Australian Council *f*or Educational Research

Literature Review

A review of the empirical evidence identifying effective interventions and teaching practices for students with learning difficulties in Years 4, 5 and 6

Nola Purdie
Louise Ellis

Learning Processes and Contexts Research Program
Australian Council *for* Educational Research
347 Camberwell Road (Private Bag 55)
Camberwell, Victoria 3124

RFT PRN 3538

February 2005

Contents

--o0o--

Preface

This review has been prepared by the Australian Council for Educational Research (ACER) under an Agreement with the Australian Government Department of Education, Science and Training (DEST). It is one component of a project to investigate effective 'third wave' intervention strategies for students with learning difficulties who are in mainstream schools in Years 4, 5 and 6. Third wave interventions are those provided for students in mainstream classrooms who have learning difficulties that persist beyond the early years of schooling.

The review builds on and extends the findings of the *Mapping the Territory*[1] research project through close examination of the local and international research literature that provides evidence of *measurable* improvements in students' learning outcomes. In this manner, we are able to increase the confidence with which we can make claims about the generalisability and ecological validity of programs and strategies that work for students who find it difficult to learn.

The valued assistance provided by Dr Ann Czislowski-McKenna (*DEST Representative* & *Griffith University*) is gratefully acknowledged, as is the support from members of the Advisory Committee: Dr Joanne Deppeler (*Monash University*); Ms Beverley Milson (*NSW DET*); Dr Marion Milton (*Edith Cowan University*); Mr Michael Traynor (*CEO, Canberra-Goulbourn*); Ms Patricia Winter (*Department of Education and Children's Services, SA*); Ms Robyn Yates (*Association of Independent Schools, NSW*). Moreover, we owe a significant debt of gratitude for the quality services provided by the staff of ACER's Cunningham Library, and in particular, by Margaret Findlay and Joel MacKeen. Without the assistance of these key persons, the present review would not have been possible.

We also wish to thank members of the research team who have provided support and comment on earlier drafts of the review: Ms Wendy Dick, Ms Nicole Fleming, Ms Kerry-Anne Hoad, Mr Ray Peck, Dr Ken Rowe, Dr Seik Toon Khoo, Mr Andrew Stephanou, (ACER); and Dr Kathy Rowe (Royal Children's Hospital, Melbourne)

Nola Purdie and Louise Ellis

Learning Processes and Contexts research program
Australian Council *for* Educational Research

[1] See Louden, Chan, Elkins, Greaves, House, Milton, Nichols, Rivalland, Rohl, & van Kraayenoord (2000).

Executive Summary

This review is provided to meet one of the specified objectives of Request for Tender No. 3538, namely to conduct a review of the literature on 'third-wave' intervention programmes and strategies for students with learning difficulties in Years 4, 5 and 6. The review is provided as an information base for the development of professional development programs for teachers in mainstream classroom of the target group of student.

Key issues and/or findings of the review are summarised as follows:

- Defining what is meant by a learning difficulty is contentious. In Australia, there is inconsistency in definitions used throughout the States and Territories, and this influences both the processes by which students are identified as having a learning difficulty and the estimation of prevalence rates.

- Contemporary understandings of what constitutes effective classroom practice influence the pedagogical practices of teachers of students with learning difficulties. The prevailing educational philosophy of constructivism has had a marked influence on shaping teachers' interpretations of how they should teach students who find it difficult to learn.

- Claims about what constitutes an effective pedagogical practice should be strongly founded on the evidence that accumulates from rigorous research. There are several approaches to synthesising research in a nominated area and each has its inherent strengths and weaknesses. The current review of the literature on interventions for students with learning difficulties relies largely, though not exclusively, on well-designed meta-analyses[2] which (a) partial out methodological artefacts from the effect sizes[3], and (b) base their classification procedures on the actual procedures and components of instruction used in the studies reviewed.

- The strongest evidence in support of a particular approach or intervention for students with learning difficulties is that which demonstrates that students make robust learning gains. Such gains are generally evident in interventions that involve either *explicit instruction* in a relevant essential skill (direct instruction, content enhancement approaches) or ones that focus on the development of cognitive, metacognitive, or self-regulation strategies (*learning strategy instruction* approach). An *eclectic approach*, whereby teachers combine, as appropriate, elements from both content enhancement and strategy instruction approaches, may provide students with the best opportunities for success.

[2] Meta-analysis is a method of statistically summarizing quantitative outcomes across many research studies. For the relevant foundational literature, see: Glass, McGaw and Smith (1981); Hedges and Olkin (1985).

[3] An effect size (expressed in standard deviation units—SD) is estimated as the difference between the mean values on an outcome measure of interest for two groups (e.g., target or treatment group, and comparison or control group) divided by the standard deviation—often the pooled SD of both groups or the SD of the control group).

- Despite the research evidence that some interventions work better than others, no one intervention or approach can address the complex nature of learning difficulties. Because not all students and tasks are the same, teachers must have a full repertoire of strategies for helping students learn; they must also have a clear understanding of how and when to implement each strategy.

Introduction

The present literature review arises in the context of the Australian Government's policy initiative of working with the States and Territories to ensure that all Australian children achieve acceptable standards of literacy and numeracy. A key Government priority has been to focus on achieving real, sustained improvements in the literacy and numeracy skills of Australian children to better prepare them for their futures. Ensuring all students gain at least a minimum acceptable standard in literacy and numeracy is critical in overcoming educational disadvantage.

The report, *Mapping the Territory. Primary Students with Learning Difficulties: Literacy and Numeracy* (Louden, et al., 2000), describes three 'waves' of intervention that support students who find it difficult to learn. These are:

- initial effective whole-class teaching ('first wave' based on the work of Snow et al 1998);
- structured early intervention within and outside the classroom which usually occurs in the second year of teaching ('second wave'); and
- subsequent intervention for children who require on-going support beyond the early years ('third wave').

The report also found that compared with the priority given by schools to first and second wave teaching there was less emphasis on 'third wave' teaching of children having difficulties beyond the early years of schooling. Other research shows that students who fail to acquire adequate literacy and numeracy skills in the early years fall further behind as they progress through the middle years of schooling (Rohl, House, Louden, Milton & Rivalland, 2000; Hill, Comber, Louden, Reid, & Rivalland, 1998).

A significant minority of children in Australian schools face difficulties in acquiring acceptable minimum literacy and numeracy skills, although, it is difficult to provide authoritative estimates of the proportion of children who have such difficulties because of national uncertainty about operational definitions of *learning difficulties*.

Thus, before proceeding to the substance of the review, we begin with a consideration of definitions, identification, and prevalence issues, in an attempt to better understand the numerous intervention approaches that have currency.

Definitions, Identification, and Prevalence

For the purposes of this project, the Department of Education, Science and Training (DEST) has specified that the term *learning difficulties* applies to students in mainstream schools who do not meet national literacy and numeracy benchmark standards. Although students with *disabilities* who have learning difficulties would fall within the above definition, the Department has indicated that the project will not focus on students with disabilities as defined by the *States Grants (Primary and Secondary) Assistance Act 2000*. According to this definition, students with disabilities are those who have been assessed by a person with a relevant qualification as having intellectual, sensory, physical, social/emotional, or multiple impairments. These students satisfy the criteria for enrolment in special education services provided by the government of the state or territory in which the student is located.

From the outset, it is important to recognise the lack of clarity surrounding definitions, and the continuing controversy about how identification should be proceed. Over the past few years, theorists and practitioners have highlighted the

necessity for definitional changes that reflect contemporary understandings and allow for easier and more consistent identification (e.g., Kavale & Forness, 2000; Scruggs & Mastropieri, 2002). Despite increasing efforts to cope with definitional problems plaguing learning difficulties research (Shaw, Cullen, McGuire, & Brinckerhoff, 1995), there is little consensus in the literature on definitional issues, especially with regard to the role played by intelligence or IQ.

Ambiguity in the literature has been further intensified by the vast number of terms currently applied when discussing students who have problems with literacy and numeracy learning. Such terms include: *students with learning difficulties*, *learning disabilities*, *special needs*, *reading disabilities*, or *dyslexia*; and *students at educational risk*. These terms have been used interdependently, both in the literature and by professionals working in the field. In a review of the current international situation in relation to this issue, Gale (2000) noted:

> Although there have been literally thousands of studies concerned with learning disabilities, particularly focused on primary and secondary education, what the literature generally shows is that researchers are no nearer to a common understanding of what is meant by such terms. (p. 130)

The lack of consistency in terminology and definitions has obvious implications for the integration of research findings. For example, Kassen (2002) identified inconsistencies in definition among 36 Canadian research articles, thereby making comparisons between studies very difficult, if not impossible. As a result, attempts to synthesise empirical research in this field must be carried out with considerable caution, and this has been the case for several decades (e.g., see Chapman, 1988).

Part of the problem with terminology and definition transpires from the heterogenous nature of learning difficulties, as noted by Farrell (1997):

> By their very nature, pupils' difficulties in learning and behaviour are complex. Each child is an individual whose pattern of disabilities is unique. To lump children with similar problems into one category may imply that they should all be taught the same curriculum, in the same way and in the same place. The reality is, of course, quite different. Two children labelled as having specific learning difficulties may in fact require totally different provision and separate teaching programmes. (p. 2)

The selection of studies for this review reflects the heterogeneity of the field and must suffice until more clearly conceptualised definitions are widely employed for identification and classification. Where terms such as *learning disabilities* and special needs were employed in studies incorporated in this review, we have changed the terms to *learning difficulties*, as long as it was evident that the sample fitted into our definition of learning difficulties outlined above.

The Australian Context. The terms used in Australia to describe students with learning problems vary from state to state and from school to school (Jenkinson, 2001; Louden, Chan, Elkins, Greaves, House, Milton, Nichols, Rivalland, Rohl, & Kraayenoord, 2000).

> In some states the term 'students with special needs', or 'students with special education needs' is preferred, or a broader term, such as 'students with disabilities or impairments' (Victoria) is used. Reference to 'special needs' can be confusing, as some authorities (for example, the Australian Capital Territory) use 'special need' to embrace a far

> wider range of need, including cultural or non-English speaking... (Jenkinson, 2001, p. viii)

Despite some state, system, and school differences in Australia, the most frequently used term to describe students with educational problems is *learning difficulties* (Elkins, 2002; Louden et al., 2000). Further, Elkins (2002) noted that Australian State and Territory education systems have generally not differentiated between learning difficulties and learning disabilities, using the former term to cover all students with high incidence learning problems. In Queensland, however, the distinction is recognised:

> Students with learning difficulties are those whose access to the curriculum is limited because of short-term or persistent problems in one or more areas of literacy, numeracy and learning how to learn.
>
> Students with learning disabilities are one small group of students with learning difficulties who, because of the neurological basis of their difficulties, have persistent long-term problems and high support needs in one or more of the areas of literacy, numeracy and learning how to learn. These students do not have generalised intellectual impairments but rather demonstrate idiosyncratic learning styles which are determined by the nature of their specific disorders and inhibit their learning at school (Department of Education Manual – CS-13, 1995).

The Australian National Health and Medical Research Council (NHMRC, 1990) has also made clear distinctions between the two terms, using *learning difficulties* as a generic or umbrella term and *learning disabilities* to refer to a small sub-group within the general field of learning difficulties. The following definitions have been proposed by the NHMRC (1990):

> Learning difficulties is a generic term which refers to the substantial proportion (10-16%) of children and adolescents who exhibit problems in developmental and academic skills. These difficulties are considered to result from one or more of the following factors: intellectual disability, physical and sensory defects, emotional difficulties, inadequate environmental experiences, lack of appropriate educational opportunities.
>
> Learning disabilities refers to the much smaller proportion (2-4%) of children and adolescents who exhibit problems in developmental and academic skills which are significantly below expectation for their age and general ability. The disabilities, which often include severe and prolonged directional confusion, sequencing and short-term retention difficulties, are presumed to be intrinsic to the individual, but they are not considered to be the direct result of intellectual disability, physical and sensory defects or emotional difficulties. Nor do they appear to derive directly from inadequate environmental experiences, or lack of appropriate educational experiences.

Essentially, the definition of learning difficulty provided by DEST is similar to those proposed by the Queensland Department of Education and the NHMRC. Each of the definitions includes those students who have significant problems in literacy and numeracy learning. However, in contrast to the definition provided by NHMRC, this project does not include students with learning difficulties that result from an intellectual, physical or sensory impairment.

Due to the deficiency of consistent and clearly conceptualised definitions in Australia, issues of identification, prevalence, and intervention are complex.

Rivalland (2000) observed that the complexity of definitions makes it very difficult to know whether or not different systems, sectors, and schools are discussing students under the same order when they describe levels of prevalence.

Louden et al. (2000) claim that prevalence rates for learning difficulties as reported by teachers varies between 6 and 30 percent. This estimate, however, is based on an achieved sample of only 377 schools from a national population database of 8199 Australian primary schools (i.e., 46%) that responded to the *Survey of Schools* (Rohl, Milton, & Brady, 2000). Given that this achieved sample represented only a 37.7 percent response rate (from the random sample of 1000 schools invited to participate in the *Survey*), the reported national prevalence estimates are seriously confounded by definitional confusion, sampling constraints, and non-response bias.

Beyond issues of identification and prevalence estimates is the issue of how students with learning difficulties should be assisted. The recent large-scale Australian study commissioned by the Department of Education, Training and Youth Affairs (DEETYA; now DEST), titled *Mapping the Territory* (Louden et al., 2000), reported that 80 percent of schools in their study receive additional funding to support students with learning difficulties. The authors found that most of the funding has been directed to students in the early years of schooling, especially to those experiencing difficulties in literacy. They identified a wide range of literacy programs that have been incorporated into Australian schools, such as *First Steps*, *Reading Recovery*, and *Success for All*. Numeracy programs, however, were found to be much less common (Louden et al., 2000).

Louden et al. (2000) distinguished between three general types of preventions and interventions for students with learning difficulties as follows:

- initial effective whole-class teaching ('first wave' based on the work of Snow et al 1998);
- structured early intervention within and outside the classroom which usually occurs in the second year of teaching ('second wave'); and
- subsequent intervention for children who require on-going support beyond the early years ('third wave').

Related research in New Zealand (Tunmer, Chapman, Greaney, & Prochnow, 2002) applies the 'wave' terminology to beginning readers in schools in this way:

> A cohort of beginning readers in New Zealand schools can be subdivided into three groups, or waves. The first wave comprises children who respond adequately to regular classroom reading instruction. The second wave comprises children selected for Reading Recovery, a nationally implemented early intervention programme designed for children who have failed to benefit from formal reading instruction after 12 months in school. This programme serves 20 to 25% of beginning readers. The third wave comprises children selected for intensive remedial instruction by reading specialists formerly called Resource Teachers of Reading, but recently renamed Resource Teachers of Literacy, or RTLits. These children have not responded adequately to Reading Recovery or to other school-based individualised reading assistance. They fall in the bottom 1 to 2% of a given cohort. (p. 20)

Thus, it is clear that although the proportion of children with learning difficulties has been reported to be as high as 25 to 30 percent, the proportion of children with a learning difficulty who require a 'third wave' intervention is considerably lower. In terms of intervention, however, Louden et al. (2000) found that, compared with the priority given by schools to first and second wave teaching, less emphasis has been given to third wave teaching of students who have difficulties beyond the early years of schooling. This is in spite of research which shows that students who fail to acquire adequate literacy and numeracy skills in the early years fall further behind as they progress through the middle years of schooling (Rohl, House, Louden, Milton & Rivalland, 2000; Hill et al, 1998).

The American Context. Since much of the research in this field has been conducted in the United States, it is important to be aware of the American context. Unlike the situation in Australia, the term learning disability has been widely used in the United States (Chan & Dally, 2002). Kavale and Forness (2000) noted that a variety of American definitions of learning disability have been proposed, but none has emerged as an unequivocal favourite. However, the definition provided in the *Individuals with Disabilities Education Act* (IDEA) is probably the one most frequently employed in current American research:

> The term 'specific learning disability' means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in imperfect ability to listen, speak, write, spell or do mathematical calculations. The term includes such conditions as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. Such term does not include a learning problem that is primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural or economic disadvantage. (IDEA amendments of 1997, PL 105-117)

The IDEA definition is used as a basis for guidelines on the funding of school programs in the United States, although this definition has generally been regarded as problematic in its exclusion of external causes such as environmental, cultural, or economic disadvantage (Elkins, 2002; Sternberg & Grigorenko, 2001). According to this view, therefore, difficulties in learning are considered to be intrinsic to the individual. Notably, this is unlike the situation in Australia, where the classification of learning difficulties includes those experiencing poverty, of non-English-speaking or Indigenous backgrounds, and others with undue problems in learning for reasons that may be unclear (Elkins, 2002).

One diagnostic criteria required in the United States for access to intervention or educational services is the presence of significant discrepancy between intellectual ability (as indicated by IQ score) and academic achievement (Bailey, 2003; Scott, 2004; Sternberg & Grigorenko, 2001). This approach is consistent with the major classification system employed by psychologists world-wide (*Diagnostic and Statistical Manual of Mental Disorders* [4th ed.]; DSM-IV; American Psychiatric Association, 1994), which stipulates that:

> Learning Disorders are diagnosed when the individual's achievement on individually administered, standardised tests in reading, mathematics, or written expression is substantially below that expected for age, schooling, and level of intelligence. The learning problems

> significantly interfere with academic achievement or activities of daily living that require reading, mathematical, or writing skills. (p. 46)

Thus, in contrast to Australia, students in the United States whose scores are low on both IQ and achievement tests are not eligible for funding or extra assistance. As affirmed by Scott (2004), "this makes them doubly disadvantaged as they cannot receive the services that come with being identified as learning disabled" (p. 6). Furthermore, the IQ-achievement discrepancy approach has been criticised in recent years for being unreliable (i.e., difference scores are not easily replicable) and susceptible to a number of statistical artefacts (Scruggs & Mastropieri, 2002; Sternberg & Grigorenko, 2001). Researchers have also found that there are few cognitive differences between students labelled as learning disabled on the basis of a discrepancy between ability and achievement, and those who are low achievers without such a discrepancy (Stanovich & Siegel, 1994). In light of this research, an increasing number of educators in the US are advocating the importance of helping *all* students to learn, not simply those who under-perform on the basis of their supposed potential (Elkins, 2002).

On the other hand, there is some evidence to suggest that intervention outcomes for students with learning disabilities may vary as a function of IQ and/or reading level. For example, Swanson and Hoskyn (1999) examined 180 intervention studies for which sample characteristics (e.g., IQ score, reading achievement level) were reported. An important finding to emerge from this synthesis was a significant intelligence by reading level interaction that was related to the magnitude of treatment outcomes. Notably, Swanson and Hoskyn found that studies which produced the highest effect sizes reported the smallest discrepancy between intelligence and reading (intelligence scores between 84 and 91 and reading scores between 84 and 91) when compared to other studies. Thus, contrary to the expectations of many, the results of this synthesis support the notion that students with a low IQ-achievement discrepancy actually benefit more from intervention programs than students with a high discrepancy.

Consistent with the situation in Australia, the prevalence of learning disabilities in the United States varies considerably from one school to another. For example, Sternberg and Grigorenko (2001) reported that prevalence rates in Connecticut range from 7 percent to 24 percent. The authors further report that identification rates have increased over time. In fact, the number of students identified as learning disabled has grown about 150 percent since 1975 (Bailey, 2003). Likewise, Rohl and Rivalland (2002) observed:

> It is known that many students who are identified and served under the label learning disabilities are a heterogenous group of low achieving students…Most students in early US services for students with learning disabilities were below average in IQ and could be better described as low achievers in reading, and there is no evidence that this situation has changed. Learning disabilities remains within the categories that are included in the Individuals with Disabilities Education Act (US Department of Education), though the proportion designated as learning disabled continues to expand, suggesting that regular teachers refer students they feel need more help than they know how to provide. (p. 46)

The substantial apparent increase in the prevalence of students with a learning disability in the US has led many to question the reliability and validity of the identification process (Lyon, 1996). No doubt, the failure to produce a clearly

conceptualised and generally agreed upon definition of learning disability has given credence to concerns about present-day identification practices (Scruggs & Mastropieri, 2002). However, despite significant shortcomings in definitions employed in this field, a number of other plausible explanations exist for the increasing numbers of students identified with learning disabilities (e.g., environmental changes, air pollutants, food additives). Lyon (1996) observed that, over the past decade, teachers have become increasingly aware that even *mild* deficits in reading and mathematics skills portent significant difficulties in academic learning. As a result, teachers are more inclined to refer students for diagnosis and intervention.

It seems that definitional issues, both in Australian and in the US, continue to be the greatest impediment to identification procedures. The ambiguity and vagueness inherent in many of the existing definitions means that some students may be identified as having learning disabilities when they do not, while others with learning disabilities may be overlooked:

> Depending upon the magnitude of financial incentives and upon unrelated factors (for example, class size, goals for increasing test scores) that often shape the decisions of classroom teachers to refer students with special needs, an individual school district may drastically overidentify or underidentify students with learning disabilities. Therefore, local or national statistics on identification rates for students with LD must be interpreted with caution. (Lyon, 1996, pp. 62-63)

The lack of definitional clarity has implications for the development of effective instructional approaches for students with learning difficulties. Another notable problem is the tendency for educators to adhere to a single philosophical paradigm about the nature of learning (Airasian & Walsh, 1998), which affects their perceptions of the types of instructional approaches that are beneficial for students with learning difficulties. However, as observed by Pressley and Harris (1990), conventional understandings about which strategies are effective are not always supported by empirical research.

Contemporary Understandings of Effective Classroom Practice

Instructional approaches have generated much interest and controversy for several decades, especially in relation to best practice in the literacy domain (Drecktrah & Chaing, 1997; Rankin-Erickson & Pressley, 2000). Two clear theoretical orientations toward reading have provided the foundation for this controversy and the basis of much classroom teaching of reading and writing: (a) explicit code-based instruction, and (b) implicit meaning based or whole language instruction (Mather, Bos, & Babur, 2001) For several decades, whole language has been the predominant teaching approach for early literacy learning (Westwood, 1999).

> Essentially, the whole language approach reflects a constructivist philosophy in which students are viewed as inherently active, self-regulating learners who construct knowledge in developmentally appropriate ways. In the context of the classroom, students read and write self-selected whole texts in a dynamic atmosphere, with very little explicit decoding instruction. (Goodman, 1986, p. 89)

The code-based approach, in contrast, focuses on an awareness of language structure and function that allows students to reflect on and consciously manipulate the language. It includes an awareness of phonemes, syllables, and morphology. It

usually requires a high degree of teacher-centred presentation and evaluation of learning material, with an emphasis on explicit instruction, scheduled practice, and feedback (Westwood, 2001c). The code-based approach is frequently associated with behaviourist teaching approaches, which have been largely discredited, but widely misunderstood.

In Australian and in other Western countries, constructivist teaching approaches have gained widespread popularly. The strongly behavioural approach of the 1960s and 1970s has been tempered by an increasing realisation that students are active contributors to the learning process (Ashman, van Kraayenoord, & Elkins, 1992).

The movement towards constructivist approaches is evident also in the field of learning difficulties:

> Evidence of this is seen in the increase of whole language philosophy and its application appearing in special language professional publications. Special educators have been called to a paradigm shift in the way students with special needs are instructed, specifically supporting a movement to holistic, constructivist ways of teaching, which encompass the whole language approach to reading and writing. (Rankin-Erickson & Pressley, 2000, p. 207)

Although whole language is widely used, there is mounting concern this approach may not be in the best interests of students with learning difficulties. Reviewers such as Stahl and Miller (1989), and Stahl, McKenna and Pagnucco (1994) have emphasised that students with learning difficulties fare worse from whole language approaches than from more traditional code-based approaches. The findings from Stahl et al.'s research are supported by a substantial body of research that has established the effectiveness of explicit code-based teaching practices for students with difficulties in reading (e.g., National Reading Panel, 2000a, 2000b; Carnine, Silbert, Kame'enui, & Tarver, 2004; Hempenstall, 1996; Iversen & Tunmer, 1993; also see Rankin-Erickson & Pressley, 2000).

On the other hand, there is little empirical research that supports the effectiveness of the whole language approach, in part "because whole language theorists and enthusiasts believe conventional scientific analyses are irrelevant and do not accurately assess the competencies that whole language attempts to foster" (Rankin-Erickson & Pressley, 2000, p. 207). In spite of this, there is ample anecdotal account by teachers and parents of positive outcomes of the whole language approach (Harris & Graham, 1996; Meyer, 2003). Advocates of code-based instruction, however, criticise the promotion of a teaching approach that has little empirical support, and draw attention to the extensive evidence establishing the effectiveness of explicit code-based instruction.

Constructivist learning principles have also become dominant in most other areas of the curriculum, such as in mathematics and science. In the domain of mathematics teaching, for example, Westwood (1999) noted that constructivist learning principles have been translated into practice through the *process approach* or *enquiry-based method*, wherein students actively collaborate in solving problems and discussing solutions. In an overview of the contemporary mathematics classroom, Kroesbergen, Van Luit and Maas (2004) observed that:

> students are expected to contribute actively to mathematics lessons by explaining their mathematical reasoning to each other and constructing their own understandings of mathematical concepts. This means that students must listen to the teacher and their peers, be able to explain

> their mathematical reasoning to others, and thereby build their own mathematical knowledge. (p. 234)

In contrast, the mathematics classroom was formerly a place of clear goals and familiar routines:

> Students were expected to learn the basic operations so that they could solve computational problems quickly and correctly. During math lessons, students had to listen carefully as the teacher explained the desired way to solve various types of problems and then work independently to practice the teacher's method until it was automatic…To do well in mathematics, students needed to listen to the teacher, memorise important procedures, and write rapidly. (Baxter, Woodward, & Olson, 2001, p. 529)

Currently, students continue to learn basic computational skills, but spend more of their time and energy on solving problems that are open-ended or that can be solved using different strategies. Whereas traditional practice was achieved by way of regular drills, revision and rote memorisation, constructivists generally assume that students will acquire basic number knowledge and skills through problem solving, enquiry, and discourse. However, some researchers are concerned that these constructivist approaches to mathematics teaching may not be appropriate for students with learning difficulties (Baxter, Woodward, & Olson, 2001; Carnine, Dixon, & Silbert, 1998). These researchers believe that multiple approaches to solving problems can only bring about confusion, and that one simple set of rules is the best approach to teaching these students. Furthermore, Westwood (1999) observed that constructivist approaches cannot guarantee that students will acquire fluency and automaticity with basic number and computation and, therefore, it is dangerous to exclude all forms of explicit instruction.

Most Australian university departments of education currently base their teacher education programs on constructivist views of teaching and learning. For example, Westwood (1999) highlighted the results of a small (N = 24) South Australian study which found that most teachers (79 percent) had been strongly encouraged to use a constructivist approach in their initial teacher-training courses and during in-service programs. Even more notably, 67 percent of the teacher trainees in this study indicated that constructivism was the *only* teaching approach to which they had been exposed in their methodological courses (Westwood, 1999). As emphasised by Westwood (2000b)

> At the same time as constructivist approaches have been promoted, direct teaching methods have been overtly or covertly criticised and dismissed as inappropriate, with the suggestion that they simply don't work and are dull and boring for learners. The message that most teachers appear to have absorbed is that all direct teaching is old-fashioned and should be abandoned in favour of student-centred enquiry and activity-based learning. (p. 5)

Given that constructivism is currently the prevailing theoretical model of how learners come to know, it is useful to provide an overview of its basic principles together with a consideration of its appropriateness as a foundation for teaching students with learning difficulties.

Basic Principles of Constructivism. The essential element in constructivism is that the learner is an active contributor to the learning process (McInerney & McInerney, 1998). Constructivist approaches to teaching and learning focus as

much on what the student can bring to the learning situation as on what is received from the environment (Casey, 1994). Constructivism has its origins in the work of J. Piaget and L. Vygotsky and in Ausubel's assertion (1968) that "the most important single factor influencing learning is what the learner already knows" (p. 332). The role of the teacher is to be a facilitator of learning (rather than a director), and to provide opportunities for individual learners to acquire knowledge and construct meaning through their own activities, and through discussion, reflection, and the sharing of ideas. While there are differing interpretations of constructivism, Vermette and Foote (2001) identified several tenets most commonly promoted:

1. Students are expected to learn subject matter by organising it themselves and developing their own personalised meanings;
2. Constructivist practice requires individuals to unite prior and new knowledge and engage in the classroom-wide conversation/dialogue necessary for internalisation and deep understanding;
3. There is a recognition that knowledge is created by people and influenced by their values, cultures, and prior experiences and therefore diversity plays a major role in the stimulation of thinking; and
4. The philosophy is manifested in instructional practice by activities such as problem-based learning, dialogues, and authentic assessment.

Vermette and Foote's summary of the major tenets of constructivism highlights the problematic nature of constructivism as a foundation for teaching students with learning difficulties. For instance, the first tenet assumes that students are able to organise subject matter. However, the research literature is replete with evidence suggesting that low performing students have substantial problems in organising learning materials (e.g., Snow, 1992; Wong & Wilson, 1984). Additionally, and in relation to the second tenet, students with learning difficulties are characterised as having problems linking previous knowledge with new knowledge (e.g., Borkowski, Estrada, Milstead, & Hale, 1989).

The four tenets presented by Vermette and Foote (2001) provide a foundation for the basic principles of teaching and learning processes associated with constructivism. However, these tenets have been emphasised in different ways, resulting in various degrees or types of constructivism. For example, constructivism is commonly divided into three broad categories: *exogenous* constructivism, *endogenous* constructivism, and *dialectical* constructivism (e.g., Moshman, 1982; Bruning, Schraw, Norby, & Ronning, 2004).

Exogenous constructivism emphasises the external nature of knowledge, whereby learning or knowledge acquisition is a process of building accurate internal models or representations of external structures that reflect 'the way things really are' in the world. On the other hand, endogenous constructivism emphasises the internal nature of knowledge. From this perspective, knowledge is not an accurate representation of external reality, but rather is an internally coherent and coordinated collection of processes and structures that provide for adaptive behaviour. Finally, dialectical constructivism lies somewhere between the transmission of knowable reality of the exogenous constructivists, and the discovery of personal/relativistic reality of the endogenous constructivists. Dialectical constructivism denotes that knowledge is the result of the *interaction* between the learner (internal) and the environment (external).

A fundamental difference between exogenous and other constructivists relates to the role of the teacher. Exogenous theorists propose that direct teaching, feedback, and explanation affect learning. Endogenous theorists, on the other hand, believe that exploration and discovery are more important than teaching. Thus, endogenous theorists perceive the teacher's role as one of simply assisting performance and the construction of knowledge, rather than explicitly providing knowledge and information.

Proponents of constructivism, and thus advocates of the whole language approach in literacy and the enquiry-based approach in numeracy, tend to discredit explicit, systematic teaching of skills. This applies especially to those skills associated with mastering the code in reading and acquiring basic computational skills in mathematics. Harris and Graham (1996) observed that to some constructivist advocates, "*teaching* is a dirty word" (p. 27). They believe it is neither necessary nor desirable to teach explicitly, provide direct explanation, or require practice. However, such a view reflects a less than perfect understanding of the nature of constructivism, and appears not to be in the best interests of children with learning difficulties, who may require substantial amounts of explicit teaching and scaffolded practice.

In Australia, as in other countries, many educators have embraced the rise of constructivist-based approaches to teaching and learning. Although these approaches may be ideal for achieving certain educational outcomes, it is imperative that educational practitioners, policy makers, and researchers make a commitment to the promotion of evidenced-based educational practices (Borman, Hewes, Overman & Brown, 2003). In this respect, the evidence appears not to be strong for the use of constructivist approaches to the teaching of students with learning difficulties when constructivism is narrowly defined as students constructing their own knowledge. Constructivism comes in many forms and can include the provision by teachers of explicit instruction to help students acquire specific knowledge and skills necessary for successful literacy and numeracy learning. As observed by Joyce, Calhoum and Hopkins (1997):

> At first, when people create or find a new model of teaching that works for some purpose, they're so thrilled they try to use it for everything. Our job is to provide some order, --findings out what each model can do and building categories to help folks find the tools they need. (p. 17)

This assertion corresponds with the purpose of the present report, which is to review existing local and international evidence-based research findings in an endeavour to identify effective interventions and teaching practices for students with learning difficulties. Before these findings are presented, however, the procedures employed to select the relevant literature for this report are outlined, along with methodological issues pertinent to this field of research.

Summary

In the preceding sections, we have provided an overview of several important issues that must be borne in mind when we interpret the research literature on teaching approaches for students with learning difficulties. These issues relate to the definition, identification, and prevalence rates of students with learning difficulties as well as to current educational philosophies (e.g., constructivism) that guide the pedagogical practices of teachers. The lack of clarity in definitions has an influence on just *which students* are identified as having a learning difficulty. In turn, this affects our ability to establish *how many students* have significant difficulties in

literacy and numeracy so that appropriate resources can be deployed to best meett their learning needs.

Approaches to Reviewing the Literature

There are several approaches to synthesising research in a nominated area, each with its own inherent limitations—the traditional research review, the vote-counting method, and meta-analysis.

The Research Review. The standard way of dealing with a multiplicity of studies and divergent findings is commonly known as a *literature review* or *research review*. Based on their reading of many studies in an area, researchers make 'informed' judgements about the direction in which the evidence is pointing.

There are a number of inadequacies of the traditional literature review. First, although a research review article can offer a handy list of findings in an area, it cannot systematically integrate or cumulate findings in a methodologically rigorous manner. Hunt (1997) cites the following stringent criticism to illustrate the unsystematic, subjective, and armchair approach that is the hallmark of the research review article.

> Too often, authors of traditional review articles decide what they would like to establish as the truth either before starting the review process or after reading a few persuasive articles. Then they proceed to defend their conclusions by citing all the evidence they can find. The opportunity for a biased presentation is enormous, and its readers are vulnerable because they have no opportunity to examine the possibilities of biases in the review. (Chalmers & Lau, 1994, cited in Hunt, 1997, p. 7)

A typical finding from a traditional literature review may be characterised as follows: "Whereas Jones and Smith found that strategy X was more effective than strategy Y for teaching reading to children with learning difficulties, Brown found the reverse to be the case. Furthermore, two studies by Carter indicated that there was no significant difference in the reading outcomes of students exposed to either strategy X or strategy Y." An obvious deficiency of such assertions is that the reader is not provided with any evidence to evaluate either the conceptual or methodological validity of the cited research, or the relative effect magnitudes.

The Vote-Counting Method. In the vote-counting method, researchers sort studies into piles for and against nominated interventions, (procedures, techniques, approaches, circumstances) and draw conclusions based on the biggest pile. A typical outcome of such an approach in the area of this current review would be a statement along the lines of "the majority of studies support the effectiveness of 'X' as a strategy for improving the educational outcomes of children with learning difficulties".

Critics of this method point out that every study counts as much as every other, even though one might be based on ten cases and another on 10,000 cases. Furthermore, there is usually little regard given to the varying strengths of results across different studies. A modified example presented by Hunt (1997) illustrates this point. One study might show that 26 students benefited from an intervention whereas 24 did not; that would put it in the positive pile. Another study might show that 20 benefited and thirty did not; that would put it in the negative pile. The issue is that the second study reveals a more strongly negative effect than the first study does a positive one, but the vote-count overlooks this fact. A final criticism of the vote-counting method is that it does not measure the size of the effect

reported in the studies. Even if a conclusion is correctly reached that the studies indicate a positive effect for an intervention, vote-counting cannot indicate whether this is a substantial or trivial effect.

Meta-analysis. Meta-analysis is a procedure to synthesise the findings across many studies in an area, assess the effects of various moderators, and ascertain the major sources of variability in the program effects. The results of individual studies are converted to a standardised metric or effect size expressed in standard deviation (SD). The scores are then aggregated across the sample of studies to yield an overall estimate of effect size. Particular attention is given to the magnitude of the effect size. Cohen (1988) suggested that .80 could be considered a large effect size estimate, .50 a moderate estimate, and .20 a small estimate, although he cautioned that such interpretations are broad and need to be interpreted in light of methodologies used (e.g., length of treatment) and field of study. Larger effects are more commonly found in sociology, economics, and in experimental or physiological psychology research than in personality, social, and clinical psychology research. In education, the typical effect of intervention is small to moderate. Effect sizes of .80, .50, and .20 mean that the score of the average person in the experimental group exceeds the scores, respectively, of 79, 69 and 58 per cent of the control group.

As a research methodology, meta-analysis has both benefits and limitations. The benefits of meta-analysis include the ability to improve the power of small or inconclusive studies to answer questions, and the ability to identify sources of diversity across various types of studies. A rigorously conducted meta-analysis may reveal how heterogeneity among populations affects the effectiveness of interventions in different settings and with different individuals (e.g., boys/girls, primary/secondary school students). It can also help detect biases, such as publication bias (the reluctance of authors and publishers to present and accept negative results for publication), as well as deficiencies in the design, conduct, analysis, and interpretation of research. In terms of limitations, meta-analysis cannot improve the quality or reporting of the original studies. Other limitations come from misapplications of the method, such as when study diversity is ignored or mishandled in the analysis or when the variability of populations, the quality of the data, and the potential for underlying biases are not addressed. Meta-analysis has promoted the sense that obtaining evidence is a global enterprise and that complete information needs to be evaluated and synthesised to obtain the most unbiased results. Analysing sources of bias and diversity is essential to performing, understanding, and using meta-analyses in any field of research.

Methodological Issues

Whatever the approach to reviewing the findings of research, and in whatever field, there are methodological issues about which reviewers need to be alert. Some of these issues are particularly pertinent to reviews of interventions for students with learning difficulties, and are briefly mentioned here.

First, researchers often fail to partial out methodological artefacts from intervention effects, thus making comparisons between the various approaches severely compromised. A significant problem concerns the procedures employed to classify the types of interventions used in the studies reviewed. Frequently, there is an over-reliance on labelling interventions or teaching approaches according to the manner in which they were labelled by the primary author rather than coding the actual procedures and components of instruction reported by the authors. For

example, in their meta-analysis of experimental intervention research on students with learning disabilities, Swanson and Hoskyn (1998) noted:

> The authors based their classification treatments on the hypothesis of the primary study, as well as key words in the introduction, abstract, and title of each article related to the treatment of choice. This is problematic, because the distinction between various treatments may be more artificial than real. (p. 279)

One of the most striking design problems in learning difficulties research has been the use of one-group pre-post designs. Threats to internal validity, including history, maturation, and regression-to the-mean effects, are likely to make one-group pre-test designs among the weakest (Cook & Campbell, 1979). Further, empirical results from a meta-analysis of school reform models by Borman et al. (2003) illustrate that studies using a one-group pre-test post-test design typically produce significantly larger effect sizes than studies employing control groups. Researchers have also pointed out that testing conducted immediately after an intervention can distort students' responses. Marsh, Richards and Barnes (1986) discussed the phenomenon of "post-group euphoria" (temporary elation at the end of a program or study), which can inflate post-test scores. As a result, Marsh et al. (1986) stressed the imperative of collecting follow-up data to examine whether initial intervention effects are maintained over time.

Another methodological problem has been the failure to assign students randomly to experimental and control conditions. For example, Lysynchuk, Pressley, d'Ailly, Smith and Cake (1989), in their evaluation of the methodological adequacy of 37 studies of reading comprehension strategy instruction, found that randomisation of students to experimental and control conditions occurred only 64 percent of the time. Consequently, any cause-and-effect conclusions were compromised in more than a third of the studies under review. Lysynchuk et al. (1989) also identified important measurement shortcomings in these studies. Only slightly more than a third of studies on reading comprehension strategy instruction included reliability information about the instrumentation or else employed instruments with easily obtainable, published reliability information. Furthermore, they found either a ceiling effect or a floor effect for at least one mean performance score in a third of the studies reviewed.

Tunmer et al. (2002) highlighted a conceptual issue that has major implications in reviewing the literature on learning difficulties intervention research. These researchers noted, "In the past, research on learning and learning difficulties has been hindered by the failure to distinguish the question of how children learn from the question of how children should be taught" (p. 12). The first question relates particularly to the characteristics of students, whereas the second relates more to the characteristics of interventions.

Intervention characteristics are as important as sample characteristics when assessing intervention effectiveness. A particularly important intervention characteristic to take into account when assessing outcome effects is the extent to which an intervention has been implemented (sometimes known as treatment fidelity). In non-experimental research, it is more difficult to control for teacher effects, with the possible outcome that one teacher will be more rigorous than another in implementing a particular program, strategy, or approach. This difference holds both within and across studies. In addition, with respect to the characteristics of an intervention, Tunmer et al. note that there is an unacceptably

large number of children who struggle to learn to read as a consequence of instructional approaches based on incorrect assumptions about the nature of the reading acquisition process. Such incorrect assumptions apply similarly in other areas of student learning, and often can be traced to inappropriate or incorrect application of constructivism in the classroom.

When the effect of an intervention is assessed without consideration of sample characteristics and sample heterogeneity, findings will have limited usefulness for practitioners. For instance, students who have specific learning difficulties who also have comorbid disorders such as attentional or behavioural problems may require different types of intervention from children without these disorders. Similarly, students' motivational and attitudinal characteristics will interact with the effectiveness of an intervention; so, too, will their entry skill levels, and degree of support received in the home environment (Tunmer et al., 2002).

One contentious so-called student characteristic is that of learning style. The notion that students have fixed, biologically determined preferences for the ways in which they learn that should be used as the foundation for teaching has been commonly promoted. However,

> …the available scientific research on learning style as a fixed and readily measurable characteristic of students provides no support for the idea that assessing children's learning styles and matching to instructional methods significantly influences their learning. (Tunmer et al., 2002, p. 16)

With respect to reading interventions, Tunmer et al. note the ineffectiveness of modality matching when we consider that both decoding and whole word methods of reading instruction pose both visual *and* auditory processing demands. Thus, teaching to only one modality will seriously disadvantage all beginning readers, but in particular students with learning difficulties, who generally find it more difficult to adjust their actions to a required task. Indeed, reviews of the modality matching and learning styles research have revealed no evidence to support such approaches (Forness, Kavale, Blum, & Lloyd, 1997; Snider, 1992; Stahl & Kuhn, 1995; Tarver, 1996).

Research reviewers need also to take account of differences between studies in terms of intervention duration, follow-up, and maintenance effects. Generally, it is assumed that interventions that occur over an extended period of time produce larger effects than those that are short-term. Various models of educational productivity, however, suggest that the effects of programs on academic performance follow a law of diminishing returns (e.g., Hattie, 1992; Walberg, 1996). That is, interventions of shorter duration have greatest initial impact and a reducing impact over time. Whether this holds for interventions for students with learning difficulties has not been thoroughly tested but it is an important consideration in comparing the effects of various interventions. Furthermore, in assessing the effects of interventions, we should assume a concern with lasting effects rather than those that are immediate but transient. If assessment does not involve follow-up, then it is difficult to claim that students have benefited from an intervention. Results may simply reflect a halo effect that fades with time and has no lasting impact on students' subsequent learning outcomes.

In conducting the current review of the literature on interventions for children with learning difficulties, we have been mindful of the issues discussed above concerning approaches to synthesising research findings, and the potential

methodological problems faced by reviewers. Time and cost factors prevented the conduct of a quantitative synthesis (meta-analysis) of research that offers empirical findings of effective interventions for children with learning difficulties. To compensate, the present review focuses a great deal of its attention, though not exclusively, on well-designed meta-analyses which (a) partialled out methodological artefacts from the effect sizes, and (b) based their classification procedures on the actual procedures and components of instruction used in the study.

Method

Procedures in Searching the Literature

To identify a broad range of studies, computer searches were conducted in the ERIC, PsychINFO, Professional Development Collection, and AEI databases from 1990 to 2004. Several key words and terms were used to locate studies, such as *learning difficulties*, *learning disabilities*, *reading difficulties*, or *at risk* paired with variations of *approaches*, *interventions*, *treatments*, *instruction*, *meta-analysis*, *synthesis*, *primary school,* and *elementary school.*

We used a number of criteria to select articles. The research:

1. Pertained to students experiencing difficulties in academic learning as per our discussion in the introductory section of this report. This concerned students with *learning difficulties* or *learning disabilities*, but excluded those with other forms of *disability* (such as physical or sensory impairment).
2. Included students of school age;
3. Was classroom based (i.e., not home-based or provided by psychologists, psychiatrists, paediatricians, or other health professionals). This includes both experimental interventions and research on teachers' regular classroom practice;
4. Pertained to literacy and/or numeracy; although some studies also reported findings in other areas such as science; and
5. Was data-informed and was not purely theoretical or speculative in nature.

After eliminating studies that did not meet these criteria, we were still left with a very large pool of studies. In order to access the literature in a convenient and economical way, we relied heavily on previous syntheses/meta-analyses conducted in the past decade (e.g., Billingsley & Ferro-Almeida, 1993; Borman, Hewes, et al., 2003; Camilli, Vargas, & Yurecko, 2003; Clark, 1996; Forness, 2001; Kroesbergen & Van Luit, 2003; Mastropieri, Scruggs, et al., 1996; Swanson, 1999, 2001; Swanson & Carson, 1996; Swanson & Deshler, 2003, Swanson & Hoskyn, 1998; 2001; Vaughn, Gersten, et al., 2000; Weinstein, Bray, et al., 2004). These reviews were supplemented by a selection of research reports. Selections were made by the informed judgements of research team members on the basis of their particular expertise in the field of learning difficulties. In addition, we consulted with other researchers in the area. The research reviewed was reported in a variety of formats, including journal articles, book chapters, reports, and dissertations. A considerable portion of learning difficulties research has been conducted in the reading domain and this is reflected in the studies incorporated in this review.

Effective Teaching Practices for Students with Learning Difficulties: A Review of the Literature

Due to the heterogeneous nature of learning difficulties, it is clear that no general or single teaching approach can be recommended for all students experiencing difficulties in literacy and/or numeracy learning (Swanson, 2001; Swanson & Deshler, 2003). However, certain teaching approaches have emerged in the empirical literature as promising for a considerable portion of this population (Swanson & Deshler, 2003; Vaughn, Gersten & Chard, 2000). This review summarises the critical findings of contemporary research and identifies general teaching approaches that underlie many of the effective intervention programs for students with learning difficulties. Evidence pertaining to the particular components or activities that characterise highly effective instructional approaches is presented. We conclude the review with a discussion of the implications for the development of professional development activities for teachers that support their work with children with learning difficulties.

Key Findings from Research Syntheses

Contemporary reviews of the literature and meta-analyses of research indicate that considerable progress has been made in uncovering key general teaching practices that underlie effective instruction for students with learning difficulties. A summary of findings from several of the most recognised meta-analyses conducted in this field is presented in Table 1.

Of the results reported in this table, perhaps greater confidence can be placed in the research findings of Swanson and colleagues because of the stringent criteria used for inclusion of studies in their meta-analysis. For example, the researchers required that the studies (a) include at least one between-instruction comparison condition (i.e., control condition) or within-design control condition (e.g., repeated measures design), and (b) focus on an extended treatment, rather than on an experiment with a single training session followed by an evaluation. Further, no other meta-analyses have considered intervention research across a broad range of academic domains, nor have they controlled so stringently for methodological artefacts.

Swanson, Carson and Sachse-Lee (1996) conducted a meta-analysis of 78 intervention studies with samples of children and adolescents (aged 6 through 18 years) with learning difficulties. Studies were classified into one of four general instructional approaches: *therapeutic* (approaches not directed specifically to academic skills), *remedial* (e.g., one-to-one tutoring of core subjects), *direct instruction* (teacher-directed lecture, discussion and learning) or *strategy instruction* (teaching techniques, principles or rules that enable students to learn, and to solve problems and complete tasks independently). The reported mean effect size scores were 0.59 for the therapeutic approaches, 0.68 for remedial instruction, 0.91 for direct instruction, and 1.07 for strategy instruction (see Table 1). Accordingly, Swanson et al. concluded that higher effect sizes emerged for direct and strategy instruction than for the two other approaches. The authors also found no significant differences in effect sizes across targeted domains (e.g., reading, mathematics, spelling).

Table 1. *Summary of results from seven meta-analyses of interventions for students with learning difficulties*

Author/s	Academic Domain	Teaching Approach	ES	N
Swanson, Carson & Sachse-Lee (1996)	General	Strategy instruction	1.07	44
		Direct Instruction	.91	8
		Remedial Instruction (approaches not directed specifically to academic skills)	.68	36
		Therapeutic	.59	17
Swanson and Hoskyn (1998)	General	Direct instruction	.68	47
		Strategy instruction	.72	28
		Direct instruction and Strategy instruction combined	.84	55
		Non Direct and Non Strategy Instruction	.62	43
Forness (2001)	Mostly literacy	Mnemonic Strategies (e.g., keyword, pegboard, or acoustic representations)	1.62	24
		Reading-Comprehension Strategies (e.g., strategy training, visual representations, or organisational cues)	1.13	????
		Direct Instruction	0.84	25
		Formative Evaluation (Charting or graphing of discrete units of progress, e.g., number of words read correctly each day)	0.70	21
		Computer-Assisted Instruction	0.52	18
		Peer Tutoring	0.46	19
		Word-Recognition Strategies	0.57	54
Jitendra, Edwards, Sacks, & Jacobson (2004)	Literacy (Vocabulary)	Keyword or Mnemonic Strategies	1.93	5
		Cognitive Strategy Instruction	1.10	10
		Direct Instruction	9.78	3
		Constant Time Delay (i.e., instructor presents a vocabulary word and immediately states the definition)		1
		Activity-Based Models	0.45	1
		Computer Assisted Instruction	0.16	2
Mastropieri, Scruggs, Bakken, & Whedon (1996)	Literacy (Reading comprehension)	Self Questioning (e.g., comprehension monitoring and questioning, activating prior knowledge, summarisation, and prediction)	1.33	67
		Text Enhancement (e.g., text manipulations, adjunct aids, representative and mnemonic pictures and graphic organisers)	.92	81
		Skills Training (vocabulary instruction, decoding skills, and fluency skills)	.62	50
		Direct Instruction	.81	4
		Process Training	1.22	1
Kroesbergen & Van Luit (2003)	Numeracy	Direct Instruction	0.91	35
		Self-Instruction	1.45	16
		Mediated/Assisted	0.35	10
Baker, Gersten & Lee (2002)	Numeracy	Direct Instruction	.80	2
		Problem solving Strategies	.55	2
		Peer Tutoring/Peer Assisted Instruction	.62	9

In a subsequent meta-analysis, Swanson and Hoskyn (1998) reclassified the four approaches (strategy instruction, direct instruction, remedial instruction and therapeutic) into (a) a combined strategy instruction and direct instruction model (referred to as the combined model), (b) direct instruction alone, (c) strategy instruction alone, and (d) no strategy or direct instruction. The results of this meta-analysis involving 180 intervention studies were supportive of the pervasive influence of strategy and direct instruction models for addressing the academic difficulties of students with learning difficulties. A comparison of these four approaches resulted in the finding that the effect size was largest for the combined model (ES = .84; compared with effect sizes of .68, .72, .62 for direct instruction, strategy instruction, and no strategy instruction or direct instruction, respectively) (see Table 1). It is important to note that the effect sizes were not the same in this study as in the earlier study of Swanson et al. (1996), largely because the authors based their analysis on 180 intervention studies compared to the 78 studies incorporated in their earlier synthesis.

In addition to meta-analyses by Swanson and colleagues, the results from several other meta-analytic studies on interventions for students with learning difficulties are also presented in Table 1. We have excluded results of interventions involving mental-health services such as psychotherapy and stimulant medication, and have presented only results pertaining to general teacher practices.

Forness (2001) summarised the results of 24 meta-analyses concerning special education provision that were published between 1979 and 1999. Consistent with the research findings of Swanson and colleagues, Forness found that mnemonic strategies (ES = 1.62), reading-comprehension strategies (ES = 1.13), and direct instruction (ES = 0.84) were the most effective teaching approaches for students with learning difficulties (note that mnemonic and reading-comprehension strategies were classified as strategy instruction in Swanson's aforementioned research).

More recently, Jitendra, Edwards, Sacks, and Jacobson (2004) provided a summary of findings of 19 studies on vocabulary instruction involving students (aged 9 through 16 years) with learning difficulties. As shown in Table 1, the highest effect sizes were 1.93 for keyword/mnemonic strategies, 1.10 for strategy instruction, and 9.78 for direct instruction. However, in comparison to other meta-analytic studies involving students with learning difficulties, Jitendra et al. provide little clarity in their description of what approaches were being compared (e.g., direct instruction compared with regular classroom practice). For instance, they reported "in three group design investigations…as direct instruction of word definitions increased, students' performance on vocabulary measures improved" (p. 316), as indicated by an effect size of 9.78. However, here it is not clear which approaches are being compared. Furthermore, this very large effect size is questionable given that the SD was 12.97 and it was obtained from only three studies in which the total number of students involved was not reported.

Mastropieri, Scruggs, Bakken, and Whedon (1996) presented the results of a meta-analysis of 68 studies on reading comprehension published between 1976 and 1994. The purpose of the meta-analysis was to discern significant trends in the teaching of reading comprehension to students with learning difficulties. The age of students in this meta-analysis ranged from 8 to 17 years. The largest effect sizes for students with learning difficulties occurred for interventions under the rubric of strategy instruction (self-questioning, ES = 1.33; and text enhancement, ES = .92). These

authors also reported a strong effect size for direct instruction (ES = .81), although they noted that this effect size was based on only four studies.

Comparatively fewer meta-analyses have been conducted in the numeracy domain. However, a summary of the results from two well-regarded meta-analyses of mathematics interventions for students with learning difficulties is presented in Table 1. Kroesbergen and Van Luit's (2003) meta-analysis involved 58 studies involving primary school students (aged 5 to 12) with learning difficulties. Each of the studies was classified into one of three general instructional approaches: direct instruction, self-instruction (teachers provide students with verbal prompts/routines to help students 'walk' through a problem), and mediated/assisted instruction (students discover and develop their own math skills, with the assistance of a teacher) (see Goldman, 1989, for further information on these categories of instructional approach). Overall, this meta-analysis showed that direct instruction (ES = 0.91) and self-instruction (ES = 1.45) produced significantly higher effect sizes than mediated/assisted instruction (ES = 0.34) (see Table 1).

Baker, Gersten and Lee (2002) employed meta-analytic techniques to synthesise the findings of 15 intervention studies designed to improve the mathematics achievement of students with learning difficulties. These studies included students in Grades 2 through 11. Although the number of studies included in this meta-analysis can be considered rather small, the quality of the studies is generally high. The results of this research identified a small body of research elucidating the especially strong effects of direct instruction for students with learning difficulties (ES = .80). Their research also demonstrated that the provision of both peer tutoring (ES = .62) and instruction in generic problem solving strategies (ES = .55) has moderately positive effects on students' mathematical achievement. In contrast, the overall effect for contextualised approaches (whereby the teacher serves primarily as a facilitator as students work through real-world examples of mathematical concepts and engage in discussions of alternative solutions to problems) approximated zero (ES = .01). As a result, Baker et al. (2002) concluded that "low achievers seem not to do well at authentic problem solving and discussion of mathematical concepts without solid preparation in the underlying mathematical foundations" (p. 68).

Before proceeding further, it is important to recognise a significant issue in relation to the classification of intervention approaches and teaching practices. The meta-analyses presented in Table 1 clearly show the disparate classification systems employed by researchers to synthesise intervention research in this field, thereby reflecting a fragmented conceptualisation of the various instructional approaches and practices. Part of the difficulty in classification transpires from the overlap in components that make up the general teaching approaches, as observed by Swanson (2001):

> Strategy instruction and direct instruction have many commonalities. Both approaches involve the active presentation of information, clear organisation, step-by-step progression from subtopic to subtopic, use of many examples, demonstrations, and visual prompts…Clearly, however, there are differences in focus…strategy interventions focus on routines and planful action and/or general principles of handling information, whereas direct instruction focuses on isolated skill acquisition to support higher-order processing…Thus, although direct instruction has been associated with the behavioral paradigms, cognitive paradigms use some of the same procedures. (p. 12)

Direct Instruction and Strategy Instruction

The results in Table 1 clearly demonstrate that teaching approaches based on direct instruction and strategy instruction produce positive effects for students with learning difficulties. What follows is a brief explication of the terms *direct instruction* and *strategy instruction* as they are interpreted in this review, and an examination of additional research supporting the pervasive influence of these two instructional approaches for addressing the academic needs of students with learning difficulties.

Direct Instruction

Direct instruction (sometimes referred to as explicit or systematic instruction) is based on the theory that learning can be greatly accelerated if instructional presentations are clear, rule out likely misinterpretations, and facilitate generalisations (Northwest Regional Education Laboratory, 2003). The principles upon which this approach is based include: (a) all children can learn; (b) the teaching of basic skills and their application in higher-order skills is essential to intelligent behaviour and should be the main focus of an instructional program; and (c) instruction with students with learning difficulties must be highly structured and permit large amounts of practice (Block, Everson, & Guskey, 1995; Engelmann, 1999). Individual differences are allowed for through different entry points, reinforcement, amounts of practice, and correction strategies (Hempenstall, 1996, 1997).

The direct instruction approach to teaching is skills-oriented and teacher-directed. It emphasises the use of small group instruction, and clearly articulated instructions. Cognitive skills are broken down into small units, sequenced deliberately, and taught explicitly. Lesson goals are clear to students; time allocated for instruction is sufficient and continuous; content coverage is extensive; student performance is monitored; questions are at a low cognitive level and produce many correct responses; and feedback to students is immediate and academically oriented. In direct instruction, the teacher controls the instructional goals, chooses material appropriate for the student's ability level, and paces the instructional episode (see Carnine, Silbert, Kame'enui, & Tarver, 2004, p. 11; Rosenshine & Berliner, 1978, p.7).

Direct Instruction in Practice

Proponents of direct instruction assume that all children can learn. Thus, failure in student learning is seen as a deficiency in teacher instruction. The goal of direct instruction is to develop 'faultless instruction' (Engelmann, 1980), that is, sequences or routines for which there is only one logical interpretation. The approach is student-centred (Veenman, Denessen, van den Oord, & Naafs, 2003) to the extent that it is characterised by explicit performance expectations, systematic prompting, structured practice, monitoring of achievement, and the provision of reinforcement and corrective feedback (Jones, Wilson & Bhojwani, 1997). Lessons follow a prescribed model-lead-test format, whereby the teacher first models a strategy, and guides the students through examples. After students are able to respond correctly on several prompted trials, they are urged to commence independent practice. Typically, lessons close with a review of what was learnt during the lesson, as well as a brief preview of the instructional objectives for the next session. These teaching practices are not content specific and can be applied to any curriculum and any instructional strategy (Stein, Carnine & Dixon, 1998).

The most salient features of direct instruction programs include the following:

1. *Teach the essentials*. The essentials are determined from task analysis, whereby the specific skills needed to accomplish certain tasks are identified. These skills are taught to students in an explicit, step-by-step manner. Direct instruction is founded on the principle that proficiency in reading and mathematics can be achieved by analysis and teaching of sub-skills in a cumulative framework. However, advocates of a whole language perspective disagree with the possibility, or desirability, of teaching in this way (Hempenstall, 1996).
2. *Small groups*. Direct instruction lessons are typically taught with groups of five to ten students. The approach assumes that small group instruction is more efficient than one-to-one instruction and provides the opportunity for more adult direction, attention, feedback, and individualisation than large group instruction (Binder & Watkins, 1990). Students are often grouped on the basis of ability, which allows students with advanced skills to progress quickly and less advanced students to receive the extra help and practice they need.
3. *Rapid Pacing*. Lessons are characterised by rapid pacing and choral group response punctuated by individual turns. This approach is based on the assumption that student with learning difficulties can catch up with their peers if they are provided with more, not less, teaching that involves the efficient use of technology and time (Cotton & Savard, 1982). Advocates of this approach have highlighted that even if students with learning difficulties are taught with effective instruction that results in their gaining at the *same* rate as their peers, they will always remain behind. Only by teaching students with learning difficulties at a *faster* than average rate can the gap be closed.
4. *Practice and Drill*. Teachers guide student practice by providing prompts, checking for understanding, and providing corrective feedback. The amount of practice decreases as the relevant skill is incorporated into more complex skills. In addition, teachers provide students with written exercises for independent practice (Veenman et al., 2003). Students are encouraged to practice a given task until mastery is attained (Hempenstall, 1996).

One feature that is sometimes associated with direct instruction is scripted presentation of lessons to control the quality of instruction. Such scripting occurs in the context of many published programs that are characterised by the use of upper-case type (Direct Instruction or DI) to distinguish them from generic application of direct instruction principles. In DI, particular examples and lesson sequences are designed to maximise learning and minimise confusion, and are field tested before widespread use of a program. DI program developers recognise that most teachers have limited training in instructional design and thus are unlikely to select and sequence teaching examples effectively without explicit instructions. It is assumed that without guidance, teachers may use language that students do not understand or that distracts students' attention from examples. As a result, DI is based on the view that teachers are more likely to use effective instructional sequences when given explicit scripts for using field-tested procedures (Binder & Watkins, 1990).

According to Carnine, et al. (2004) DI "is represented most clearly and extensively in instructional programs authored by Engelmann and published by SRA/McGraw-Hill" (p. 11) One of the most comprehensive, self-contained series of DI programs is DISTAR (Direct Instructional System for Teaching and Remediation), based on the work of Bereiter & Engelmann (1966). The original

DISTAR program has been revised and renamed Reading Mastery I and II and subsequently expanded through six levels. Further revisions have occurred during the last 25 years. These programs use an explicit phonics approach and emphasise students' ability to apply thinking skills in order to comprehend what they read. Another popular DI program is Corrective Math, designed for students in Grades 4 to 12 who are two or more grade levels below grade placement.

One model of direct instruction that is not associated with a particular commercially prepared program is Chall's (1983) developmental model of reading instruction, summarised in Carnine et al. (2004) in their text on direct instruction on reading. Carnine and colleagues provide sound advice to teachers on the selection of instructional materials, advice that is applicable across both literacy and numeracy domains, and which gives attention to comprehensive core programs, focused core programs, supplementary materials, intervention materials, and computer-based instruction (see Carnine et al., 2004, Ch. 3).

Research on Direct Instruction

Research conducted over the past thirty years has provided considerable evidence to support the efficacy of direct instruction programs in primary schools. Recent meta-analyses of intervention research have found that techniques associated with direct instruction are some of the most effective teaching practices for improving academic achievement, particularly for students with learning difficulties (e.g., Borman et al., 2003; Forness, Kavake, Blum & Lloyd, 1997).

The study by Borman et al. (2003) examined the effects of 29 widely implemented models in primary and secondary schools across the United States. Direct instruction was one of only three models found to have strong positive effects, and benefits were consistent across various school contexts and study designs. The models in this study were evaluated on the basis of a combination of the quantity, quality, and statistical significance of the evidence.

An earlier meta-analysis conducted in Australia by Lockery and Maggs (1982) also supported the benefits of direct instruction programs across a range of populations and in a variety of settings. This analysis consisted of more than thirty studies over a ten-year period and was notable in demonstrating the success of direct instruction for students both with and without learning difficulties. The authors of this study concluded that:

> If Direct Instruction is used appropriately we are finding that there is as yet no ceiling in sight for the progress possible. This applies to maintaining children in the regular classroom, continuing to improve the skills of the more severely handicapped child and in integrating an increasing number of children into effective participation in the regular classroom. There is no other major output of acceptable educational research in Australia that has shown the results obtained by this Direct Instruction research. (Lockery & Maggs, 1982, pp. 286-287)

Direct Instruction Research in the Literacy Domain. There is substantial evidence relating the use of direct instruction to success in the development of phonemic awareness, vocabulary knowledge and word recognition (e.g., Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Swanson, 1999; Wright & Jacobs, 2003). For example, Foorman et al. (1998) investigated the effects of direct instruction on growth in word reading for students with learning difficulties. In this study, 285 Year 1 and 2 students received one of three types of classroom reading programs: direct instruction in letter-sound correspondences practiced in decodable

text (direct code); less direct instruction in systematic sound-spelling patterns embedded in connected text (embedded code); and implicit instruction in the alphabetic code while reading connected text (implicit code). The results of this research showed that students who received direct code instruction improved in word reading at a significantly faster rate and had higher word-recognition skills than those receiving implicit code instruction. Furthermore, 46 percent of students in the implicit code research group and 44 percent of the embedded code group exhibited no demonstrable growth in word reading compared with only 16 percent in the direct code group.

Support also has been found for the benefit of direct instruction in the teaching of reading comprehension (e.g., Foorman et al., 1998; Gardill & Jitendra, 1999; Swanson, 1999; Gersten & Carnine, 1986; Vallecorsa & deBettencourt, 1997). In one study, Gardill and Jitendra (1999) investigated the effectiveness of direct instruction of an advanced story map procedure on reading comprehension performance of six sixth and eight-grade students with learning disabilities. The results of this study found a significant increase in story grammar and basal comprehension from baseline to the independent phase condition of the intervention. In addition, generalisation to a novel passage and maintenance of effects were observed for all students on the story grammar tests and for four students on basal comprehension tests.

Overall, the findings of instructional reading research indicate, however, that direct instruction may be more effective for highly structured reading tasks, such as decoding, explicit reading procedures, and foreign language vocabulary, than less structured tasks, such as reading comprehension, and analyzing literature (Rosenshine, 1986; Swanson, 1999). Swanson's (1999) well-regarded meta-analysis on 54 reading intervention studies with samples of children and adolescents with learning difficulties was conducted in the domains of word recognition and reading comprehension. The results of this synthesis showed that a prototypical intervention study has an effect size of .72 for reading comprehension and .59 for word recognition. Furthermore, the synthesis demonstrated that effect sizes for measures of comprehension were higher when studies included derivatives of both strategy and direct instruction (ES = 1.15), whereas effect sizes were higher for word recognition when studies included direct instruction (ES = .70). Thus, the findings from this study are supportive of the conception that direct instruction is particularly effective for more structured tasks, such as word recognition.

Direct Instruction Research in the Numeracy Domain. Although teaching approaches in mathematics have not been studied extensively, (Swanson & Carson, 1996; van Kraayenoord & Elkins, 2004), recent research indicates that direct instruction may be an effective model for teaching mathematics (Butler, Miller, Lee & Pierce, 2001; Farkota, 2003; Grossen & Ewing, 1994; Kroesbergen & van Luit, 2003; Kroesbergen, van Luit, & Maas, 2004; Miller, Butler & Lee, 1998; Tarver & Jung, 1995). For example, Grossen and Ewing (1994) conducted research on the application of direct instruction to the learning of fractions, decimals and percentages by Year 5 and Year 6 students (n = 58). For this study, students were randomly assigned to either a direct instruction or constructivist treatment condition. The duration of treatment was two years. Notably, this study showed that the performance of students in the direct instruction group was significantly higher than that of students in the constructivist group.

More recently, Kroesbergen, Van Luit and Maas (2004) compared the effects of small-group direct instruction and constructivist mathematics instruction in basic

multiplication on low-achieving students' performance and motivation. This study included 265 students with learning difficulties, aged 8 through 11 years. Students in the experimental conditions received 30 minutes of explicit or constructivist instruction twice weekly for 5 months. The results demonstrated that explicit math instruction was significantly more effective than constructivist instruction, although the latter was still more effective than the control group condition for low achievers in this study.

Strategy Instruction

Learning strategies are strategies used by students to enhance their performance on a given task or tasks. Strategies may be broadly classified as cognitive, metacognitive, or self-regulatory in nature.

Cognitive strategies are strategies that focus on developing or enhancing particular task-related skills, such as underlining, note taking, rehearsing, and summarising. As observed by Pintrich (1999), these strategies can be applied to simple memory tasks (e.g., recall of information, words, or lists) or to more complex tasks that require comprehension of the information (e.g., understanding a piece of text).

Metacognitive strategies are strategies that focus on the self-management of learning, that is, on planning, implementing, and monitoring one's learning efforts, and on the conditional knowledge of when, where, why, and how to use particular strategies in their appropriate contexts (Hattie, Biggs, & Purdie, 1996, Pintrich, 2002).

Similarly, *self-regulation strategies* have been defined in terms of self-generated thoughts, feeling, and actions, which are systematically oriented toward the attainment of students' own goals (Zimmerman and Schunk, 1989).

Alexander, Graham and Harris (1998) observed that although self-regulation and metacognitive strategies have several overlapping features (such as the oversight, monitoring, or control of one's thinking), there are important distinctions. Boekaerts (1996) defined self-regulatory learners as "students who are (meta)cognitively and (meta)motivationally aware of what they are doing and what needs to be done to successfully attain self-defined or set goals" (p. 102). Thus, self-regulation pertains not only to the intentional monitoring or management of one's cognitive performance, but also to the regulation of one's motivational or affective state, behaviour, and social environment. Indeed, Alexander et al. (1998) observed that teachers working with students with learning difficulties have found it critical to teach them how to effectively regulate their motivational and emotional states.

Research clearly demonstrates that students with learning difficulties have problems accessing and coordinating appropriate cognitive strategies to assist their learning (Borkowski et al., 2001). They also have problems in metacognitive and self-regulating mechanisms, such as checking, planning, monitoring, testing, revising, and evaluating during an attempt to learn or solve problems (e.g., see Swanson, 1990). Students with learning difficulties have been found to exhibit deficits in logical organisation and coordination of incoming information that requires them to carry out mental operations (e.g., Swanson, 1988). They perform poorly on a variety of tasks that require the use of general control processes or strategies for solution (e.g., see Pressley & Levin, 1987, for review).

Based on such findings, researchers and practitioners have sought to develop students' ability to use cognitive learning strategies, and to enhance their

metacognitive awareness and self-regulation of the processes of learning. Interventions have been directed at both (a) enhancing students' knowledge base and making them aware of the factors that influence their behaviour; and (b) teaching strategies that will allow students to monitor and coordinate their learning more effectively (van Kraayenoord & Elkins, 1998).

It is widely recognised that strategy instruction is based on a different view of the student than direct instruction. For instance, in the literacy domain, whereas direct instruction "assumes a passive reader who has mastered a large number of subskills and automatically and routinely applies them to all texts…[strategy instruction] assumes an active reader who constructs meaning through the interrogation of existing and new knowledge and the flexible use of strategies to foster, monitor, regulate and master comprehension" (Dole et al., 1991, p. 242). Furthermore, contrary to direct instruction, which is seen to focus primarily upon the acquisition of foundational skills (a "bottom-up" approach), strategy instruction aims to develop students' higher-order cognitive abilities (a "top-down" approach).

Strategy Instruction in Practice

Teaching designed to develop metacognitive awareness and self-regulation typically involves a detailed description of one or more cognitive strategies, explanation of why the strategy should be used, discussion of how the strategy should be applied, and provision of examples of the circumstances under which the strategy should be used (van Kraayenoord, 2004). Some of the instructional components of strategy instruction include modelling by teachers; the provision of step-by-step prompts or multi-process instructions; reminders to use certain strategies or procedures; and the provision by teacher of necessary assistance only (Swanson & Hoskyn, 1998).

Instruction begins with the teacher describing each step of a strategy, providing a rationale for the steps, and discussing how the steps are to be used to cue important thinking behaviours. During the initial stages of instruction, the teacher commences discussion on the parameters of generalisation and the process of enabling students to understand what the strategy is and how it works. The teacher models the strategy using think-aloud, dialectal, and scaffolding techniques and then guides the students through a number of practice examples. Gradually, there is a decrease in teacher control as the students become confident and competent with the strategy. Throughout the teaching process, the teacher directs students to think about instances where the strategy might be used, ways in which they can remember to use the strategy, and how to evaluate if the strategy has been successful (van Kraayenoord, 2004).

Although strategy and direct instruction are based on different underlying philosophies, they share a number of similar techniques (Block, 1993; Dole et al., 1991). Dole et al. (1991) summarised the similarities of and differences between the two approaches as follows:

> Both emphasise explicit cues by teachers about what is going to be learned, guided practice of the to-be-learned material, and application to independent situations. However, there are three major differences. There is no assumption that the strategy will be broken down into componential subskills. The strategy is modelled, practiced, and applied to the whole comprehension task. There is no single correct answer or a single best way to apply a particular strategy. The strategy is modelled in a variety of ways and with different tasks. There is no feedback about the correctness of applying a particular strategy; rather the adaptability and flexibility of strategies are emphasised. (p. 252)

In summary, strategy instruction concentrates more on the learning of generic or global strategies than on the acquisition and retention of specific skills (Dole et al., 1991; Swanson, 1996).

Advocates of the strategy instruction approach have made clear distinctions between learners who are skilful and those who are strategic, explaining that differences pertain to the automaticity of performance and to learner awareness or intentionality (Alexander, Graham, & Harris, 1998). According to this view, strategies are "conscious, instantiated, and flexible plans students apply and adapt" to a variety of tasks, whereas skills are "highly routinized, almost automatic behaviours" (Dole et al., 1991, p. 242).

Some of the most salient features, or the *how*, of strategy instruction are described below.

1. *Present strategy in small steps.* Proponents of strategy instruction have drawn on varying theoretical assumptions about teaching and learning associated with instructional practices, and correspondingly, they vary in the degree to which explicit instruction of task-specific strategies is emphasised (see Butler, 2003). Theorists who have been heavily influenced by cognitive-behavioural theories stress the importance of explicit methods of teaching, particularly in the early stages of instruction. They advocate the importance of presenting new strategies to students in several small, concrete steps. However, as the instruction progresses and students move towards mastery, there is a conscious and marked shift to more implicit methods to enhance the generalisation of strategy use, as well as adaptation, independent design, and application of strategies by the students themselves (Schumaker & Deshler, 2003).
2. *Modelling.* Other strategy instruction theorists have emphasised Vygotsky's socio-cultural models of teaching and learning when describing learning and teaching processes. They contend that students become more strategic when they internalise cognitive processes that are first explained or modelled by others (see Butler, 2003). Advocates of this perspective stress the importance of teacher modelling using think-aloud, dialectal, and scaffolding techniques. Initially, the modelling of a strategy should be simple and straightforward, focusing mainly on the surface features of the strategy (e.g., self-cueing performance of the strategy steps). As the lesson proceeds, teachers gradually reveal more sophisticated cognitive processes and increase their collaboration with students through open dialogue (Ellis, 1993).
3. *Guided student practice and feedback.* Researchers influenced by sociocultural perspectives also emphasise the imperative for teachers to monitor students' progress as they apply their newly learned strategies to a range of tasks in a variety of contexts. Students are often encouraged to use overt verbalisations to guide their own thinking processes. The practice of encouraging students to think-aloud also gives teachers an opportunity to encourage and reinforce appropriate use of strategies, or to provide assistance when necessary (van Kraayenoord, 2004).

Research on Strategy Instruction

Recent syntheses of research on instruction techniques have found that students with learning difficulties respond well to strategy instruction (e.g., Forness, 2001; Forness et al., 1997; Jitendra et al., 2004; Swanson, 2001). Forness (2001) examined the results of twenty-four separate meta-analyses across twenty intervention topics

in special education. The primary purpose of this synthesis was to draw tentative conclusions about the relative power of interventions as determined by the magnitude of the mean effect size for each intervention. The results of this analysis were important in indicating that strategy-based models have stronger positive effects on student outcomes than all other types of interventions examined (e.g., behaviour modification, direct instruction, psychotherapy, stimulant medication, computer-assisted instruction, and perceptual training). Overall, the highest effect sizes were found for studies involving the development of mnemonic strategies (Mean ES = 1.62) and reading comprehension strategies (Mean ES = .94).

Research evidence suggests that strategy instruction is effective not only for students with learning difficulties, but also for students without learning difficulties. For example, Symons, MacLatchy-Gaudet, Stone and Reynolds (2001) evaluated the effectiveness of strategy instruction in enhancing the ability of Year 3 through 5 students' (n = 180) to effectively locate information in text. None of the participating students had been identified as experiencing serious academic difficulties at school. The students were randomly assigned either to a strategy instruction condition or the no-treatment, control condition. The results showed that students who were taught to identify indexed terms, to skim text carefully, and to monitor how well extracted information fulfilled the search goal, were significantly more successful in locating information than control group participants. Notably, students also transferred the strategy to an unfamiliar book. This finding is particularly encouraging, as it suggests that strategy instruction helps students develop transferable knowledge, in this case about locating information in text.

Strategy Instruction Research in the Literacy Domain. In comparison with the more behaviourally-based approaches to reading that conceptualise reading as a set of discrete skills to be mastered, strategy instruction is founded on a more holistic view. Reading is seen as a process in which readers actively search for and make meaning for themselves in what they read (Pressley & Wharton-McDonald, 1997). Indeed, there is considerable evidence that skilled readers use their prior knowledge as well as a number of flexible, adaptable strategies to construct a mental model of the text (e.g., see Dole et al., 1991; Dole, Brown, & Trathen, 1996). Strategy instruction is founded on these findings and emphasises the enhancement of student's existing knowledge as well as a set of reading strategies that good readers employ in a metacognitive, self-regulatory way.

Dole et al. (1991) identified five core strategies used by skilled readers which include the ability to: (a) separate important from unimportant information; (b) effectively summarise information; (c) draw inferences from text; (d) generate story-specific questions; and (e) monitor strategic processes.

A substantial body of research supports the benefits of strategy instruction for improving students' reading comprehension (e.g., see Anderson & Roit, 1993; Block, 1993; Deshler & Schumaker, 1993; Dole et al., 1996; Dole et al., 1991; Pressley & McDonald Wharton, 1997; Swanson, 1999). Although relatively few studies have investigated the comparative effectiveness of strategy instruction and other instructional approaches, there is evidence to suggest that strategy instruction is particularly effective for enhancing students' ability to complete higher-order cognitive tasks, such as reading comprehension and writing. For example, Dole et al. (1996) randomly assigned fifth and sixth grade students (n = 67) from a designated at-risk school to one of three treatments—strategy instruction, teacher-directed instruction (which authors called story content instruction), and basal

control instruction. The results of this study showed that students who received strategy instruction made superior gains in comprehension performance over their peers who received teacher-directed or basal instruction. The superior performance of the strategy group became particularly evident when students were asked to read texts on their own, without any instructional support from their teachers. Consistent with the findings of Symons et al. (2001), this study elucidated the specific value of strategy instruction in enhancing students' comprehension of unfamiliar text.

There is also evidence to suggest that strategy instruction is beneficial for teaching expressive writing to students with learning difficulties. In a recent meta-analysis, Gersten and Baker (2001) examined thirteen studies designed to teach writing strategies to students with learning disabilities. The mean effect size in the meta-analysis was .81, which is typically considered a strong effect. Gersten and Baker noted a number of commonalities among the thirteen interventions. For example, most interventions adhered to the framework of three basic steps in the writing process: planning, writing, and revising. Invariably, explicit teaching of each step was provided by the teacher through several examples, often supported by a 'think sheet', a prompt card, or a mnemonic. Another component common to all interventions was guided feedback. Either teachers or peers provided frequent feedback to students on the overall quality of writing, missing elements, and strengths. Many of the studies in this meta-analysis did not investigate transfer of writing skills. However, when transfer measures were included, the results were decidedly mixed.

Wong (1994) has urged refinement in writing interventions to promote transfer. In order to reach this goal, she asserted that "insufficient mindfulness during strategy learning appears to explain the difficulties in obtaining transfer among students with disabilities. This is because the typical intervention with students with learning disabilities rarely permits them to engage in the kind of deep and intent thinking necessary for transfer" (Wong, 1994, p. 111). Wong (1994) has called for instruction that provides students with learning disabilities the opportunity to reflect on "the relationship between their strategy [and]…the subsequent successful learning outcome" (p. 111).

Strategy Instruction Research in the Numeracy Domain. A growing body of research suggests that strategy instruction is beneficial for enhancing the mathematics performance of students with learning difficulties. For example, Tournaki (2003) investigated the differential effects of teaching basic, one-digit addition facts to 42 second-grade general education students and 42 students with learning difficulties. Students received instruction via either: (a) a minimum addend strategy; (b) drill and practice; or (c) control. The results of this study were important in demonstrating that students with learning difficulties improved significantly on both post-test and transfer tasks in the strategy condition but not in the drill-and-practice and control conditions. On the other hand, when compared with the control condition, general education students improved significantly in both strategy and drill-and-practice conditions. Thus, the findings of this study indicate that strategy instruction and drill-and-practice instruction have different effects on addition skills, depending on student characteristics. More particularly, Tournaki concluded that when teaching students with learning difficulties, teachers should not rely on the premise that their strategies will change as a result of practice per se. For these students, even simple tasks, like single digit addition, are problems to be solved, and they do appear to benefit from strategy instruction.

Naglieri and Gottling (1997) studied the effectiveness of a strategy instruction program for students with learning difficulties in mathematics. Twelve students (aged 9 to 12 years) participated in 7 baseline sessions and 21 intervention sessions designed to facilitate planning processes. The results showed that the intervention had beneficial effects on mathematical computation for all students but was especially helpful for students who were poor in planning. Naglieri and Gottling suggested that the students with low planning scores improved more than those with high scores because (a) the instruction met their need to be more planful, and (b) previous research has found that planning is important for mathematics computation. Thus, commensurate with the findings reported by Tournaki (2003), the results of this study indicate that students will benefit in different ways from strategy instruction, and that matching instruction to the specific cognitive weaknesses of students is important.

The preceding studies support the benefits of strategy instruction for improving students' performance in basic math computation. However, there is also evidence to suggest that this form of instruction can be beneficial for enhancing students' problem solving ability. For example, Case, Harris and Graham (1992) examined the effectiveness of a five-step strategy designed to help students comprehend mathematical problems and devise appropriate solutions. The strategy was taught via one-to-one tutoring to four Year 5 and 6 students with learning difficulties. The five steps of the strategy were to: (a) read the problem aloud; (b) look for important words and circle them; (c) draw pictures to help; (d) write down the math sentence; and (e) write down the answer. The results of this study demonstrated that, upon completion of instruction, students' performance on mixed sets of addition and subtraction word problems improved, and they were much less likely to perform the wrong operation. More specifically, students' average baseline scores of 82 percent for word problems and 30 percent for subtraction problems increased to 95 percent and 82 percent, respectively. Furthermore, all four students generalised the use of the strategy from the tutoring sessions to their classrooms. However, assessment of strategy effects eight to 13 weeks after instruction revealed mixed results. Two students maintained instructional gains, while two dropped in their performance.

The work of Montague and colleagues (Montague, 1992; Montague, Applegate, & Marquard, 1993) has also been important in demonstrating the effectiveness of strategy instruction for improving the mathematical problem solving performance of students with learning difficulties. The model of mathematical problem solving (MPS) that served as the foundation for their studies is presented in Figure 1. It is important to bear in mind that this model reduces a highly complex, recursive activity, involving a host of cognitive functions and resources, to a relatively simple description of the processes and strategies involved in efficient problem solving. Research has suggested that this model reflects the predominant cognitive and metacognitive activities used by good problem solvers (Montague & Appelgate, 1993a, 1993b).

Using this model, Montague (1992) investigated the effects of cognitive and metacognitive strategy instruction on the problem solving performance of six middle-school students with learning difficulties. Students were taught the seven cognitive strategy steps, as well as the three metacognitive strategy steps, depicted in Figure 1. Following six days of instruction, Montague found that five of the six students showed marked improvement in their problem solving test scores. However, follow-up generalisation measures that were undertaken several months

after instruction indicated that students were unable to maintain their strategy knowledge without periodic review sessions.

In a subsequent study, Montague, Applegate and Marquard (1993) investigated the effects of cognitive and metacognitive strategies (see Figure 1) on the problem solving performance of 72 students (aged 13 and 14 years) with learning difficulties. The results of this study showed that, on average, students significantly improved in mathematical problem solving performance on two different measures of one-, two-, and three-step word problems and also compared well with a normally-achieving peer group.

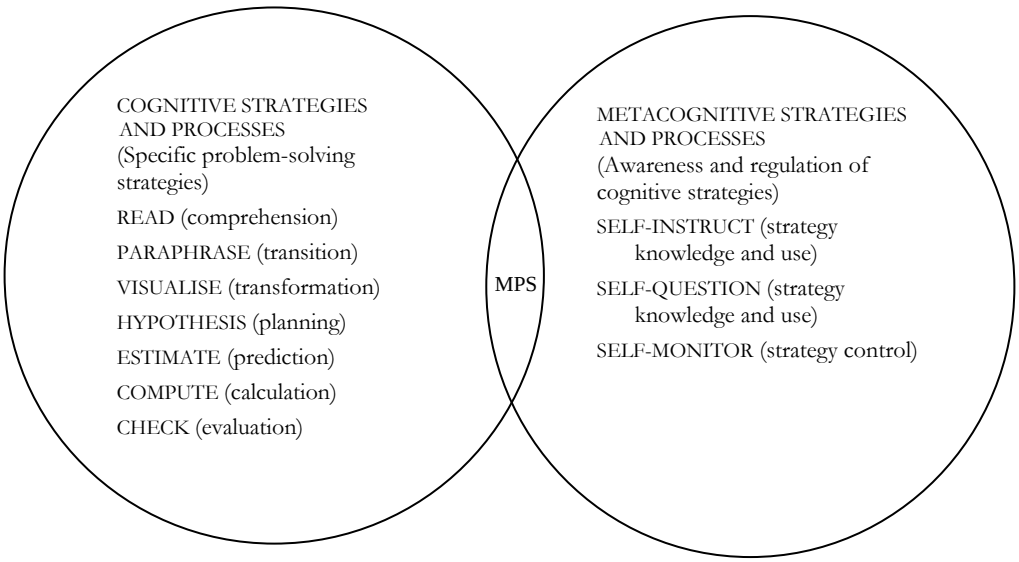

Figure 1. *Cognitive and metacognitive model of mathematical problem solving adopted by Montague and colleagues.*

A New Categorisation

Swanson and colleagues have moved away from using the term *direct instruction* and use instead the term *content enhancement* (see Swanson & Deschler, 2003). *Content enhancement* is, however, closely aligned with direct or explicit instruction approaches, and involves making decisions about what content to teach, manipulating and translating that content into easy-to-understand formats, and presenting it in memorable ways (Deshler et al., 2001).

In addition, the term *learning strategy instruction* is now used by Swanson and colleagues' instead of *strategy instruction.* Learning strategy instruction encompasses instructional approaches that involve the teaching of techniques, principles, or rules that enable students to learn and to solve problems, and to complete tasks independently (Schumaker & Deshler, 1992). Although there is broad array of learning strategies, there is an instructional methodology to which Swanson and Deschler adhere that involves an eight-stage teaching sequence that is central to the effective instruction of any learning strategy:

1. *Pre-test and Make Commitments*. Motivate students to learn a new strategy and establish a baseline.
2. *Describe the Strategy*. Present a clear picture of the overt and covert processes and steps of the new strategy.

3. *Model the Strategy*. Demonstrate the cognitive behaviours and overt physical acts involved in using the strategy.
4. *Verbal Practice*. Ensure comprehension of the strategy and facilitate student mediation.
5. *Controlled Practice and Feedback*. Provide opportunity for practice and provide feedback to build confidence and fluency and shift responsibility for strategy use to students.
6. *Advanced Practice and Feedback*. Provide practice in advanced materials.
7. *Post-Test and Make Commitments*. Document mastery and build a rationale for self-generalisation.
8. *Generalisation*. Ensure successful use of the strategy in other settings.

Swanson's move away from use of the term *direct instruction* perhaps is desirable because of common misconceptions about the meaning of the term (e.g., 'chalk and talk' and 'drill and kill'). Moreover, he has moved away from comparing the various approaches to instruction and intervention, and has concluded that an effective general model of instruction combines components of content enhancement *and* learning strategy instruction. Thus, comparisons may not always be useful because the instructional components that make up content enhancement and learning strategy instruction sometimes overlap.

An Eclectic or Balanced Approach

The idea that an effective general model of instruction for students with learning difficulties combines components of both content enhancement (direct or explicit instruction) and learning strategy instruction has growing currency amongst educational researchers and practitioners. There remain, of course, advocates of one approach or another who would not agree. For instance, some constructivists consider that any form of direct or explicit teaching is antithetical to constructivist principles and is equivalent to enforcing rote learning on students. We believe this position to be somewhat misguided. Some constructivists acknowledge that students also need teacher-directed instruction and guided practice. For example, Von Glasersfeld (1995), one of the leading advocates of constructivism, has recognised that there are "matters that can and perhaps must be learned in a purely mechanical way" (p. 5). This view is also supported by a considerable body of evidence that explicit instruction is of tremendous value, particularly for students with learning difficulties. However, it is a misconception to believe that teachers should reject constructivism in its entirety and swing back to purely teacher-directed methods:

> I believe that bridges can and must be built between whole language and more traditional approaches to enable teachers to blend the best of both in order to help every child reach his or her full literacy potential. Above all, we must avoid either/or positions that reject out of hand the possibility of blending and blind us to the value of different perspectives. (Spiegel, 1992, p. 43)

Indeed, research supports the perspective that eclectic or balanced approaches provide students with the best opportunities for success. As discussed earlier in this review, Swanson and Hoskyn's (1998) meta-analysis demonstrated that the highest effect size emerged for a combined model that included elements of both direct instruction and strategy instruction. As shown in Table 1, the effect sizes for the

direct instruction and strategy instruction models in isolation (ES = .68 for direct instruction only; ES = .72 for strategy instruction only) are fairly strong and thus, both approaches seem viable for students with learning difficulties. However, these effect sizes for these approaches were smaller than the combined model (ES = .84 for direct instruction and strategy instruction combined) and thus, Swanson (2001) concluded that students with learning difficulties are most positively influenced by teaching approaches that combine essential elements of both direct instruction and strategy instruction:

> Effective instruction is neither a bottom-up nor a top-down approach in isolation. Lower-order and higher-order skills interact to influence treatment outcomes. Clearly, performance at complex levels (writing prose, inferring the meaning of text) cannot occur without some critical threshold of skills. Children with LD [learning difficulties] vary in these skills. What is clear from this synthesis, however, is that varying degrees of success across treatment domains draw from treatments that focus on both high- and low-order instruction (i.e., strategy and direct instruction). (p. 11)

Likewise, Vaughn, Gersten & Chard (2000), in their synthesis of research findings in the literacy domain, concluded that an integration of bottom-up and top-down instruction is valuable. These researchers reminded us that although it is important to capitalise on the benefits of explicit teaching, this does not mean the abandonment of top-down teaching that focuses on the development of metacognitive skills. Notably, they found that some of the most effective interventions were metacognitive and strategic (e.g., Mastropieri et al., 1996).

Contrary to extreme constructivist views, there is research to suggest that teachers can successfully construct a balanced integration of instructional approaches in their regular classroom practice. This evidence has mostly been found in American schools, where there is growing acceptance that effective teaching for students with learning difficulties must combine explicit teaching with constructivist learning opportunities.

For example, Pressley, Yokoi, Rankin, Wharton-McDonald, and Mistretta (1996), surveyed a national sample of fifth-grade teachers from the United States nominated by their supervisors as being outstanding in promoting the literacy of their students. In this survey, teachers described their instruction as an integrated articulation of many components, including whole-language experiences and explicit skills instruction. These findings are consistent with the findings of Drecktrah and Chiang (1997) in their survey of 183 American primary school teachers of students with learning difficulties. The results of this study showed that, although a large number (64 percent) of fifth-grade teachers indicated that they used whole language frequently, only half that number considered the whole language approach alone to be effective. Over 70 percent of the teachers surveyed believed that a combination of direct instruction and whole language approaches is effective in teaching reading and writing. The results of these two studies suggest that effective teachers often integrate teaching practices from each approach and, in accordance with the findings of Swanson and Hoskyn (1998), that a balanced approach may be more effectual than exclusive reliance on one single approach.

A number of researchers and educational professionals worldwide are now promoting the benefits of employing teacher-directed approaches in conjunction with student-directed approaches in the classroom (e.g., Butler, Miller, Lee, & Pierce, 2001; Harris and Graham, 1996, 1998; Spiegel, 1992; Westwood, 1999,

2000). Notably, these educators do not endorse a *laissez faire* combination of approaches, but rather a thoughtful, carefully balanced selection of validated instructional components (Harris & Alexander, 1998). For example, Galton, Hargraves, Comber, Wall and Pell (1999) have proposed that methods of instruction that best suit the types of learning involved in a lesson should be adopted, and that in deciding such matters the age, ability, and aptitude of the students must be taken into account. Accordingly, a teaching method should be judged on *fitness for purpose* (Galton et al., 1999).

Eclecticism in the classroom may not always involve a pedagogy that draws on components from *both* content enhancement and strategy enhancement approaches. Eclecticism may involve the teacher in making an informed choice of *either* one *or* the other approach, given a particular set of student or task attributes.

For instance, Montague (1993) highlighted the importance of tailoring instruction to individual student attributes, and noted that in instances where the content of instruction or the instructional approach, rather than the student, becomes the focal point of the program, the purpose of instruction must be re-examined. According to Montague, the ultimate goal for teachers is to find the best fit between the instructional approach and task, and also between the instructional approach and student. For example, she observed that a mnemonic strategy such as the keyword technique might be particularly effective for remembering information. However, for a student who has difficulty forming and retaining mental images or making conceptual connections, the keyword strategy may not be as useful as categorical organisation of terms, or simple rehearsal or memorisation using flash cards. Thus, Montague advocates that teachers need to know how to select instructional approaches that will enhance learning for particular students.

Rosenshine (1995) recommended that a particular teaching approach be selected depending on the degree of structure of the task. For instance, he suggested that direct instruction is more suitable for well-structured tasks. That is, these tasks can be broken down into a fixed sequence of subtasks that consistently lead to the same goal. Long-division computation is an example of a well-structured task. The steps are concrete and visible and there is a specific, predictable algorithm that can be followed, one that enables students to obtain the same result each time they perform the algorithmic operations. These well-structured tasks are best taught by explicitly teaching each step of the algorithm to students**.** On the other hand, Rosenshine suggests that constructivist approaches are more useful for less structured tasks. According to Rosenshine, unstructured tasks cannot be broken down into a fixed sequence of subtasks and steps that consistently and unfailingly lead to the goal.

Spiegel (1998) captures the essence of eclecticism in his article on literacy development, although the principles apply equally to students' numeracy development.

> A balanced approach to literacy development is a decision-making process through which the teacher makes thoughtful choices each day about the best way to help each child become a better reader and writer. A balanced approach is not constrained by or reactive to a particular philosophy. It is responsive to new issues while maintaining what research has already shown to be effective. It is an approach that requires and frees a teacher to be a reflective decision maker and to fine tune and modify what he or she is doing each day in order to meet the needs of each child. (p. 34)

This assertion is supported by findings reported by Camilli, Vargas and Yurecko (2003) in their reanalysis of the *National Reading Panel* study (National Institute of Child Health and Human Development, 2000a, 2000b). Although their research did not focus specifically on students with learning difficulties (students across the full range of reading ability were included), Camilli et al. concluded that "a balance of systematic phonics, tutoring, and language activities is best for teaching children to read".

Camilli et al. noted that their findings are consistent with two conclusions from the NRP reports:

> Programs that focus too much on the teaching of letter-sounds relations and not enough on putting them to use are unlikely to be very effective. In implementing systematic phonics instruction, educators must keep the *end* in mind and ensure that children understand the purpose of learning letter-sounds and are able to apply their skills in their daily reading and writing activities. (National Institute of Child Health and Human Development, 2000b, p. 2-96)
>
> Finally, it is important to emphasize that systematic phonics instruction should be integrated with other reading instruction to create a balanced reading program. Phonics instruction is never a total reading program (National Institute of Child Health and Human Development, 2000b, p. 2-97).

Thus, as Camilli et al. (2003) note, program administrators and teachers need to understand that although evidence-based research might support the role of one approach, research may also support other approaches deriving from different models of learning. As such, it is important not to over-emphasise one aspect of a complex process and ignore other equally important aspects.

Important Components of Effective Teaching Practice

To extrapolate from the research reviewed, it seems possible to identify components of effective teaching practices for students with learning difficulties. Two relevant, recent key papers in this respect are (a) a meta-analysis of the instructional components that positively influence performance of adolescents (Swanson & Hoskyn, 2001), and (b) a paper in which the previous meta-analytic findings are converted into practical guidelines for classroom practice (Swanson & Deshler, 2003). Because these papers are important, we summarise key points in some detail, although readers are referred to the actual publications for further detail.

In the first key paper (a meta-analysis), Swanson and Hoskyn (2001) focus on *how* information is taught (e.g., scaffolding, skill modelling) and sustained rather than on *what* is taught (e.g., inferential comprehension, editing). They argue that it is not possible to adequately assess what should be taught unless one can identify how information should be taught, sustained, and retrieved. For instance, reading interventions that vary the content of phonics instruction have different outcomes depending on the way in which phonics is taught (Necheochea & Swanson, 2003).

Swanson and Hoskyn initially categorised instructional activities into 18 components (see Table 2). Further detailed analysis resulted in the reduction of these 18 components into eight major instructional factors: (a) questioning; (b) sequencing/segmentation; (c) skill modelling; (d) organisation/explicit practice; (e) small group setting; (f) indirect teacher activities; (g) technology; and (h) scaffolding. However, the effect sizes for seven of the eight factors were very small

and insignificant. The only significant factor was organisation/explicit practice, contributing 16 percent of the variance to effect size. This factor includes only two instructional components: *advance organisation* and *explicit practice*.

Advance organisers provide students with a mental scaffold with which to build understanding of information. Thus, providing statements about the content to be learned provides a structure to students for new information, and for relating this new information to information they already possesses. Explicit practice focuses on activities that relate to distributed review and practice, repeated practice, sequenced reviews, daily feedback, and/or weekly reviews. In terms of explicit practice, there is strong evidence to suggest that distributed practice is more effective for retention than the intensive practice of newly-learned information that often occurs in the early stages of learning (e.g., Dempster, 1987).

Swanson and Hoskyn note that although these two components are especially relevant for adolescents, the other six identified components match basic instructional core practices that have been identified in other research (e.g., Borkowski, Weyhing, & Carr, 1988; Graham & Harris, 1989; Rosenshine, 1995; Scruggs & Mastropieri, 1989)

From the data-informed identification of effective instructional components, Swanson and Deschler (2003), in a second key paper, provide a summary of how teachers could incorporate these findings into their classroom practice. They embed the translation into classroom practice of the advanced organiser and explicit practice components in a teaching approach model that evolved from their original categorisation of approaches and which incorporates subsequent revisions.

The research of Swanson and colleagues indicates that no matter what the theoretical orientation of a study, the use of advance organisers and explicit practice results in the greatest learning gains for all students, including those with learning difficulties. However, Swanson and Hoskyn (2001) note that no program is sufficient with just these two components; they must be put in the context of daily teaching practice. Swanson and Hoskyn suggest a sequence of events for effective classroom practice for all students that incorporates these two components:

1. State the learning objectives and orient the students to what they will be learning and what performance will be expected of them.
2. Review the skills necessary to understand the concept.
3. Present the information, give examples, and demonstrate concepts and materials.
4. Pose questions (probes) to students, assess their level of understanding, and correct misconceptions.
5. Provide group instruction and independent practice. Give students an opportunity to demonstrate new skills and to learn the new information on their own.
6. Assess performance and provide feedback. Review the independent work and give a test. Give feedback for correct answers and teach skills if answers are incorrect.
7. Provide distributed practice and review.

Table 2. *Description and frequency of selected instructional components, N = 93 (from Swanson & Hoskyn, 2001)*

	Instructional Component	Statements in the Treatment Description About:	Incl. %
1.	Advance organisers	Directing adolescents to look over material before instruction, directing adolescents to focus on particular information, providing prior information about the task, or teacher stating objectives in instruction.	34.4
2.	Attribution	Teacher presenting the benefits of taught strategies.	1.0
3.	Control of difficulty or processing demands of tasks	Probing learning, fading of probes or prompts, providing short activities so that the level of difficulty is controlled, or teacher providing necessary assistance.	43.0
4.	Elaboration	Additional information or explanation provided about concepts, or redundant text or repetition within text.	8.6
5.	Explicit practice	Distributed review and practice, repeated practice, sequenced reviews, daily feedback, or weekly reviews.	32.3
6.	Large-group instruction	Instruction in large groups or teacher-only demonstration.	49.5
7.	New content/skills	Implementation of a new curriculum or emphasis on teacher presenting new material from the previous lesson.	44.1
8.	One-to-one instruction	Activities related to independent practice, tutoring, individually paced instruction, or individually tailored instruction.	74.2
9.	Peer modelling	Peers presenting or modelling instruction.	6.5
10.	Questioning	Directing students to ask questions, teacher and student or students engaging in dialogue, or teacher asking questions.	17.2
11.	Reinforcement	Intermittent or consistent use of rewards and reinforcers.	2.2
12.	Sequencing	Breaking down the task into subtasks or sequencing short activities.	52.7
13.	Skill modelling	Modelling by teacher in terms of skills.	31.8
14.	Small-group instruction	Statements in the treatment description about instruction in a small group or verbal interaction occurring in a small group with other students or teacher.	16.3
15.	Strategy cues	Reminders to use strategies or multi-step procedures, teacher verbalising steps or procedures to solve problems, or use think-aloud models.	18.3
16.	Activities supplementary to teacher instruction	Homework or parents helping to reinforce instruction.	6.5
17.	Task reduction	Breaking down the targeted skill into smaller units, mastery criteria, or task analysis.	49.5
18.	Technology	Developing pictorial representations, using specific materials or computers, or using media to facilitate presentation and feedback.	45.2

Note. Incl. % = percentage of studies that included this component.

Implications for Educational Practice

Regardless of the disparity in classification systems employed by researchers of interventions for students with learning difficulties, the results in Table 1 clearly demonstrate that teaching approaches based on models of direct or explicit instruction (content enhancement models) and learning strategy instruction tend to produce higher positive effects for students with learning difficulties than other approaches. Furthermore, when an eclectic or balanced approach is adopted in which teachers have the necessary knowledge and skills to combine the essential elements of both approaches, the outcomes for students are likely to be most positive.

However, in designing professional development programs that build capacity in teachers to maximise the schooling outcomes for students with learning difficulties, Spiegel's (1998) observation concerning student and task variation is worth noting.

> Learners, teachers, curricula, and schools vary. Not everyone learns in the same way; not every task requires the same strategies; not every teacher has the same talents; not every school has the same combination of learners and teachers. Rather than trying to shoot each child with the same silver bullet, we need to recognise, celebrate, and work with this wonderful diversity. A balanced literacy program allows each teacher to select what is right for each child and each task and to change the emphasis easily. A balanced literacy approach is flexible, and that flexibility empowers teachers to tailor what they do for each child each day….
>
> Because not all children, tasks, and teachers are the same, teachers must have a full repertoire of strategies for helping children develop literacy and a clear understanding of how and when to implement each strategy. (p. 118)

It seems, therefore that *no one intervention or approach can address the complex nature of learning difficulties*.

Although some educators have argued that a pure or radical form of constructivism is the key to addressing students' difficulties in learning, we are less sanguine about such outcomes based on any single paradigm. At the same time, we value and recognise the continuing need for stimulation and critical evaluation engendered by theoretical separation and competing models.

We believe that an integration of knowledge and successful practices is critical in today's schools. For teachers of students with learning difficulties, such knowledge and practice pertains to:

(a) literacy and numeracy processes per se (e.g., the reading process involves both knowledge of the written code *and* an ability to extract meaning from the written code; Foorman, Francis, Fletcher, & Schatschneider, 1998); and

(b) student developmental, cognitive, and social processes (e.g., students' ability to hold, sequence, and process accurately what is heard will have strong effects on their literacy progress, attentive behaviours in the classroom, and general wellbeing; Rowe, Pollard, & Rowe, 2003).

It is perhaps judicious to bear in mind the experience of what has been referred to as the largest and most expensive educational program implemented in the US. *Project Follow Through* was designed to 'follow through' on *Head Start*, an educational program intended to fight poverty by assisting students, many of whom had

learning difficulties, to develop skills necessary to break out of their existing cycle of failure. Twenty-two architects of various theories and approaches, who believed their methods were at the core of effective pedagogical practice, were invited to become sponsors of their models. The U.S. Department of Education hired two independent agencies to collect and evaluate the effects of the various models. Each participating school was compared with a matched nonparticipating school.

The evidence (based on a significant effect that was at least one-quarter of a standard deviation) was clear in terms of which models worked best (e.g., see Bereiter & Kurland, 1981; Stebbins et al., 1977; Watkins, 1995). The point to make here is not in terms of which model was best. Rather, we wish to draw attention to why the results of *Follow Through* failed to impact the policies and practices of the educational community.

In her analysis of why the results of *Follow Through* were not acted on, Watkins (1995) made a number of pertinent observations. She observed that "parochial vested interests that work to either maintain the status quo or to advance self-serving models can prevent the implementation of teaching methods, approaches, or practices that clearly have an impact on student learning outcomes" (p. 61). Vested interested can be those of policymakers, faculties of Education, teachers, school districts, publishers, and the public. For instance, Watkins observed that policymakers frequently develop policy that is based on public support, or social and political contingencies, rather than on empirical evidence. They may rely on inaccurate or incomplete information that others provide. Stakeholders who exert power but ignore the evidence may unduly influence them.

Bereiter and Kurland (1981), in their initial analysis of *Follow Through*, also noted the battle of the philosophies that was evident at the time. But "Philosophies don't teach kids. Events teach kids." (Bereiter & Kurland, 1981, p. 16). The events that need to happen for students with learning difficulties are those devised by teachers for implementation in their classrooms. The events should be informed by a thorough knowledge of *what* works, *why* it works, and *how* it works.

In one sense, the evidence presented in this literature review can only alert us to *what* works for students with learning difficulties. It is not possible in limited space and time to provide the detail of *how* teachers should implement effective approaches. However, although we have focussed on summarising the findings from reports of intervention research, many of those reports do provide valuable information of *how* the interventions were implemented (or they referred to other sources containing such detail).

Such limitation aside, we believe there are key components that will differentiate successful teacher professional development programs from less successful ones. At the very least, such programs will assist teachers of students with learning difficulties to:

- engage with the evidence-based literature on what works for students with learning difficulties;
- understand what constitutes evidence;
- avoid faulty assumptions about the nature of the skill to be taught (e.g., reading acquisition process);
- develop thorough and up-to-date subject-matter knowledge;

- develop a deep understanding of how students learn particular subjects or skills;
- draw on the expert knowledge of education systems advisors;
- avoid or question educational fads that promote a philosophy or approach that is not evidence-based;
- be knowledgeable about a wide range of approaches from which to make informed choices, depending on student and context characteristics;
- practise using a range of approaches; and
- work in partnership with parents, teachers, and allied professionals to share expertise and seek solutions for particular problems.

Concluding Comment

> Which instructional reading approach or method, or combination of approaches or methods, provided in which setting or combination of settings, under which student–teacher ratio conditions and teacher–student interactions, provided for what period of time and by which type of teacher, have the greatest impact on well-defined elements of reading behaviour and reading-related behaviours, for which children, for how long, and for what reasons? (Lyon, 1993, p. 3)

The question, posed by Lyon with respect to children with reading difficulties highlights the remarkable challenge faced by educational researchers and practitioners as they look for effective ways to cater for the educational needs of children who find it difficult to learn. Our careful examination of the research literature clearly reveals that there is no simple answer.

Nevertheless, clear directions have been obtained from a careful scrutiny of recent evidence-based research literature. The emphasis given to evidence-based research in this review has been deliberate. In the Australian context, the claims for successful programs and strategies for primary children with learning difficulties, summarised by Rohl et al. (2000) and documented more fully in Louden et al. (2000, Vol. 3: Case Studies), are based on single-site case studies of only 20 schools in five Australian mainland States. This is not to deny either the value or legitimacy of such work. Indeed, this work [together with similar work reported by van Kraayenoord et al. (2000) derived from case studies in 10 schools], has provided rich insights into what Rohl et al. (2000) responsibly refer to as "What seems to work in schools". We believe that the present review extends the findings of such research through close examination of studies that provide evidence of measurable improvements in students' learning outcomes.

We acknowledge limitations in the review that are related either to the focus of research studies or to gaps in the research. For instance, we are aware that there is copious research on how best to teach reading but much of this research does not discriminate between teaching students with learning difficulties and teaching students without learning difficulties. Sometimes different approaches are needed and sometimes they are not. Furthermore, we have not explored recent models of reading, such as the four roles model[4] (Freebody & Luke, 2003) that has gained

[4] Freebody and Luke postulated that children need to learn four reader roles if they are to become good readers. These roles are: text decoder, text participant (making meaning), text user, and text analyst (understanding point of view and how the author positions the reader).

ascendancy in some Australian schools recently. In this instance, there is simply no empirical research to provide direction for how this model might inform the development of intervention strategies for students with learning difficulties. Such gaps highlight the need for ongoing research that provides evidence of measurable improvements in students' learning outcomes that are clearly related to the strategies that teachers use.

Finally, in the search for ways to ensure that all Australian children achieve an acceptable standard of literacy and numeracy skills, it is crucially important to make connections with established bodies of knowledge about teacher effectiveness. In this context, it is important to note that pedagogical practices and strategies per se are not independent of the teachers who deliver them to students, whether or not those students experience learning difficulties in the classroom (Hattie, 2003; Rowe, 2003). To this end, the ACER research project team plans to supplement this review of the evidence-based research literature on effective interventions and teaching practices for students with learning difficulties with further research that draws on established bodies of knowledge about teacher effectiveness, teaching quality, teacher training, and teacher professional development. Only through a thorough investigation of the links between what has often developed as separate lines of research can a more complete picture emerge of how to assist children who find it difficult to learn.

References

Airasian, P. W., & Walsh, M. E. (1998). Constructivist cautions. In A. Woolfolk (Ed.). *Readings in Educational Psychology* (pp. 153-160) Boston, MA: Allyn & Bacon.

Alexander, P. A., Graham, S., & Harris, K. R. (1998). A perspective on strategy research: Progress and prospects. *Educational Psychology Review, 10*(2), 129-154.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders (4th ed.). Text revision*. Washington, DC: Author.

Ashman, A. F., van Kraayenoord, C. E., & Elkins, J. (1992). Intervention research in Australia. In B. Y. L. Wong (Ed.). *Contemporary intervention research in learning disabilities: An international perspective*. New York: Springer-Verlag.

Ausubel, D. P. (1968). *Educational psychology: A cognitive view*. New York: Holt, Rinehart & Winston.

Bailey, D. S. (2003). Who is learning disabled? *Monitor on Psychology, 34*(8), 58-60.

Baker, S., Gersten, R., & Lee, D. S. (2002). A synthesis of empirical research on teaching mathematics to low-achieving students. *The Elementary School Journal, 103*(1), 51-73.

Baxter, J., Woodward, J., & Olson, D. (2001). Effects of reform-based mathematics instruction in five third grade classrooms. *Elementary School Journal, 101*(5), 529-548.

Bereiter, C., & Kurland, M. (1981). A constructive look at Follow Through results. *Interchange 12,* 1-22.

Binder, C., & Watkins, C. L. (1990). Precision teaching and direct instruction: Measurably superior instructional technology in schools. *Performance Improvement Quarterly, 3*(4), 74-96.

Block, J. H., Everson, S. T., & Guskey, T. R. (1995). *School improvement programs: A handbook for educational leaders*. New YorkL: Scholastic.

Boekaerts, M. (1996). Self-regulated learning at the junction of cognition and motivation. *European Psychologist, 1(*2), 100-112.

Borkowski, J.G., Estrada, M., Milstead, M., & Hale, C. (1989). General problem-solving skills: Relations between metacognition and strategic processing. *Learning Disabilities Quarterly, 12,* 57-70.

Borkowski, J. G., Weyhing, R. S., & Carr, M. (1988). Effects of attributional retraining on strategy-based reading comprehension in learning-disabled students. *Journal of Educational Psychology, 80, 46-53.*

Borman, G. D., Hewes, G., Overman, L. T., & Brown, S. (2003). Comprehensive school reform and achievement: A meta-analysis. *Review of Educational Research, 73*(2), 125-230.

Bruning, R. H., Schraw, G. J., Norby, M. M., & Ronning, R. R. (2004). *Cognitive psychology and instruction* (4th Edition). Englewood Cliffs, NJ: Prentice Hall.

Butler, D. L. (2003). Structuring instruction to promote self-regulated learning by adolescents and adults with learning disabilities. *Exceptionality, 11*(1), 39-60.

Butler, F. M., Miller, S. P., Lee, K-H., & Pierce, T. (2001). Teaching mathematics to students with mild-to-moderate mental retardation: A review of the literature. *Mental Retardation, 39*(1), 20-31.

Camilli, G., Vargas, S., & Yurecko, M. (May 8, 2003). Teaching children to read: The fragile link between science and federal education policy. *Education Policy Analysis Archives, 11*(15). Retrieved December 9, 2004 from http://epaa.asu.edu/epaa/v11n15/.

Carnine, D., Dixon, R., & Silbert, J. (1998). Effective strategies for teaching mathematics. In E. Kameenui & D. Carnine (Eds.), *Effective teaching strategies that accommodate diverse learners* (pp. 93-112). Columbus, OH: Merrill.

Carnine, D. W., Silbert, J., Kame'enui, E., & Tarver, S. G. (2004). *Direct instruction reading* (4th ed.). Columbus, OH: Pearson.

Case, L. P., Harris, K. R., & Graham, S. (1992). Improving the mathematical problem-solving skills of students with learning disabilities: Self-regulated strategy development. *Journal of Special Education, 26*(1), 1-19.

Casey, K. (1994). *Teaching children with special needs: An Australian perspective.* Wentworth Falls, NSW: Social Science Press.

Chall, J. S. (1983). *Learning to read: The great debate.* New York: McGraw-Hill.

Chan, L. & Dally, K (2000). Review of literature. In W. Louden, L. Chan, J. Elkins, D. Greaves, H. House, M. Milton, S. Nichols, M. Rohl, J. Rivalland, & C. Van Kraayenoord. *Mapping the territory. Primary students with learning difficulties: Literacy and numeracy* (Vol 2, pp. 161-331). Canberra: Department of Education, Training and Youth Affairs.

Chapman, J. W. (1988). Learning disabled children's self-concepts. *Review of Educational Research, 58*(3), 347-371.

Cohen, J. (1988). *Statistical power analysis of the behavioural sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Cook, T. D., & Campbell, D. T. (1979). *Quasi-experimentation: Design and analysis issues for field studies.* Chicago: Rand McNally.

Cotton, K. & Savard, W. G. (1982). *Direct instruction. Topic summary report. Research on School Effectiveness Project.* Portland, OR: Northwest Regional Educational Lab.

Dempster, F. (1987). Time and the production of classroom learning: Discerning implications from basic research. *Educational Psychologist, 22*, 1-21.

Deshler, D. D., Schumaker, J. B., Lenz, B. K., Bulgren, J. A., Hock, M. F., Knight, J., et al. (2001). Ensuring content-area learning by secondary students with learning disabilities. *Learning Disabilities Research & Practice, 16*, 96-108.

Dole, J. A., Brown, K. J., & Trathen, W. (1996). The effects of strategy instruction on comprehension performance of at-risk students. *Reading Research Quarterly, 31*(1), 62-88.

Dole, J. A., Duffy, G. G., Roehler, L. R., & Pearson, P. D. (1991). Moving from the old to the new: Research on reading comprehension instruction. *Review of Educational Research, 61*(2), 239-264.

Drecktrah, M. E., & Chaing, B. (1997). Instructional strategies used by general educators and teachers of students with learning disabilities. *Remedial and Special Education, 18*(3), 174-181.

Elkins, J. (2002). Learning difficulties/disabilities in literacy. *Australian Journal of Language and Literacy, 25*(3), 11-18.

Engelmann, S. (1980). Toward the design of faultless instruction: The theoretical basis of concept analysis. *Educational Teachnology, 20*(2), 28-36.

Engelmann, S. (1999). The Benefits of Direct Instruction: Affirmative Action for At-Risk Students. *Educational Leadership, 57*(1), 77-79.

Farkota, R. M. (2003). *Effects of direct instruction on self-efficacy and achievement in mathematics*. Unpublished PhD thesis, Monash University, Australia.

Farrell, P.T. (1997). *Teaching pupils with learning difficulties: Strategies and solutions*. London: Cassell.

Foorman, B. R., Francis, D. J., Fletcher, J. M., & Schatschneider, C. (1998). *The role of instruction in learning to read: Preventing reading failure in at-risk children*. Journal of Educational Psychology, 90*(1), 37-55*.

Forness, S. R. (2001). Special education and related services: What have we learned from meta-analysis? *Exceptionality, 9*(4), 185-197.

Forness, S. R., Kavale, K. A., Blum, I. M., & Lloyd, J. W. (1997). What works in special education and related services: Using meta-analysis to guide practice. *Teaching Exceptional Children, 29*(6), 4-9.

Freebody, P., & Luke, A. (2003) Literacy as engaging with new forms of life: The four roles model. In G. Bull & M. Anstey (Eds.). *The literacy lexicon*. Frenchs Forest, NSW: Prentice Hall.

Gale, T. (2000). (Dis)ordering teacher education : from problem students to problem based learning. *Journal of Education for Teaching, 26*(2), 127-138.

Gardill, M. C. & Jitendra, A. K. (1999). Advanced story map instruction: Effects on the reading comprehension of students with learning disabilities. *Journal of Special Education, 33*(1), 2-17.

Gersten, R. (1985). Direct instruction with special education students: A review of evaluation research. *Journal of Special Education, 19*(1), 41-58.

Gersten, R., & Baker, S. (2001). Teaching expressive writing to students with learning disabilities: A meta-analysis. *The Elementary School Journal, 101*(3), 251-272.

Gersten, R., & Carnine, D. (1986). Direct instruction in reading comprehension. *Educational Leadership, 43*(7), 70-78.

Goldman, S. R. (1989) Strategy instruction in mathematics. *Learning Disability Quarterly, 12,* 43-55.

Graham, S., & Harris, K. R. (1989). Components analysis of cognitive strategy instruction: Effects on learning disabled students' compositions and self-efficacy. *Journal of Educational Psychology, 81*, 353-361.

Grossen, B., & Ewing, S. (1994). Raising mathematics problem-solving performance: Do the NCTM Teaching standards help? Final Report. *Effective School Practices, 13*(2), 79-91.

Harris, K. R., & Graham, S. (1996). Memo to constructivists: Skills count, too. *Educational Leadership, 53*(5), 26-29.

Hattie, J. A. (1992). Measuring the effects of schooling. *Australian Journal of Education* 36(1), 5–13.

Hattie, J. A. (2003). *Teachers make a difference: What is the research evidence?* Background paper to invited address presented at the 2003 ACER Research Conference, Carlton Crest Hotel, Melbourne, Australia, October 19-21, 2003.

Hattie, J., Biggs, J., & Purdie, N. (1996). Effects of learning skills interventions on student learning: A meta-analysis. *Review of Educational Research, 66*(2), 99-136.

Hedges, L., & Olkin, I. (1985). *Statistical methods for meta-analysis*. New York: Academic Press.

Hempenstall, K. J. (1996). The gulf between educational research and policy: The example of direct instruction and whole language. *Behaviour Change, 13*(1), 33-46.

Hempenstall, K. J. (1997). *The effects on the phonological processing skills of disabled readers of participating in DI reading programs*. Unpublished PhD thesis, RMIT University, Australia.

Hill, S., Comber, B., Louden, B., Reid, J. & Rivalland, J. (1998) 100 children go to school: Connections and disconnections in literacy experience prior to school and in the first year of school. Department for Education, Employment, Training and Youth Affairs, Canberra.

Hunt, M. (1997). *How science takes stock: The story of meta-analysis*. New York: Russell Sage Foundation.

IDEA (1997). Available: http://www.ed.gov/offices/OSERS/Policy/IDEA.

Iversen, S. A., & Tunmer, W. E. (1993). Phonological processing skill and the Reading Recovery program. *Journal of Educational Psychology, 85*, 112-125.

Jenkinson, J. C. (2001). Special education: A matter of choice? *Australian Education Review No. 46*. Melbourne: ACER.

Jitendra, A. K., Edwards, L. L., Sacks, G., & Jacobson, L. A. (2004). What research says about vocabulary instruction for students with learning disabilities. *Exceptional Children, 70*(3), 299-322.

Jones, E. D., Wilson, R., & Bhojwani, S. (1997). Mathematics instruction for secondary students with learning disabilities. *Journal of Learning Disabilities, 30*(2), 151-163.

Joyce, B., Calhoun, E., & Hopkins, D. (1997). *Models of learning: Tools for teaching*. Buckingham: Open University Press.

Kavale, K. A., & Forness, S. R. (2000). What definitions of learning disability say and don't say. A critical analysis. *Journal of Learning Disabilities, 33*(3), 239-256.

Klassen, R. (2002). The changing landscape of learning disabilities in Canada. Definitions and practice from 1989-2000. *School Psychology International, 23*(2), 199-219.

Kroesbergen, E. H., & Van Luit, J. E. H. (2003). Mathematics interventions for children with special educational needs: A meta-analysis. *Remedial and Special Education, 24*(2), 97-114.

Kroesbergen, E. H., van Luit, J. E. H., & Maas, C. J. M. (2004). Effectiveness of constructivist mathematics instruction for low-achieving students in The Netherlands. *The Elementary School Journal, 104*(3), 233-251.

Lockery, M., & Maggs, A. (1982). Direct instruction research in Australia: A ten-year analysis. *Educational Psychology, 2*(3-4), 263-288.

Louden, W., Chan L.K.S., Elkins, J., Greaves, D., House, H ., Milton, M., Nichols, S., Rivalland, J., M.& van Kraayenoord, C. (2000). *Mapping the territory. Primary students with learning difficulties: Literacy and Numeracy*. (Volumes 1-3). Canberra*:* Department of Education, Training and Youth Affairs.

Lyon, G. R. (1996). Learning disabilities. The future of children: Special education for students with disabilities, 6(1), 54-76.

Lysynchuk, L. M., Pressley, M., d'Ailly, H., Smith, M., & Cake, H. (1989). A methodological analysis of experimental studies of comprehension strategy instruction. *Reading Research Quarterly, 24*(4), 458-470.

Marsh, H. W., Richards, G. E., & Barnes, J. (1986). Multidimensional self-concepts: The effect of participation in an Outward Bound program. *Journal of Personality and Social Psychology, 50*, 195-204.

Mastropieri, M. A., Scruggs, T. E., Bakken, J. P. & Whedon, C. (1996). Reading comprehension: A synthesis of research in learning disabilities. *Advances in learning and behavioral disabilities, 10B,* 201-227.

Meyer, R. J. (2003). Captives of the script – killing us softly with phonics: A critical analysis demonstrates that scripted phonics programs hold students and teachers as curriculum hostages. *Rethinking Schools Online, 17*(4). Available at http://www.rethinkingschools.org/

Miller, S. P., Butler, F. M., & Lee, K. (1998). Validated practices for teaching mathematics to students with learning disabilities: A review of literature. *Focus on Exceptional Children, 31***,** 1-24.

Moats, L. C. (1994). The missing foundation in teacher education: Knowledge of the structure of spoken and written language. *Annals of Dyslexia, 44,* 81-102.

Montague, M. M. (1992). The effects of cognitive and metacognitive strategy instruction on the mathematical problem solving of middle school students with learning disabilities. *Journal of Learning Disabilties, 25*(4), 230-248.

Montague, M., & Applegate, B. (1993a). Mathematical problem solving characteristics of middle school students with learning disabilities. *Journal of Special Education, 27*, 175-201.

Montague, M., & Applegate, B. (1993b). Middle school students' mathematical problem solving: An analysis of think-aloud protocols. *Learning Disability Quarterly, 16*, 19-32.

Montague, M., Applegate, B., & Marquard, K. (1993). Cognitive strategy instruction and mathematical problem solving performance of students with learning disabilities. *Learning Disabilities Research & Practice, 8*(4), 223-232.

Mosham, D. (1982). Exogenous, endogenous, and dialectical constructivism. Developmental Review, 2, 371-384.

Naglieri, J. A., & Gottling, S. H. (1997). Mathematics instruction and PASS cognitive processes: An intervention study. *Journal of Learning Disabilities, 30*(5), 513-520.

National Health and Medical Research Council (1990). Expert advisory panel on learning difficulties in children and adolescents. *Learning difficulties in children and adolescents*. Canberra, ACT: Department of Community Services and Health.

National Institute of Child Health and Human Development. (2000a). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction.* Retrieved Dec. 9, 2005 from http://www.nationalreadingpanel.org/Publications/summary.htm.

National Institute of Child Health and Human Development. (2000b). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups.* Retrieved Dec. 9, 2005 from http://www.nichd.nih.gov/publications/nrp/report.pdf.

Northwest Regional Educational Laboratory (2003). The catalog of school reform models. Available: http://www.nwrel.org/scpd/catalog/index.shtml.

Necoechea, D. M., & Swanson, H. L. (2003). The role of reading intervention research in the identification of children with reading difficulties: A meta-analysis of the literature funded by the NICHD. *Advances in Learning and Behavioral Disabilities, 16*, 83-161.

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International Journal of Educational Research, 31*, 459-470.

Pintrich, P. R. (2002). The role of metacognitive knowledge in learning, teaching, and assessing. *Theory Into Practice, 41*(4), 219-225.

Pressley, M., & Harris, K. R. (1990). What we really know about strategy instruction. *Educational Leadership, 48*(1), 31–34.

Rankin-Erickson, J. L. & M. Pressley (2000). A Survey of Instructional Practices of Special Education Teachers Nominated as Effective Teachers of Literacy. *Learning Disabilities Research & Practice*, *15*, 206-225.

Rivalland, J. (2000). Policies and practices: Students with literacy difficulties. In W. Louden, L. Chan, J. Elkins, D. Greaves, H. House, M. Milton, S. Nichols, M. Rohl, J. Rivalland, & C. Van Kraayenoord. *Mapping the territory. Primary students with learning difficulties: Literacy and numeracy* (Vol 1, pp. 41-65). Canberra: Department of Education, Training and Youth Affairs.

Rivalland, J. & House, H. (2000). Mapping system provision for learning difficulties. In W. Louden, L. Chan, J. Elkins, D. Greaves, H. House, M. Milton, S. Nichols, M. Rohl, J. Rivalland, & C. Van Kraayenoord. *Mapping the territory. Primary students with learning difficulties: Literacy and numeracy* (Vol 2, pp. 125-159). Canberra: Department of Education, Training and Youth Affairs.

Rohl, M., House, H., Louden, W., Milton, M., & Rivalland, J. (2000). *Successful programs and strategies for children with learning difficulties.* National Language and Literacy Project Brochure. DETYA: Western Australia.

Rohl, M., & & Rivalland, J. (2002). Literacy learning difficulties in Australian primary schools: Who are the children identified and how do their schools and teachers support them? *The Australian Journal of Language and Literacy, 25*(3), 19-40.

Rosenshine, B. V. (1986). Synthesis of research on explicit teaching. *Educational Leadership, 43*(7), 60-69.

Rosenshine, B. V. (1995). Advances in research on instruction. *Journal of Educational Research, 88*, 262-268.

Rowe, K. J. (2003). *The importance of teacher quality as a key determinant of students' experiences and outcomes of schooling.* Keynote address presented at the 2003 ACER

Research Conference, Carlton Crest Hotel, Melbourne, 19-21 October 2003. Available in PDF format at: http://www.acer.edu.au/research/programs/learningprocess.html

Rowe, K. S., Pollard, J., & Rowe, K. J. (2003). Auditory processing: Literacy, behaviour and classroom practice. *Speech Pathology Australia: ACQuiring Knowledge in Speech, Language and Hearing, 5*(3), 134-137.

Schumaker, J. B., & Deshler, D. D. (1992). Validation of learning strategy interventions for students with learning disabilities. Research of a programmatic research effort. In B. Y. L. Wong (Ed.), *Contemporary intervention research in learning disabilities: An international perspective* (pp. 22-46). New York: Springer Verlag.

Schumaker, J. B., & Deshler, D. D. (2003). Can students with LD become competent writers? *Learning Disability Quarterly, 26*, 129-141.

Scott, W. (2004). Learning difficulties and learning disabilities: Identifying an issue: The issue of identification. In B. A. Knight, and W. Scott (Eds.). *Learning difficulties: Multiple perspectives*. Frenchs Forest, NSW; Pearson Education.

Scruggs, T., & Mastropieri, M. A. (1989). Mnemonic instruction of LD students: a field based study. *Learning Disability Quarterly, 12*, 119-125.

Scruggs, T. E., & Mastropieri, M. A. (2002). On babies and bathwater: Addressing the problems of identification on learning disabilities. *Learning Disability Quarterly, 25*, 155-165.

Shaw, S. F., Cullen, J. P., McGuire, J. M., & Brinckerhoff, L. C. (1995). Operationalising a definition of learning disabilities. *Journal of Learning Disabilities, 28*(9), 586-597.

Snider, V. E. (1992). Learning styles and learning to read: A critique. *Remedial and Special Education, 113*, 6-18.

Snow, C. E., Burns, M. S., & Griffin, P. (Eds.) (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.

Snow, J. H. (1992). Mental flexibility and planning skills in children and adolescents with learning disabilities. *Journal of Learning Disabilities, 25*(4), 265-270.

Spiegel, D. (1992). Blending whole language and direct instruction. *The Reading Teacher, 46*, 38-44.

Spiegel, D. L. (1998). Silver bullets, babies and bath water: Literature response groups in a balanced literacy program: *The Reading Teacher, 52,* 114-124.

Stahl, S. A., & Kuhn, M. R. (1995). Does whole language or instruction matched to learning styles help children learn to read? *School Psychology Review, 24,* 393-404.

Stahl, S. A., McKenna, M. C., & Pagnucco, J. R. (1994). The effects of whole-language instruction: An update and a reappraisal. *Educational Psychologist, 29*(4), 175-185.

Stahl, S. A., & Miller, P. D. (1989). Whole language and language approaches for beginning reading: A quantitative research synthesis. *Review of Educational Research, 59*, 87-116.

Stanovich, K. E., & Siegel, L. S. (1994). Phenotypic performance profile of children with reading disabilities: A regression-based test of the phonological-core variable-difference model. *Journal of Educational Psychology, 86*(1), 24-53.

Stein, M., Carnine, D., & Dixon, R. (1998). Direct instruction: Integrating curriculum design and effective teaching practice. *Intervention in School & Clinic, 33***,** 227-234.

Sternberg, R. J., & Grigorenko, E. L. (2001). Learning disabilities, schooling, and society. *Phi Delta Kappan, 83*(4), 335-338.

Swanson, H. L. (1988). Learning disabled children's problem solving: Identifying mental processes underlying intelligent performance. *Intelligence, 12*, 261-278.

Swanson, H. L. (1990). Instruction derived from the strategy deficit model: Overview of principles and procedures. In T. Scruggs & B. Wong (Eds.), Intervention research in learning disabilities (pp.34-65). New York: Springer Verlag.

Swanson, H. L. (1999). Reading research for students with LD: A meta-analysis of intervention outcomes. *Journal of Learning Disabilities, 32*(6), 504-534.

Swanson, H. L. (2001). Searching for the Best Model for Instructing Students with Learning Disabilities. *Focus on Exceptional Children, 34*(2), 1-15.

Swanson, H. L. & Carson, C. (1996). A selective synthesis of intervention research for students with learning disabilities. *School Psychology Review, 25(3),* 370-391.

Swanson, H. L., Carson, C., & Sachse-Lee, C. M. (1996). A selective synthesis of intervention research for students with learning disabilities: Is there general support for a strategy deficit model? *Advances in Learning and Behavioral Disabilities, 10B*, 51-179.

Swanson, H. L. & Deshler, D. (2003). Instructing Adolescents with Learning Disabilities: Converting a Meta-Analysis to Practice. *Journal of Learning Disabilities, 36*(2), 124-134.

Swanson, H. L., & Hoskyn, M. (1998). Experimental intervention research on students with learning disabilities: A meta-analysis of treatment outcomes. *Review of Educational Research, 68*(3), 277-321.

Swanson, H. L., & Hoskyn, M. (1999). Definition x treatment interactions for students with learning disabilities. *School Psychology Review, 28*(4), 644-658.

Swanson, H. L., & Hoskyn, M. (2001). Instructing adolescents with learning disabilities: A component and composite analysis. *Learning Disabilities Research & Practice, 16*(2), 109-119.

Symons, S., MacLatchy-Gaudet, H., Stone, T. D., & Reynolds, P. L. (2001). Strategy instruction for elementary students searching informational text. *Scientific Studies of Reading, 5*(1), 1-33.

Tarver, S. G. (1996). Should method of teaching beginning reading be matched to the student's learning style? *Effective School Practices, 15*(4), 37-38.

Tournaki, N. (2003). The differential effects of teaching addition through strategy instruction versus drill and practice to students with and without learning disabilities. *Journal of Learning Disabilities, 36*(5), 449-458.

Tunmer, W. E., Chapman, J. W., Greaney, K. T., & Prochnow, J. E. (2002). The contribution of educational psychology to intervention research and practice. *International Journal of Disability, Development and Education, 49*(1), 11-29.

Vallecorsa, A. L. & deBettencourt, L. U. (1997). Using a Mapping Procedure To Teach Reading and Writing Skills to Middle Grade Students with Learning Disabilities. *Education and Treatment of Children, 20*(2), 173-188.

van Kraayernoord, C. E. (2004). Teaching strategies for reading: How can we assist students with learning difficulties? In B. A. Knight, and W. Scott (Eds.). *Learning difficulties: Multiple perspectives* (pp. 67-84). Frenchs Forest, NSW; Pearson Education.

van Kraayernoord, C. E. & Elkins, J. (1998). Learning difficulties in regular classrooms. In A. Ashman and J. Elkins, *Educating children with special needs* (3rd edition, pp. 131-176). Sydney, Prentice Hall.

van Kraayernoord, C. E. & Elkins, J. (2004). Learning Difficulties in Numeracy in Australia. *Journal of Learning Disabilities, 37*(1), 32-41.

Vaughn, S., Gersten, R., & Chard, D. J. (2000). The underlying message in LD intervention research: Findings from research syntheses. *Exceptional Children 67(1),* 99-114.

Veenman, S., Denessen, E., van den Oord, I., & Naafs, F. (2003). The influence of a course on direct and activating instruction upon student teachers' classroom practice. Paper presented at the European Association for Research on Learning and Instruction (10th Biennial Conference). Padova, Italy (August 26-30).

Vermette, P., & Foote, C. (2001). Constructivist philosophy and cooperative learning practice: Toward integration and reconciliation in secondary classrooms. *American Secondary Education, 30*(1), 26-37.

Walberg, H.J. (1996). U.S. Schools Teach Reading Least Productively. *Research In the Teaching of English, 30*(3), 328–343.

Watkins, C. L. (1995). Follow Through: Why didn't we? *Effective School Practices, 15,* 57-66.

Westwood, P. (1999). Constructivist approaches to mathematical learning: A note of caution. In D. Barwood, D. Greaves, & P. Jeffrey. *Teaching numeracy and literacy: Interventions and strategies for "at risk" students*. Coldstream, Victoria: Australian Resource Educators' Association.

Westwood, P. (2003a). *Learning and learning difficulties: A handbook for teachers.* Camberwell, Victoria: ACER.

Westwood, P. (2003b). *Numeracy and learning difficulties: Approaches to teaching and assessment*. Camberwell, Victoria: ACER.

Westwood, P. (2003c). *Reading and learning difficulties: Approaches to teaching and assessment*. Camberwell, Victoria: ACER.

Wright, J., & Jacobs, B. (2003). Teaching phonological awareness and metacognitive strategies to children with reading difficulties: A comparison of two instructional methods. *Educational Psychology, 23*(1), 17-47.

Wong, B. Y. L. (1994). Instructional parameters promoting transfer of learned strategies in students with learning disabilities. *Learning Disability Quarterly, 17*, 110-120.