pupils who reach average attainments on standardised tests after a year of learning support, who do not have a diagnosed learning difficulty, may not have access to the targeted support that they need the following year.

The problem is that in the academic year which follows, they often return to Stage 1 monitoring in class. In some cases the gap in learning has been essentially closed by learning support. Often though, the child returns to struggling in the classroom and this is reflected at the end of the year in a drop back to around the 10th percentile. They then qualify again for learning support in the third year of this cycle. This in turn, generally brings their skills and scores back up so they are now not eligible for learning support in their fourth year. Thus, an observable *yo-yo effect* is visible when one examines many of the pupil's scores from year to year. It is worth re-iterating that such a child has no evidence of having a special educational need, they simply respond better to small group teaching. In this case, a programme of EF training may assist their ability to learn in larger group settings.

For the alternate years that the child does not attend learning support and return to being at Stage 1 in the system, that is, under close monitoring by teachers, it is also important to state that every effort is made to support parents, class teachers and the child themselves in having a successful year without learning support. However some pupils persistently respond best only to small group and targeted learning programmes.

Interim Support with Executive Function Training

Strategies for early intervention and prevention are priorities in the appropriate provision of learning support for pupils (DES, 2000, P.22). A child who yo-yo's from year to year may benefit from EF training in the interim years, when they

are not receiving direct learning support. This training could take place at home, or in school, and may offer an interim solution for those pupils whose EF is affecting their scholastic performance. For pupils returning to Stage 1, having attended learning support, or those being monitored at Stage 1 because of teacher/parental concern, one appropriate intervention which could be deployed at school or at home, would be a programme of EF training. By addressing the EF first, one might expedite not only the cognitive processes of the child but also their capacity to generalize and transfer those skills.

This interim measure may also serve pupils who do not meet the criteria for learning support, for example, pupils scoring in the lower percentile brackets (but not low enough to access supplemental support). The old adage "Just wait, they'll catch up" does not hold up to the empirical data' (Foorman, et al., 1997).

EF and Learning Support Provision

How might EF training be integrated into the provision of learning support? Aside from the interim type of support outlined above, a programme of EF training could be integrated into learning support at the prevention, early intervention or on-going support stages. As a pre-emptive measure it may be a good idea to arrange or facilitate EF training for pupils as a primer to a programme of learning support or resource. Whilst EF training could be delivered as a type of precursor intervention, it could also be beneficially delivered in parallel with literacy and numeracy support. The degree to which each individual child has acquired the concepts and skills of that associated year's curriculum will vary from child to child. The spiralling nature of the primary curriculum offers a concession for the child who did not fully grasp a subject or concept when it was initially introduced. However the cognitive processes which underlie the acquisition of these skills are, in many ways, equally important to the child's educational development. Training the child's EF may facilitate access to the curriculum as a result of increased ability to focus, increased working memory or greater visual short term memory.

The aim of Learning Support is to enable pupils to attain 'adequate levels of proficiency in literacy and numeracy before leaving primary school' (DES, 2000, P.15). Targeted intervention programmes like Reading Recovery (1993) are popular in Ireland, New Zealand and elsewhere. Reading Recovery was created by Marie Clay (1993) in New Zealand, directed at beginner readers who are struggling with initial literacy skills. Pupils who are engaged in the programme receive a 30 minute daily tutorial for 12-20 weeks, after which point they are either at the appropriate class literacy level or candidates for learning support. If a child has deficits in their EF, they may not have the ability to fully access programmes like Reading Recovery thus rendering parts of the intervention redundant for them. In order to maximize the effect of this type of support, a programme of EF training or 'EF Recovery' would be useful in parallel with a literacy intervention programme.

Vipassana Meditation and EF

Computer based brain-training interventions are not the only avenue being explored with regard to developing a student's EF. Studies on both exercise and mediation have also been correlated with increases in EF. Meditation, in particular the type of meditation known as Vipassana has been linked to an increase in attentional control (Slagter et al., 2007). This specific type of meditation clearly leads to an improvement in focus – a critical executive function in learning and cognition.

Is it plausible to contend that some pupils might be better served, perhaps the learning support child, for example, if a programme of development for EF was delivered prior to or in parallel with a programme of learning support or resource teaching? If this is true, should specific time be allocated to the development of these cognitive processes so that they can be prioritized in a framework of the child's learning needs? Such interventions may have significant and positive implications for the trajectory of all learners but in particular for those pupils with learning difficulties.

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Differentiating for Language and Literacy *Within* Subject Areas in Post-Primary Schools

Ann Marie Farrell

Introduction

Since the Minister for Education and Science, Mícheál Martin's 'automatic entitlement' guarantee (Department of Education and Science (DES), 1998) and the enactment of the Education Act (Government of Ireland, 1998), the last decade or so has been an era of change in Irish schools in terms of the range of children included in mainstream classes. A raft of legislation and policy followed since (Government of Ireland, 2000; 2004; 2005) which has formalised the rights of pupils with special educational needs (SEN) to be included in mainstream schools if they so wish. A parallel set of expectations is placed on teachers to ensure that pupils with SEN effectively access the education that is there for all (National Council for Special Education (NCSE), 2006; DES Inspectorate, 2007). However, it has to be acknowledged that the existence of legislation and policy does not guarantee that 'street level bureaucrats' (Lipsky, 1980) are willing or able to implement that policy on the ground and there are many issues to be considered.

The aim of this article is to focus on one issue: differentiation by subject teachers in post-primary schools to include students with SEN. This issue is examined with particular reference to oral language and literacy difficulties which need to be addressed through differentiation *within*[1] the subject area regularly so that students can access the specific concepts within that subject. First, the issue of subject teaching in post-primary schools is explored briefly. Second, the concept of differentiation is developed and defined. Third, oral

[1] It should be noted that subject teachers may also be expected to differentiate *through* a subject in order to meet individual education plan (IEP) targets. Usually, an IEP focuses on core areas of learning such as literacy, mathematics, social skills development, oral language and communication; any area of learning that traverses subject boundaries. While some aspects of these may be taught discretely, all can be addressed *through* other subject areas such as history, science, art, home economics etc. In that instance, the subject teacher may have to incorporate learning targets that explicitly address, for example, oral language development within a geography lesson. In other words, the teacher is using the subject; teaching *through* the subject to address a skill or a concept that does not explicitly arise from the subject itself. Differentiation *through* a subject is not addressed in this article.

language and literacy development is examined with specific reference to the inherent facets of each and the links between these two areas of learning. Finally, the teaching/learning cycle is analysed in order to highlight practical strategies that can be used by teachers in a lesson or a series of lessons in order to differentiate for the oral language and literacy needs of pupils. This article has been written with students with high-incidence SEN in mind i.e. students with borderline/mild general learning disabilities, specific learning disabilities and so on. While all of the strategies outlined could be further adapted for students with low-incidence SEN, the specific needs of that group of students are not addressed.

Subject teaching in post-primary schools

Post-primary schools are complex organisations in terms of organisation of curriculum (range of choices, programmes, levels), the nature of assessment, timetabling and the multiplicity of teachers who play different roles in the education of the students in the school (Naughton, 2003). Effectively including students with SEN in such organisations is challenging (Church of Ireland College of Education (CICE), 2005). It is not clear that subject teachers have the skills or confidence to effectively differentiate for and include students with SEN (Tomlinson, Brighton, Hertberg, Callahan, Moon, Brimijoin, Conover and Reynolds, 2003) and often one of the key roles of a learning support/resource teacher in a post-primary school is to provide support for subject teachers in this area (Farrell and O'Neill, 2012). It is not uncommon for post-primary teachers to see themselves as teachers of a subject rather than teachers of students and, while the focus of the subject teacher is on the subject-specific knowledge that students need to acquire, assumptions can be made about the level of literacy abilities within the student cohort

(Cogan and Flecker, 2004). Further, the pressure of the state examination system in post-primary education may contribute to teachers sacrificing understanding for coverage (Tomlinson et al., 2003).

Defining differentiation

The term 'differentiation' has arguably become a buzz word in education over the last decade. It is not clear, beyond agreeing that it is important, that teachers actually understand what it means or how, when or for whom it should be used. The National Council for Curriculum and Assessment (NCCA) defines differentiation as referring to…

> *… the process of varying content, activities, teaching, learning, methods and resources so to take into account the range of interests, needs and experience of individual students. Differentiation applies to all effective teaching but is particularly important for students with special educational needs.*
>
> (NCCA, 2007, p. 8).

Essentially, differentiation can be defined as "teaching things differently according to observed differences among learners" (Westwood, 2011, p. 177) so that access to the curriculum is maximised for all. It means that teachers need to adapt aspects of their teaching to ensure that differences are accommodated as much as possible. It necessitates the provision of challenging but achievable goals, implying the adaptation of learning goals depending on the needs of the student. It means proactively thinking about the teaching of a skill or topic in advance so that potential areas of difficulty are planned for rather than reacting to student difficulties during the lesson (Tomlinson et al., 2003). Of course, students may present with specific difficulties during the lesson which must be responded to but most potential difficulties in understanding can be anticipated beforehand once the teacher has an understanding of the ability levels of the students.

Differentiation is not easy. At times, it is assumed that once differentiation is defined teachers will understand how to operationalise the concept effectively. However, there are two issues to be considered here. Firstly, asking teachers to differentiate by outcome, by adapting teaching strategies, by process, by varying activities and tasks and so on, assumes that there is a commonly held understanding of each of these terms. Secondly, there is an inherent tension in differentiating for individual students while simultaneously delivering a curriculum for all students in the group. An extreme interpretation of the "equality principle" (Lewis, 1995, p. 73) holds that students with SEN should be treated in fundamentally the same manner as other students and therefore the heavy emphasis in terms of differentiation is on teaching methods. The "individuality principle" (Lewis, 1995, p. 74) states that meeting the individual needs of pupils with SEN is paramount and therefore, what is done with the majority is of secondary importance. With the individuality principle, the heavy emphasis in terms of differentiation is on learning targets. This theoretical tension between the two principles manifests itself in reality in teachers when they feel pulled in two, seemingly opposing directions i.e. trying to ensure that the curriculum/programme is covered with the full group while simultaneously trying to adapt that same curriculum for individual children, perhaps necessitating quite different learning outcomes for some. This tension, or *dilemma of difference* (Norwich, 2008), can be particularly pronounced in post-primary schools because of the heavy emphasis on examinations and the propensity to develop discrete programmes of learning, historically comprising of syllabi instead of learning outcomes rather than a generic curriculum, as is the case at primary level (although more recently developed and/or revised post-primary programmes have been written in terms of learning outcomes e.g. Junior Certificate Schools Programme, Leaving Certificate Applied Programme).

One needs to think about differentiating *within* a subject area so that the students can access the key concepts in that subject. In that instance the teacher needs to

think about how s/he is going to approach the teaching of the subject-specific concepts to maximise all students' understanding. It may be that the teacher will differentiate the learning outcomes i.e. set challenging but achievable learning targets that may be different for some students. Or s/he may set different tasks for some students. In other words, the motivation for differentiation is to increase the students' subject knowledge and understanding.

Oral language and communication

Before considering differentiating for oral language and communication within subject areas at post- primary level, we first must understand the nature of oral language and communication. A range of terms are associated with oral language skills, *inter alia;* grammar, linguistics, pragmatics, semantics, turn-taking (Hetherington and Parke, 2003; Shiel, Cregan, McGough and Archer, 2012). These terms and concepts can be collapsed to form three key components: form, content and use (McGough, 2008[2]). Table 1 outlines the nature of each of the components of language and the possible difficulties that students with SEN may experience within each one.

Table 1: Components of oral language and communication.

Component	Keywords and key concepts	Potential difficulties experienced by students
Form	Linguistic structure – to do with sentences, phrases, tenses, word endings etc.	Difficulties with sound production and articulation; sounds may be distorted, omitted, substituted
	Phonology – the range of sounds in language and how short sounds can change meaning	Difficulties distinguishing words that rhyme and words that are phonologically similar
	Grammar – consists of *morphology* which refers to the small modifiers that change meaning e.g. word endings such as 's' / 'ing' and *syntax* which refers to how words are ordered in sentences in an accepted form e.g. 'the big, blue car' not 'the blue, big car'.	Word endings may present difficulties e.g. -ing, -ed, plurals and possessives Difficulties in understanding complex sentence structures
		May be producing short utterances with very simple structures and with more nouns than adjectives and adverbs
		May mix up the order of words in sentences

[2] McGough (2008) also refers to a fourth component, the listener/speaker relationship. However, for the purposes of discussing differentiation *within* a subject area, this component has been subsumed within Language Use.

Content	To do with meaning or semantics *Semantics* refers to the meaning of words in sentences Here we look at the ability to talk on a , topic the availability of suitable vocabulary, being able to convey meaning, being able to make oneself understood by the listener	Small vocabulary with which to expand on his/her topic Talk confined to topics concerning themselves only, or related only to the 'here and now' May repeat the same topic over and over The meaning of what is being said may be unclear to the listener May rely on general terms e.g. 'thing'
Use	*Pragmatics* - refers to the use of language in real situations. It includes being aware of the conventions and appropriate use of language in different contexts. Think about how successful the pupil is in using language for different functions – explain, predict, recount, inform, argue etc. *Listener/Speaker Relationship* – refers to the student's ability to turn take, listen to the opinion of others	Difficulty in initiating conversation Difficulty in interpreting facial expressions, or the listener's emotional state Difficulty maintaining topic, extending topic, repairing communication breakdowns Lack of appreciation of the listener's needs Difficulty generalising language uses learned in specific contexts General lack of competence within the listener/speaker relationship

Most research has focused on oral language development in relation to learners for whom English is an additional language (EAL) (e.g. Lyons, 2010), or oral language development in the first language of young children (Whitehead, 2004; McGough, 2008; Shiel et al., 2012). However, while the oral language development in the first language of adolescents may not be addressed, it would be erroneous to assume that there is nothing applicable to that age-group of students. On the contrary, Cassidy and Kiely (2001) highlight the link between oral language development and literacy in terms of subject teachers providing access to content knowledge within a subject.

Literacy

"In secondary school, we are concerned with helping students to read increasingly more difficult texts and helping them to read to learn" (McPhillips, 2011, p.85). Arguably, a heightened importance is placed on the text book in post-primary school. Certainly, with exception of some subject areas, almost all

formal assessment is literacy-based i.e. requirements on students to read exam papers, write answers, essays and so on. For students with literacy difficulties, the prerequisite demand for literacy skills can create a barrier to accessing the subject-content. "The ultimate goal of reading instruction at secondary school level is comprehension – gaining meaning from the text" (Edmonds, Vaughn, Wexler, Reutebuch, Cable, Klinger Tackett and Wick Schnakenberg, 2009, p. 263). However, many post-primary teachers assume that if students can read the words of the text, they will automatically comprehend what they are reading and therefore they neglect to teach students to extrapolate meaning (Edmonds et al., 2009). Further, it is the case that many post-primary students cannot be assumed to be able to read/decode new words. The technical, dedicated vocabulary that goes with most subjects can pose difficulty for students with literacy difficulties (McPhillips, 2011) and needs to be explicitly taught (Cassidy and Kiely, 2001; Chapman and King, 2003) so that they can access the subject, building a direct link between vocabulary growth and conceptual development (Salinger, 2003). Engaging in writing tasks requires students to express themselves and subject teachers should think about the prerequisite skills needed e.g. words they need to spell, amount they have to write, genre of writing that is expected (e.g. sequencing events, summarising, creative writing, explanation in response to questions and so on). Again, students with difficulty need scaffolded instruction to effectively access writing tasks (McPhillips, 2011). Table 2 outlines components of literacy that should be addressed and potential difficulties experienced by students.

Table 2: Components of literacy

Component	Key words and key concepts	Potential difficulties experienced by students
Reading	*Word identification* – sight words, word attack, contextual analysis etc. *Comprehension* – identifying the main idea, explaining a concept, answering literal and inferential questions based on text *Fluency* – pace, clarity, tone, modulation etc.	Strategies for approaching new words weak or absent Difficulty in grasping the main idea of a text Inability to extract the key points – cannot differentiate between the central and peripheral information Difficulty accessing the flow of the text, using punctuation to read the passage with sense

Writing	*Spelling* *Constructing sentences* *Punctuation* *Flow of thought* *Handwriting* *Genre* - explanation, description, sequence, instruction, creative etc Amount to be written Context of the writing – responding to questions, follow up to practical work, follow up to discussion and so on	Basic difficulties with spelling...small bank of sight spellings, difficulty with word families and so on Difficulty with the 'rules' of writing i.e. full stops, capital letters, commas, spacing between letters/words etc Difficulty understanding what is expected within different genres of writing; difficulty getting the key points elucidated clearly so that the reader understands May have difficulty with elongated passages of writing May need extra preparatory support before writing and provision of points of reference, writing framework etc during the writing process

Links between language and literacy

It is important to think about language and literacy separately in the first instance so that the components of each can be clearly seen and therefore explicitly addressed. However, it is also important to acknowledge that both are inextricably linked. They are both about language, oral and written. Language, whether oral or written, is either receptive or expressive. Table 3 outlines the overlap between written and oral language.

Table 3: Link between oral and written language

Receptive language	Oral language and communication Literacy	Listening – understanding the vocabulary, following instructions, listening to a story for meaning, following an explanation, listening and turn-taking within a conversation… Reading – reading individual words, reading sentences for meaning…
Expressive language	Oral Language and communication Literacy	Talking – explaining, giving instructions, describing… Writing – spelling, explaining, describing, answering questions…

Generally, expressive language, whether oral or written, makes more demands on the skills and abilities of students. It requires the construction of words and meaning. Therefore, it is crucial that students' oral language skills are developed in the first instance to ensure that they actually have the vocabulary needed to access a subject before expecting them to engage in reading that vocabulary in text or using the vocabulary to engage in written tasks (Cassidy and Kiely, 2001). In both cases, students with difficulty need to have their learning scaffolded and the key skills explicitly taught.

Teaching/learning cycle

Every lesson or series of lessons moves in and out of three distinct phases – presentation, operation and response (Moss, 1996). The presentation phase refers to the period(s) within the teaching/learning cycle when the teacher is drawing students' attention to a new skill or concept and explicitly teaching that for the first time. At some point(s) in the teaching/learning cycle, the focus moves more directly to the students when the teacher sets up tasks requiring them to operate on the skill or concept being taught. And, finally, the response phase refers to those times in the teaching/learning cycle when the teacher seeks responses from the students to ascertain their level of understanding of the skill or concept. Responses may be ascertained either by assessment *for* learning or assessment *of* learning. The former usually refers to that minute-by-minute, day-by-day assessing of students' understanding as the teacher moves through the teaching/learning cycle (formative assessment) while the latter refers to more formal assessment of a particular concept which may occur at stages during the teaching/learning cycle, or at the end of a period of teaching, and is very closely linked to the learning targets that were set at the outset (summative assessment) (Cohen, Manion and Morrison, 1996). In terms of thinking about assessment of students' understanding, teachers should be open to evaluating what the students have fully grasped, half grasped, or not grasped at all. All three phases of presentation, operation and response may occur within one lesson but it is probably more usual to step in and out of each phase a few times across a series of lessons. Within each phase there are opportunities to differentiate, to ensure that students with SEN are accessing the concept as effectively as possible.

Presentation

Depending on the topic and the small learning steps necessary to acquire the 'big' idea, teachers may move in and out of the presentation phase on a number of occasions within a series of lessons i.e. present one smaller concept, set tasks for the students to operate on that concept to consolidate their understanding, and assess that understanding before moving on to present the next step. In any case, when presenting new information, it may be useful to consider the following differentiation strategies in order to take language and literacy difficulties into account.

- Provide an overview of the lesson (Rosenberg, O'Shea and O'Shea, 2006) and explicitly share the learning intentions with the students and the special needs assistant (SNA) if present. Students should not be left to wonder where the lesson is going; rather, the teacher needs to flag what s/he intends them to learn during the lesson. This strategy serves to empower the students and provides a signpost for the direction of the lesson and a scaffold for pupils with SEN. The SNA needs to know too as this will increase his/her ability to support students with SEN to access the lesson. The teacher might cue the students orally or by providing two or three bullet points on the 'board.

- Elicit/activate prior knowledge of the topic in hand (Heffernan, 2003 and McKenna, 2004 cited in Taylor, Mraz, Nichols, Rickleman, Wood, 2009). This may be the first time that the teacher is presenting a particular concept to this group, but it is possible that the students already have some understanding. In addition, students with SEN often do not make links with their own prior learning and the 'new' concept. Providing opportunities in the presentation stage of the teaching/ learning cycle to articulate what they know and/or to hear what other students say, creates those links and provides 'hooks' upon which to hang the new information. It provides an opportunity for the teacher to evaluate the specific vocabulary that the students have already. It may be useful to direct questions/comments at individual students as well as general ones to the whole group. Teachers' reasons for asking questions can vary, depending on the nature of the subject (Wragg, 2001), and it is useful for teachers to interrogate their use of questioning in terms the language, the purpose of the questioning and so on.

- Most subjects have a dedicated vocabulary, and for students with language and literacy difficulties, this is the first barrier they encounter before actually trying to access the subject-specific concept itself. Before teaching a new topic, teachers should try to identify the associated vocabulary and pre-teach the keywords (Taylor et al., 2009). Much of this teaching should be orally-based i.e. talking about the words; encouraging students to provide their own definitions and so on, leading to the development of keyword lists (Cassidy and Kiely, 2001). In explicitly teaching the subject-specific vocabulary, the teacher is, by default, teaching most of the key concepts (Salinger, 2003). Ensuring that students have the vocabulary in their oral language banks will aid their interaction with written language later.

- During the presentation stage teachers should avoid over-reliance on the text-book (Cogan and Flecker, 2004), or indeed any written language. This is not to say that written language cannot be used at all; rather that

it should not be relied upon when introducing a new concept. Teachers who begin teaching a new idea by turning to a new page in the text book, automatically create a barrier to the subject content for those students who have language and literacy deficits.

- Using a variety of materials when introducing a new concept helps students access the idea from a number of angles i.e. visual, auditory, kinaesthetic and so on. Visual cues are particularly useful in helping students with SEN to grasp the language of the topic.

- When explaining a concept, teachers should try to simplify their talk. For some students with SEN, understanding receptively what the teacher is saying, can be as much about a language deficit as it is about cognitive understanding of the concept. Teachers should think about vocabulary, sentence structure, length of sentence, pace and so on when speaking.

- Demonstration and modelling are two teaching strategies that are particularly useful at the presentation stage. Demonstration refers to the method whereby the teacher shows the students how to do something e.g. the steps in a mathematical problem, carrying out an experiment, baking an apple tart. Modelling takes demonstration one step further, by actually placing the teacher in the role of the student. For example, modelling a mathematical problem involves the teacher 'thinking aloud' as s/he moves through each step, 'making a mistake' and articulating the discovery of the error, and possible ways to address it. Both strategies are useful, but modelling is probably most effective for students with SEN in many instances because they need to 'see' the thinking process/behaviour in action, so that they can apply it themselves, and it allows the teacher to use the language of the topic appropriately.

- Developing points of reference which can be used again in later stages of the lesson(s) is also useful e.g. keyword poster, steps of a task and so on.

- If necessary, either the SNA or the teacher can provide additional presentation of the new concept to individual or groups of students while the rest of the class moves on to work on a task. If possible, teachers should try to ensure that SNAs and other relevant staff are listening during the presentation of the new ideas so that they can reteach the key ideas using the same language, explanations and approach.

Operation

The operational phase of the lesson(s) refers to those times when the students are working on the new learning and can be considered in terms of the nature of the task (what the student has to do) and structure of the task (how the student is to do it). Both aspects can be differentiated to include students with SEN.

Differentiation in terms of the *nature of the task* could include:

- Changing the task characteristics for particular groups of students/ individuals. For example some students could use a writing frame to scaffold a written task in science (Cassidy and Kiely, 2001). Visual cues could be provided for some students to work out the sequence of a historical event before being asked to write a summary.

- While the class is working on the task, the teacher can provide additional support to some students if necessary. For example, a common task set by teachers is for students to use the text book to answer questions, summarise main points etc. When this type of task is set, the teacher may use the modelling strategy outlined above to aid students with such a comprehension task rather than assuming that they have the necessary comprehension strategies to carry out the task themselves (Edmonds et al., 2009). In other words, the teacher 'becomes the student' and engages in the task articulating aloud how s/he is identifying the keywords and concepts in the text.

- Explicit teaching of comprehension strategies provides students with the tools to approach the text themselves, so that the teacher can eventually fade the additional support needed. For example, the strategy *PQRS* (Westwood, 2011) is a step-by-step comprehension strategy that students can use with any text. First, students *preview* the text attending to headings, subheadings, keywords, pictures and diagrams to gain a general impression of what the text might be about. Next, students may generate *questions* to provide a focus to their reading. Or, if the questions have already been set by the teacher or as part of the text, the students might read those first and use them to make further predictions about the content of the text. Then the students *read* the text carefully, using their insights from the preview and questioning phases as a lens with which to interrogate the text. And finally, the students summarise the main idea of the text and briefly state the main points in their own words. It is important for the teacher to demonstrate and model this comprehension strategy for students so that they learn how to use it effectively. *PQRS* is just one reading comprehension strategy; there are other approaches to teaching reading comprehension which provide students with a strategy with which to

deal with a text which may also be useful (e.g. Cassidy and Kiely, 2001; Chapman and King, 2003; McPhillips, 2011; Westwood, 2011).

- If students are using a text it may be useful to reduce the extraneous material to enable them to focus on the main points. Sometimes text books provide lots of additional information around a topic and while it may be interesting, it may not be necessary to acquire a good understanding of the key concepts. Some students with SEN can experience difficulty in deciphering what is important and what is peripheral. Devising a system to highlight the key points in a text enables students to focus on the central ideas and makes it more accessible to them.

- Provision of a point of reference will help students to work on a task with some independence. A point of reference may be a keyword poster on a wall, a reading cue card outlining the steps to be used when answering comprehension questions in a text, provision of a worked example and so on. Points of reference may be provided for the whole class or just for individual students.

When thinking about the *structure or organisation of a task* it may be useful to consider the following methods of differentiation. The most common form of task organisation is for students to work on a task individually, either in class or at home. While there are times when this is useful and necessary, it may be good to think of alternatives to this method of organisation a task. Students with learning difficulties may benefit from learning with and from peers.

- One way of supporting students with SEN in a task is to use peer tutoring (Rosenberg et al., 2006), whereby a more able student in the class, or an older student from another class, re-teaches the key concepts and supports the student with SEN when operating on the task. When using peer tutoring it is important to ensure that the tutors are capable of the role and understand what is required. When using same-age peers thought should be given in advance to opportunities whereby roles can be reversed so that the tutee can become the tutor.

- Students can also work in pairs of similar ability. Teachers might think about tasks that are routinely set as individual tasks and consider opportunities when two students could work together to answer the comprehension questions, complete the assignment and so on. Working on a task in pairs is particularly useful for students who have behavioural difficulties and who cannot cope well in a larger group situation, or students who are particularly shy and withdrawn and need to develop group work skills e.g. turn taking, sharing materials,

listening to another's opinion, expressing their own opinion. Using a 'writing buddy' (Hammeken, 2000, p.67) also allows students to share the language and literacy demands of the task.

- If working in pairs to complete a task proves successful over time, it may be appropriate to snowball the pairs into groups of four but to keep them to the same task. For example, pairs of students may work on a geography task based on using the textbook to find and write answers to questions already discussed in class. When the pairs have completed the task, they 'snowball' into groups of four and compare their answers. For a student with learning difficulties this provides an opportunity to review the concepts once more and to see and hear how other students use the textbook to find information. For students with behavioural difficulties, it provides a gentle introduction to group work. The nature of the task remains constant but the structure moves up a notch to provide a bit more challenge. The student with the behavioural difficulty only has to concentrate on being in a larger group; the conceptual learning has already occurred in the paired structure.

- Using jig-saw groups (Rosenberg et al., 2006; Gregory and Chapman, 2007) allows the teacher to set different tasks for each member of the group at his/her level of ability and interest. When each person has completed their part of the project it is brought back to the group and each part of the jigsaw forms the final product. This is particularly useful in allowing a student with SEN to contribute meaningfully to a group task while simultaneously tailoring the literacy and language demands of the task to suit the learner's needs. Group work requires fairly high levels of skill, and is dependent on sharing of information and materials; students need to be explicitly taught such skills (Gregory and Chapman, 2007) and teachers need to be clear on their expectations, procedures and rules before using this task structure.

Response

As mentioned previously, assessment *of* and *for* learning are essential in order to judge the students' understanding of the concepts. Again, there are a number of issues to think about in terms of differentiation for special needs in this aspect of the teaching/learning cycle. Evaluating students' responses has to be closely linked with the learning target that was planned at the outset. If the learning target was differentiated for the student with SEN then that will have to be taken into account when assessing the learning.

- Teachers need to consider the amount of work set in order to assess a students' learning. Is it necessary to set ten questions if five will provide enough information upon which to evaluate his/her level of understanding?

- Consideration of the nature of the assessment is also important. When assessing a subject-based learning target, the teacher needs to keep in mind that s/he wants to find out about the student's understanding of that concept, and not how well they can read, spell, write. If the assessment is text-based, those with language and literacy difficulties face that hurdle first before ever trying to demonstrate their subject knowledge.

- Teachers also need to be clear on their criteria for success; what will satisfy him/her that the student has grasped the concept sufficiently to move on? What constitutes success may differ between individual teachers, and it may be necessary to think about different criteria for different students.

- Just as pre-teaching the keywords in a textbook is important, so too is pre-teaching the keywords of an examination paper, particularly regularly occurring instructional words and phrases.

- How teachers communicate feedback on assessment to students is an aspect of teaching that is often not considered. Sometimes even positive feedback may not be helpful,l if the student does not know what was praiseworthy about their responses (Rosenberg et al., 2006). Often in post-primary schools, a percentage is the main form of feedback, and even if accompanied by helpful, formative suggestions for improvement, can be the only thing students see. Students with SEN need to explicitly see their own progress. They (and sometimes teachers and other students) often measure their abilities and progress against that of their peers, and in that scenario, it is very difficult for them ever to be able to demonstrate or achieve excellence in learning. Instead, students with SEN need to measure their learning against themselves e.g. they need to see what they have learned in the last week, month, year. This necessitates careful monitoring of progress by the teacher and explicit feedback to the student. Consider the following questions in guiding grading practices: (a) how do learners benefit from a grading system that reminds everyone that students with SEN or students with EAL do not perform as well as students without SEN or for whom English is their native tongue? (b) How do current grading practices encourage struggling or advanced students to persist? (c) Is there an opportunity for struggling students to encounter excellence and/or advanced learners to encounter struggle in current grading practice? (Tomlinson, 2000, p. 11).

Conclusion

This article does not provide the definitive list of differentiation strategies, merely the starting point for consideration of the language and literacy hurdles that some post-primary students must jump over in order to access subject-specific concepts. As stated before, differentiation is not easy. Tomlinson (2000) states that differentiation is not something the teacher does but rather, it is a way of thinking. I agree that differentiation is the manifestation of a philosophy, a way of thinking about diversity in the classroom. However, it is also something teachers do. In order to understand differentiation and to embed teaching for diversity in practice, teachers need to 'do' differentiation as part of their own learning process, to ensure that it becomes a way of thinking. It would probably be impossible to differentiate for all students, in all the ways outlined above, in all lessons, all of the time. However, it may be possible to begin by thinking about the needs of one student, in one lesson by adapting one teaching strategy. Begin by 'doing' differentiation in small steps and assess what is effective. In the doing comes a deepening understanding of one's own practice and the manifestation of differentiation as a way of 'thinking' about diversity.

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Movement and Learning

Colette Nic Sitric

> The greater duration of time in the chair,
> The greater the depth of student despair.
> *(Jensen 2000)*

Besides the weekly PE class and structured playtime with Infant classes, I became very aware, as a class teacher, of how important it was to have "movement breaks" throughout the day, where children got the opportunity to get off their chair. Incorporating these breaks into the school day had a positive impact on the children's learning and was an effective way to move from subject to subject. As part of our learning support team programme, we had introduced a gross motor and fine motor skills element to our team teaching in the Infant classes, which had proven very successful in identifying children with movement and other specific difficulties as well as developing the social skills of all the children. We also, more recently, developed a movement programme each morning in the school hall for children with specific difficulties…both motor and social. This was a new departure for our school and I wished to review the research findings in the area of movement and learning.

What are the movement experiences of today's generation of children?
In today's society there is less of a need to physically exert oneself. Over recent decades there has been a marked decline in demanding physical work and this has been accompanied by more sedentary lifestyles and reduced leisure-time activity. Weeding the garden, baking and helping out with jobs are no longer part of most children's weekly routine. Children who once resourcefully devised their own construction toys tend to have more prefabricated materials to play with. Games that require more physical manipulation of materials like Monopoly, draughts, cards are not as common as their computer counterparts. In Ireland, one in four children and one in two adults are overweight or obese (Report of the National Task force on Obesity 2005). Children who watch TV for hours or play with computers, video games for vast amounts of time are at a higher risk of obesity than those who are playing sports. We do not appear to have learnt any lessons from the experiences of US society:

> We are under exercised as a nation. We look instead of play. We ride instead of walk. Our existence deprives us of the minimum of physical activity essential for healthy living.
> *(U.S President John F. Kennedy cited in Santrock 1999)*

Movement difficulties are often associated with children who have learning problems. Much more attention is being paid to the comorbidity or common difficulties across the different syndromes, including autism and attention deficit hyperactivity disorder (ADHD); one of these is movement. Kirby and Drew (2003) describe comorbidity "as a situation where two or more conditions that are diagnostically distinguishable from each other tend to occur together". Very often children with dyslexia have a movement difficulty which hinders their articulation or their writing. Kirby (1999) established in a U.K study that 50% of children with dyslexia also have dyspraxia. Children with development coordination disorder (DCD) or dyspraxia account for 8-10% of all children, the majority of that percentage being boys (Kirby 1999). The majority of children with attention deficit disorder (ADD) have some form of fine motor co-ordination difficulty which affects their handwriting (Serfontein 2004). Serfontein believes that physical clumsiness may lead to social problems, especially for boys, in sporting areas. Most boys interact at their best when they are playing some form of game. Many therapists use a specialised movement therapy to treat autism, learning disabilities, attentional deficits and sensory-motor problems.

In our society there are many children with no label at all who do not move easily and well. They have little awareness of how their bodies are functioning in space and their movement decisions are miscued e.g. how fast to move and where to go. Macintyre (2002) refers to this as the planning side to movement i.e. what kind of movements a child might make to fulfil a set task, or what kinds of movements might come logically together to produce a flowing sequence. Macintyre (2002) makes the following observation:

> Movement is fundamental to all aspects of learning and to the developing self-confidence of young people. Being able to run, jump, ride a bike, and play all sorts of games are the kinds of things children value. They count so much, for not being able to do them means being left out of games, never being chosen and often having a miserable time when ones friends go off to play. Moreover, not being able to do these activities is public – everyone can see – unlike inadequacies in classroom subjects, which can be discussed privately and hidden away.
>
> *(Macintyre 2002, p.2)*

What are the stages of movement acquisition?

To ensure survival immediately after birth, primitive reflexes operate until more mature reflexes and sensory systems develop. Postural control reflexes prepare a child for advanced movement patterns such as creeping, sitting or rolling. Both primitive and postural reflexes help create myelinated pathways to and from the sensory processing systems. Myelin is a protective coating which helps insulate and protect neurons from other connective tissue. This process of coating these pathways plays an important part in cognitive and physical functions. Macintyre (2001) points out that in multiple sclerosis the myelin sheath is breaking down,

causing sufferers to lose control of their movements. The myelinisation of neurons affecting gross motor movement finishes at about 6 years of age (Macintyre 2001; Tassoni 2007). Children at this age start to run faster and are also able to hop and skip. Many of these original "reflexes" are eventually replaced by "intentional" movements. The following is a more detailed description of this process:

> The transformation of primitive reflexes to postural reflex marks successful passage through basic postural abilities and motor skills in the early years, which underpin later automatic control of balance, posture, coordination and centres involved in the control of eye movements. It also reflects increased maturity in the functioning of the central nervous system.
>
> *(Blythe 2005, p.416)*

Children with learning or behaviour problems, however, commonly have residual primitive reflexes left over from their infanthood and react to the environment involuntarily; sometimes they also appear to have movement problems (Cheatum & Hammond, 2000). Glazener (2004) believes that in some cases this may be because children are spending far less time on the floor and on their stomachs than they did in the past. The new car seats that double as infant chairs contribute to infants being left in the seats for longer periods of time. If a primitive reflex is retained beyond six to twelve months of life, it is aberrant and can affect the development of gross motor skills and the particular sensory system with which the reflex is associated (Glazener 2004).

The term 'neurological dysfunction' describes the continued active presence of primitive reflexes beyond 6-12 months of age, and underdevelopment of postural reflexes, in a child beyond 3.5 years of age (Blythe 2005). The Institute for Neuro-Physiological Psychology (INPP) in Chester was established by Dr Peter Blythe in 1975 to research the effects of central nervous system dysfunction in children with specific learning difficulties. The INPP developed a Test Battery and Developmental Exercise Programme for Children in Schools in 1996. A series of independent studies were carried out using this programme on children with special needs and each study indicated the following:

1. Neurological dysfunction (reflex scores greater than 25%) was a significant factor in educational underachievement (reading age below their chronological age).

2. Neurological dysfunction did respond to the INPP Developmental Exercise Programme for use in schools with children with special needs, with children in the experimental groups showing significantly greater improvement in reflex scores and tests for balance and coordination than the control or comparison groups.

3. There was a general trend whereby children who did fit the criteria for using the INPP programme (reflex scores greater 25% and reading age below their chronological age) showed greater improvement in educational measures after using the INPP programme than comparison groups who did not take part in the programme.

(Blythe 2005, p.429)

Training was then provided for teachers and other professionals by the INPP in the administration of a short battery of tests to assess the following three reflexes:

- The asymmetrical tonic neck reflex (ATNR).
- The symmetrical tonic neck reflex (STNR).
- The tonic labyrinthine reflex (TLR).

The following difficulties occur if ATNR remains active after six months (www.inpp.ie).

- Hand-eye coordination (impacting on pencil grip and writing)
- Inability to cross the vertical midline
- Difficulty with visual tracking

Blythe (2005) provides substantial independent research evidence to substantiate the above findings. INPP train therapists in Ireland and Galway therapist Mary O'Connor (www.inpp.ie) is an ardent advocate of the programme. A learning support teacher attending one of her courses on neurological developmental therapy (NDT) made the following observation:

> It was beyond my field of comprehension as to how simple physical exercises could impact on a child's ability to learn.
>
> *(Hunter, p.19 inTouch, June, 2002)*

There are many other programmes such as Brain Gym, Connect Ed and The Dore Programme that recommend personal programmes of exercise for children with learning difficulties. Drs. Paul and Gail Dennison founded the movement methodology known as Educational Kinesiology (EK) or Brain Gym, a direct-movement programme currently used in thirty six countries and often recommended for children with mild learning difficulties and behaviour disorders. This is whole brain learning through the use of movement repatterning, and many teachers use these movements in their classroom every day, while others use only the movements related to reading, during the reading hour. However Hyatt (2007) maintains that Brain Gym has no substantive theoretical or research report and should no longer be used with children, in the

hope of ameliorating a problem. Any research-supported theoretical foundation for Brain Gym contains serious methodological flaws. While certain individuals claim it provided the necessary stimulation for effective learning (Chaker 2005, Hannaford 1996), Hyatt argues that the majority of articles were not reviewed because they were sold by the organisation publishing the journals, namely Brain Gym. Quality research should be published in peer-reviewed journals available through academic libraries weeney (2007) recommends assessing all children's gross motor skills in Infant classes (Irish Learning Support Association Conference Presentation 2007). She also encourages delivering motivating and structured motor skills' programmes as class lessons for all learners. The Belfield Infant Assessment Profile assesses motor development, as well as providing remedial suggestions for developing gross motor skills.

In relation to children with dyspraxia, Sweeney noted that, to date research has not proved the effectiveness of programmes such as NDT and Brain Gym as a way of strengthening the gross motor skills of children with dyspraxia. In relation to dyslexia, Reid (1998) believes that while motor skills and literacy are two distinct strands of development there is a growing awareness of the link between the two and therefore a programme of activities focusing on motor skills, may be extremely useful in helping the teacher tackle difficulties associated with dyslexia. The Tips for Teens and Teenagers booklet issued by the Dyspraxia/DCD Association, Cork recommends the book of Brain Gym exercises for children with dyspraxia.

It is clear from the above findings that there are mixed feelings regarding the educational value of these programmes. Besides following specific programmes, there are many other ways of using movement to enhance a child's ability to learn that can be integrated into a daily classroom programme.

Breathing exercises can enhance oxygen flow, reduce heart rate and anxiety (Bernardi et al., 2000 cited in Glazener 2004) and facilitate learning. Although the brain contributes to only two per cent of the body's weight, it uses 20 per cent of the body's oxygen (Greenfield, 1996). Stretching releases the contraction of the muscles, thus allowing the fluid carrying messages through the central nervous system to the brain, to flow more freely (Promislow, 2000 cited in Glazener). Cross lateral motor movements, which move a limb from one side of the body across the midline to perform a task on the other side help to keep the two hemispheres of the brain in constant communication with each other (Hannaford 1995). The vestibular system commonly known as the balancing system is critical for cognition and advocates playground activities such as swinging, spinning, rolling, jumping and turning that stimulate inner ear motion (Jensen 2000). A paediatric physician tracked a group of normal infants and vestibular disabled infants for three years and found that children with vestibular problems also demonstrated delays in motor development, balance, language acquisition, reading and writing (De Quiros, 1976 cited in Jensen 2000).

Students who tip back the legs of their chairs in class are often stimulating their brain with a vestibular-activating motion. While it is an unsafe activity it happens to be good for the brain. Sitting for long periods takes its toll on our body. Spinal disc pressure is 30% greater when sitting versus standing. Sitting in chairs for more than brief ten minute intervals reduces our awareness of physical and emotional sensations (Cranz 1998 cited in Jensen) and fatigue. Incorporating more movement in your day will help to counteract this. Specific movements can be easily integrated into a class teachers or learning support teacher's day as they only need five minutes a couple of times during the day.

The teaching of reading and writing through the use of Jolly Phonics Programme developed by Sue Lloyd and Sara Wernham incorporates a kinesthetic element where an action for each sound helps children remember the letter that represents it and acts as a stepping stone to identifying sounds.

It is impossible to write about movement and children without mentioning play. For Freud and Erikson (cited in Santrock 1999), play is an especially useful form of human adjustment, helping the child master anxieties and conflicts. Play permits the child to work off excess energy and to release pent up tensions. For Piaget and Vygotsky (1962 cited in Santrock 1999) play advances children's cognitive development. Play permits children to practise their competencies and acquired skills in a relaxed, pleasurable way. Piaget felt that cognitive structures need to be exercised, and play provides the perfect setting for this exercise. Vygotsky was especially interested in the symbolic and make-believe aspects of play, as when a child substitutes a stick for a horse. For young children, the imaginary situation is real. This kind of play advances creative thought. Santrock (1999), points out that social play can be sensorimotor (rough and tumble), symbolic or constructive. Jensen (2000) believes that brain development may be enhanced by play. In the early years of a child's development, the complex interaction of social, physical and emotional factors contribute towards neural connectedness.

The Primary School Curriculum (1999) cites that physical education is an integral part of the curriculum providing vital opportunities for the physical, social, emotional and intellectual development of the child. It recommends that an hour per week be allocated to PE. Drewett's study (2002) carried out in primary schools in the Kildare area, indicated that the allocated time for PE ranged from 16 to 45 minutes (cited at the INTO Consultative Conference 2007). Though schools have two hours discretionary time, there is no evidence that this time is spent on PE. The average weekly timetable for PE across the EU in primary schools is 109 minutes (Appendix A). Ireland is lagging behind its European counterparts in the amount of time dedicated to physical education in primary schools. The Worcester University Study (2007) recommends the following:

> EU countries should adopt a policy of 120 minutes of PE curriculum time allocation per week with agreement to work towards a minimum of 180 minutes weekly with schools endeavouring to go beyond this minimum where this is possible and a call for at least 60 minutes daily physical activity in or out of school settings
> *(cited at the INTO Consultative Conference Discussion Document 2007 p10).*

Children should be involved in at least 60 minutes per day of moderate physical activity in order to prevent excess weight gain (Report of the National Task force on Obesity 2005). The importance of physical activity for children has been highlighted by many bodies, such as the National Heart Alliance, the Working Group on Lifelong Involvement in Sport and Physical Activity, the Health Service Executive, and the ESRI among others. The centrality of PE, play and movement in a child's development needs to be acknowledged and acted upon (The INTO Consultative Conference 2007).

While it is the writer's view that it may not be advisable to invest time and finances on particular commercial programmes of exercise until more substantial research is completed, there is mounting evidence that incorporating regular physical activity and movement into class lessons is beneficial to the overall development of the child.

Jensen (2000) makes the following recommendation:

> Quick little wake up activities increase energy levels, improve storage and retrieval of information and help learners feel good. Teachers need to engage students in a wider variety of postures including walking, laying down, swinging, spinning, skipping, leaning, perching, kneeling and squatting while also providing children with more movement choices throughout the day.

As teachers incorporate more physical activity, all children, not just children with movement difficulties, will experience increased intrinsic motivation, and improved attitudes. Encouraging pupils to take part in a wide variety of physical activities can have many additional benefits for pupils – cooperation in group situations, acceptance of success and failure, concepts of working hard and 'fair play' and an appreciation of the skills and attributes of others. To quote a wise man:

> The quality of life is determined by its activities.
> *Aristotle (Greek philosopher, 5th Century B.C)*

APPENDIX A

The Allocation for Physical Education in Primary Schools: 1999-2006				
	1999		2006	
	Minimum	Maximum	Minimum	Maximum
Austria	100	200	100	200
Belgium	100	120	100	100
Bulgaria	120	120	100	150
Cyprus	90	90	80	80
Czech Republic	90	135	90	135
Denmark	90	100	90	90
Estonia	90	135	135	135
Finland	90	90	90	90
France	240	240	120	240
Germany	90	180	60	150
Greece	90	90	90	135
Hungary	90	90	112	225
Ireland	**30**	**60**	**30**	**60**
Italy	100	120	60	120
Latvia	120	120	80	80
Lithuania	90	90	150	150
Luxembourg	100	135	100	100
Malta	90	90	150	150
Netherlands	50	100	45	90
Poland	135	135	135	180
Portugal	150	180	90	135
Romania	100	100	100	100
Slovakia	90	135	90	135
Slovenia	135	135	45	135
Spain	60	60	100	180
Sweden	110	110	100	100
United Kingdom	30	120	30	130

Ref. *Current Situation and Prospects for Physical Education in the European Union,* University of Worcester, for DG Internal Policies of the Union – Structural & Cohesion Policy 2007

APPENDIX B

Jolly Phonics: Sue Lloyd and Sara Wernhaw

The Actions

s	Weave hand in an s shape, like a snake, and say **ssssss**
a	Wiggle fingers above elbow as if ants crawling on you and say a, a, a.
t	Turn head from side to side as if watching tennis and say t, t, t.
i	Pretend to be a mouse by wriggling fingers at end of nose and squeak i, i, i.
p	Pretend to puff out candles and say p, p, p.
n	Make a noise, as if you are a plane - hold arms out and say nnnnnn.
c k	Raise hands and snap fingers as if playing castanets and say ck, ck, ck.
e	Pretend to tap an egg on the side of a pan and crack it into the pan, saying eh, eh, eh.
h	Hold hand in front of mouth panting as if you are out of breath and say h, h, h.
r	Pretend to be a puppy holding a piece of rag, shaking head from side to side, and say rrrrrr.
m	Rub tummy as if seeing tasty food and say mmmmmm.
d	Beat hands up and down as if playing a drum and say d, d, d.
g	Spiral hand down, as if water going down the drain, and say g, g, g.
o	Pretend to turn light switch on and off and say o, o; o, o
u	Pretend to be putting up an umbrella and say u, u, u.
l	Pretend to lick a lollipop and say l l l l l l.
f	Let hands gently come together as if toy fish deflating, and say f f f f f f.
b	Pretend to hit a ball with a bat and say b, b, b.
ai	Cup hand over ear and say ai, ai, ai.
j	Pretend to wobble on a plate and say j, j, j.
oa	Bring hand over mouth as if you have done something wrong and say oh!
ie	Stand to attention and salute, saying ie ie.
ee or	Put hands on head as if ears on a donkey and say eeyore, eeyore.
z	Put arms out at sides and pretend to be a bee, saying zzzzzz.
w	Blow on to open hand, as if you are the wind, and say wh, wh, wh.
ng	Imagine you are a weightlifter, and pretend to lift a heavy weight above your head, saying ng...
v	Pretend to be holding the steering wheel of a van and say vvvvvv.
oo oo	Move head back and forth as if it is the cuckoo in a cuckoo clock, saying u, oo; u, oo. (Little and long oo.)
y	Pretend to be eating a yogurt and say y, y, y.
x	Pretend to take an x-ray of someone with an x-ray gun and say ks, ks, ks.
ch	Move arms at sides as if you are a train and say ch, ch, ch.
sh	Place index finger over lips and say shshsh.

th th Pretend to be naughty clowns and stick out tongue a little for the th, and further for the th sound (this and thumb).
qu Make a duck's beak with your hands and say qu, qu, qu.
ou Pretend your finger is a needle and prick thumb saying ou, ou, ou.
oi Cup hands around mouth and shout to another boat saying oi! ship ahoy!
ue Point to people around you and say you, you, you.
er Roll hands over each other like a mixer and say ererer.
ar Open mouth wide and say ah. (UK English) Flap hands as if a seal, and say ar, ar, ar. (US English)

APPENDIX C

Sample activities to improve a child's balance (vestibular) as well as their awareness in space (proprioceptive): Glazener Laurie (2004) *Sensorcises Active Enrichment for the Out-of-Step Learner,* The Brain Store

Whirling and Swirling
1. Stand and extend your hands straight out to the sides with your palms down.
2. Spin as fast as is comfortable for fifteen seconds in either direction.
3. Stop and close your eyes, keeping your balance while standing still for fifteen seconds.
4. Repeat, for two to five minutes, the sequence of spinning for fifteen seconds and resting for fifteen seconds.

Cross Overs
1. Very deliberately and slowly, touch your arms to the opposite legs. Repeat this movement ten times.
2. Then, touch your arms to the legs on the same side.
3. Alternate between cross-body and one-side movements three or four times.
4. Finish by doing a final series of cross-body movements.

Variations
- Perform these movements while sitting, standing or lying on your back.
- Perform these movements in front of your body or behind your back.
- Perform these movements with your eyes closed to help improve balance.
- Skip or bounce between touches.

Lateral Tapping
For two or three minutes, tap out various rhythms against your body and have your student repeat the pattern.

1. Sit in a chair with both of your feet on the ground and one hand on each knee to start.
2. Determine a pattern that your students will have to repeat. Begin with three-step patterns and advance as students become more skilled. One sequence might be to tap your left thigh with your left hand, tap your right thigh with your right hand and then stomp both of your feet. Model the pattern and then have them copy it a minimum of three times.
3. Encourage the children to orally repeat the pattern as they are performing it.
4. Increase the difficulty of the pattern by increasing the number of steps in the pattern.

Variations

- Require the students to perform the repeating pattern to a steady beat.
- Vary the tempo of the pattern.

Wake Up Little Brain

Select one or more of the exercises below and stay in motion for two to five minutes

1. While sitting in a chair, vigorously stomp your feet on the floor ten times, or, rock and shift your weight from side to side ten times.
2. Move your chair back so there are twelve inches between your stomach and your desk. Place your hands flat on the desk, shoulder-width apart, as if you were about to do push ups. Then do ten seated push ups (keep your bottom in the chair). Make your push ups nice and slow and expend as much muscular effort as possible.
3. Do five chair lift-ups by placing your hands next to your thighs on the seat of your chair and pushing down to lift your bottom off the chair.

Don't Rock The Boat

1. Stand with your feet slightly apart.
2. Raise one foot about ten inches off the floor and hold the balance for a minimum of five seconds. Switch feet.
3. Next, balance on one foot and swing your other leg back and forth ten times. Switch.
4. To understand the role vision plays during balancing repeat any one of the balances with your eyes closed.

Variations

- Increase the level of balances difficulty by closing your eyes and rotating them under your eyelids.
- Write your name in the air with one foot while balancing on the other.

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