Evidence-Based Teaching
Strategies that Promote Learning

Robyn M. Gillies
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Public school systems are now under increasing pressure to close achievement gaps between the able and less-able students, minority and non-minority students, and disadvantaged students and their non-disadvantaged peers. Moreover, there is now an expectation that schools and teachers will use those programs and practices that have been demonstrated to be are efficacious through rigorous scientific research.

Evidence-based teaching: Strategies that promote learning is designed to provide teachers with an overview of the types of evidence that can be used to enhance their teaching practices. It does this by documenting those practices that have been used effectively in classrooms to facilitate how teachers teach and how students learn. This text is designed to make teachers aware of how to critically evaluate different types of evidence that can be used to inform their teaching practice. It achieves this by making explicit the link between theory, research and practice.

The book will have appeal to pre-service and experienced teachers who are interested in how different evidence-based teaching practices can be used in school curricula to promote student learning. It will also be valuable as a reference text in post-graduate courses that focus on research training in education.
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PREFACE

Public school systems have come under enormous pressure since the enactment of the No Child Left Behind (NCLB) Act (2001) by making schools accountable for the education they provide to their students. The NCLB Act places an emphasis on using those programs and practices that have demonstrated that they are efficacious through rigorous scientific research; that is, there is evidence that they work. The purpose of this book is to provide pre-service teachers, teachers, and postgraduate education students with the information they need to determine what is meant by evidence, the types of evidence that can be used to support educational change, and the issues that need to be addressed if teachers are to adopt evidence-based practices in their classrooms.

AN OVERVIEW OF THE CHAPTERS

Chapter 1 outlines the types of evidence that are used in education to support an educational intervention. In particular, this chapter discusses evidence that can be collected both formally and informally, including experimental and quasi-experimental studies, design experiments, case studies, and program evaluation studies. This chapter also discusses the types of evidence that can be collected with each type of study such as observations of specific behaviours, responses to questionnaires, teacher reports, and authentic assessment information such as portfolios, exhibitions of performance, the products of problem-based inquiries, and other written materials. In presenting examples of the evidence that teachers can collect, the following issues around context, relevance, practicality, understanding of the principles of instruction, and the need to reduce the research to practice gap are also discussed.

Chapter 2 focuses on student-centred approaches to teaching that have gained momentum over the last three decades as research has emerged demonstrating that students are more motivated to learn and they learn more when conditions are created that encourage them to be active in the learning process. Many teachers who have implemented student-centred learning methods have seen and appreciated how they can be used in classrooms to assist children to cooperate and also help teachers deal with many of the major issues they confront today. This chapter provides an overview of student-centred learning and, in particular, the personal and social constructivist theories that have informed these approaches to teaching and learning. The chapter presents research that demonstrates support for constructivist learning, and the strategies used to promote student agency, engagement, and learning.

Chapter 3 provides an overview of how peers mediate each other’s learning, and how, in turn, they learn to be responsive to others’ requests for help as they work cooperatively together. This chapter details information on the different peer learning strategies known to enhance student discourse and learning and how these can be used in regular classrooms to enhance students’ thinking and reasoning.
The following chapter provides an overview of how teachers’ communicative behaviours affect students learning. In particular, this chapter focuses on how teachers mediate students’ learning and how students, in turn, model and appropriate this discourse in their interactions with each other. The types of dialoguing strategies teachers use to challenge children’s thinking and learning are also presented.

It is well accepted that the type of task assigned to a group determines how members interact and learn. Chapter 5 outlines how teachers can use the research on group work to develop tasks and cooperative group activities that require students to interact about the process, exchange ideas, and share information, and, in so doing, develop interactions that promote thinking, problem-solving, and learning. This chapter discusses how teachers can use complex tasks to promote discourse, problem-solving and learning.

Assessment plays a key role in educational accountability. Being able to assess the outcomes of student learning is very important as schools are now expected to justify the use of public monies for different programs and resources against the progress students make. The purpose of this final chapter is to provide information on the different types of assessments that teachers can construct to monitor the teaching and learning process, including both formative and summative assessments. The research that supports the use of formative and summative assessments for raising academic standards is also discussed.

Robyn M. Gillies
EVIDENCE – WHAT IS IT?

INTRODUCTION AND LEARNING OBJECTIVES

Public school systems have come under enormous pressure since the enactment of the No Child Left Behind (NCLB) Act (2001), designed to ensure that no child is trapped in a failing school by making schools accountable for the education they provide to their students. The accountability provisions of this federal law are intended to close the achievement gaps between the able and less-able students, minority and non-minority students, and disadvantaged students and their non-disadvantaged peers to ensure that all students meet required proficiency levels (Kim & Sunderman, 2005).

In order to achieve this outcome, the NCLB Act places an emphasis on using those programs and practices that have demonstrated that they are efficacious through rigorous scientific research. For example, this includes such scientifically-based reading instruction programs in the early grades as the Reading First program and in pre-school, the Early Reading First program (Four pillars of NCLB, 2004). In order to provide some guidance to schools on scientifically-based programs, the Institute of Education Sciences (IES) has released information on a number of programs that meet this criteria such as the guide for Improving Adolescent Literacy: Effective Classroom Intervention Practices (August, 2008) (Kamil et al., 2008) and the guide for Organizing Instruction and Study to Improve Student Learning (September, 2007) (Pashler et al., 2007). Additionally, the IES also publishes information on those programs that do not meet the criteria for scientifically-based research such as Accelerated Math (Institute of Education Sciences, 2004).

The evidence that is used to determine whether a program meets the criteria for scientifically-based research are rigorous with the IES having identified the quality of the evidence needed to establish whether an intervention provides strong evidence of its effectiveness. In all cases the crème de la crème of evidence is the randomised control trial where groups that have been randomly allocated to receive the intervention (e.g., a reading intervention) are compared to those groups that have not received it across a number of outcome measures. There is no doubt that if an intervention is able to demonstrate its effectiveness under such conditions there is strong evidence that if it is implemented under conditions similar to the original study then it is likely to render similar results. It is very important to ensure that if schools are intending to embark on implementing programs that they use the very best evidence available to help inform their decisions. However, while the evidence from these studies are very important and teachers need to consider how the information obtained may be used to enhance their practice, there are
situations where evidence is lacking or is questionable or weak. Consequently, teachers need to understand how they can collect evidence-based research that will allow them to evaluate the “worthwhileness” or otherwise of a program or practice that they may intend to adopt.

The purpose of this chapter is to provide an overview of the types of evidence that are used in education to support an educational intervention. In particular, the chapter will discuss evidence that is collected both formally and informally, including experimental and quasi-experimental studies, design experiments, case studies, and program evaluation studies. This chapter will also discuss the types of evidence that are collected with each type of study such as observations of specific behaviours, responses to questionnaires, teacher reports, and authentic assessment information, including portfolios, exhibitions of performance, the products of problem-based inquiries, and other written materials. In presenting examples of the evidence that teachers can collect, the following issues around context, relevance, practicality, understanding of the principles of instruction, and the need to reduce the research to practice gap will also be discussed.

When readers have finished this chapter they will know:
- The different types of research that can be undertaken in schools
- The types of evidence that can be collected to support educational changes
- The issues that need to be addressed if teachers are to adopt evidence-based practices in their classrooms

DIFFERENT TYPES OF RESEARCH THAT CAN BE UNDERTAKEN IN SCHOOLS

The sections that follow will provide descriptions on the different types of research studies that can be undertaken in schools, the advantages and disadvantages of each, and their application to practice in school environments. One of the greatest concerns of educational researchers have is helping teachers to realise the value of evidence-based practices; practices that have demonstrated that they work in educational settings and that there is value in adopting them.

Experimental and Quasi-experimental Studies

The experimental study provides the strongest evidence of the effectiveness or otherwise of a particular intervention or treatment. Basically, participants (i.e., students, schools) are allocated randomly to either the experimental condition (i.e., the condition that is to receive the intervention or treatment) or the control condition (i.e., no intervention or no treatment condition). Once participants have been allocated to the experimental or control condition the assumption can be made that the conditions are equivalent; that is, that both have a similar composition of participants (e.g., similar age, ability, or grade). Pre- and post-test data are collected to determine if the intervention has been effective over the period of its implementation. If it has, then the experimental group will show significantly different results to those of the control condition, provided the study has been implemented as it was intended and there have not been any mitigating factors that have affected or ‘contaminated’ the results.
Factors that may affect the results are: changing the way the intervention was implemented so that either the experimental or control condition received the same or similar aspects of the treatment; the experimental and control groups are in the same school so that potentially there could be some diffusion or contamination of the results (i.e., teachers in the experimental condition sharing information about the treatment with teachers in the control condition); or, the treatment was varied so that it was only implemented in part or not implemented at all. Other issues that may affect the results are: the perceptions by participants in the control group that they are missing out on the treatment so they work harder to compensate; the composition of one of the conditions changes significantly during the course of the intervention (i.e., participants leave or new ones are included); or, the ‘alternative intervention’ given to the control condition is similar to the experimental condition so that differences between the two conditions are less evident.

An example of an experimental study. The following experimental study involves one experimental condition and two control conditions. The teachers were randomly allocated by school (i.e., all teachers in the one school were in the same condition) to one of three conditions, the experimental condition, the cooperative condition (control condition 1), or the small-group condition (control condition 2).

**Example 1: The effects of teacher discourse on students’ discourse, problem-solving and reasoning during cooperative learning.** In this study, Gillies and Khan (2008) sought to determine if teachers who are taught specific communication skills that are designed to challenge students’ cognitive and metacognitive thinking during cooperative, small-group learning (experimental group) use more challenging and scaffolding verbal behaviours to mediate students’ learning than teachers who implement cooperative learning (control condition 1) or small-group work (control condition 2) who have not been taught these skills. The study involved 51 Grade 5-6 teachers from 17 primary schools who were randomly allocated by school to one of three conditions: the Experimental condition and two control conditions and two groups of children with 3-4 members in each group from each teacher’s classroom. The teachers in the experimental condition were trained to use a number of communication skills to help challenge and scaffold students’ learning. These skills included learning to ask good questions and learning to respond to questions by providing detailed explanation, justifications, or reasons. In addition, these teachers were also trained in how to establish cooperative, small-group learning in their classroom curricula. In contrast, the teachers in control condition 1 were taught how to establish cooperative, small-group learning into their classroom curricula while the teachers in control condition 2 were only asked to establish small-group...
learning as they would normally do. The teachers in this latter condition were provided with a workshop on a range of effective learning strategies that did not include cooperative learning.

The study showed that the teachers in the experimental condition used significantly more scaffolding and challenging behaviours than the teachers in the small-group condition (control condition 2) but not more than the teachers in the cooperative condition (control condition 1). The study also showed that the children in the experimental condition provided significantly more detailed help and assistance to their peers than students in the control conditions and they obtained higher scores on the follow-up reasoning and problem-solving task.

The authors suggested that the lack of significant difference between the teachers in the experimental condition and control condition 1 may have been because the teachers were aware of the purposes of the study (i.e., they had access to an email newsletter that provided them with information on different strategies to promote students’ engagement and higher-level thinking during cooperative learning) and they may have decided to implement some of the communication strategies themselves as a way of promoting student dialogue, thus affecting the outcomes. Interestingly, while the teachers in control condition 2 also had access to this email newsletter, they did not implement these strategies, possibly because they were not involved in establishing cooperative learning in their curricula so they may not have realised the importance of promoting student dialogue during small-group discussions. The results provide support for the importance of training teachers to use those communication strategies that challenge children’s cognitive and metacognitive thinking and promote learning.

The above study demonstrates, in part, one of the difficulties of an experimental design—how to ensure that there is no contamination of one or more conditions during the intervention. In this study, all teachers had access to an email newsletter that was sent to all participants to provide them with background information about the study. The difficulty, in this instance, was that the teachers who did not participate in the communication skills training saw value in using some of the strategies designed to promote student engagement and higher-level thinking and used them in their classrooms.

The quasi-experimental study differs from the experimental study in that there is no random allocation of participants to either the experimental or control condition (often called the comparison condition) hence, the two conditions cannot be assumed to be equivalent (i.e., participants in one condition are similar to those in the other condition). Like the experimental study (outlined above), the participants in the experimental condition receive the treatment or intervention while the participants in the control condition do not. Once again, pre- and post-testing is undertaken to determine if there are significant differences between the two conditions as a result of the experimental condition receiving the treatment. The advantage of a control condition is that it enables the researcher to determine how the participants in the experimental condition responded in comparison to their peers in the comparison condition. However, the researcher always needs to keep in mind that the difference identified could be because that the participants in each condition were different (e.g., the participants in one condition were higher-achieving students than students
in the other condition). The difference identified could also be due to maturation (i.e., one group learns information more readily than the other) or to their previous experiences with an intervention (i.e., participants who have been taught how to provide effective help during small group discussion are likely to be more proficient at providing this type of help than their non-trained peers). Once researchers are aware of these threats to the validity of their study, they can take steps to try and minimise them by trying to ensure that the experimental and control conditions resemble each other as closely as possible (i.e., same age, grade level, same mix of abilities) so that any differences that emerge after the intervention can be attributed to the treatment the experimental condition received.

**Design of Quasi-experimental Study**

<table>
<thead>
<tr>
<th>No random allocation to condition</th>
<th>Pre-test</th>
<th>Intervention (X)</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Condition</td>
<td>O</td>
<td>X</td>
<td>O</td>
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<tr>
<td>Control condition</td>
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*An example of a quasi-experimental study.* The following quasi-experimental study investigated the effects of cooperative learning on junior high school students’ behaviours, interactions, and learning during small group learning. In contrast to the experimental study, described above, students in this study were not randomly allocated to conditions because they were already working in schools that either systematically implemented cooperative learning or they were in schools that did not systematically implement cooperative learning.

**Example 2: The effects of cooperative learning on junior high school students during small group learning.** In this study, Gillies (2004) investigated the effects of cooperative learning on junior high school students who worked in schools that systematically implemented cooperative learning or they did not systematically implement cooperative learning. Two hundred and twenty-three students from six high schools participated in the study. While all schools indicated that they encouraged their teachers to use cooperative learning, only three of the schools were identified as implementing cooperative learning systematically into their curricula because they had undertaken extensive professional development on this approach to teaching and learning; they encouraged teachers to use it in their classrooms; and, they had referred to it in their policy documents as a practice that promotes effective learning and teaching. In contrast, schools that had not demonstrated this level of commitment were regarded as not systematically implementing cooperative learning (comparison condition). The students were videotaped as they participated in mathematical problem-solving activities and data were collected on their behaviours, interactions, and learning. Data were also collected on students’ perceptions of their cooperative learning experiences.

The results found that the students in the schools that had systematically implemented cooperative learning were more willing to work with each other on assigned tasks and they provided more elaborative help and assistance to each other.
than their peers in schools where cooperative learning had not been systematically implemented. Furthermore, as the students in the cooperative groups had more opportunities to work together, they developed a stronger perception of group cohesion and social responsibility for each other’s learning than their peers in the groups where cooperative learning was not systematically implemented.

Difficulties with Experimental and Quasi-experimental Studies

While threats to the validity of an experimental study are minimised because of the random allocation of participants to the experimental or control condition so that the results obtained can generally be assumed to be valid and reliable, the ability to implement this type of study is something that teachers or schools are unable to do without the help of trained researchers. For example, experimental studies often require large numbers of participants (i.e., 150 participants in each condition) across different settings (i.e., different schools) who are tested pre- and post-intervention on a range of measures to determine if the intervention has been effective. The sheer scale of this type of testing is often beyond the means of most teachers unless they are working with trained researchers on a research project investigating the effects of a specific intervention.

Similarly, quasi-experimental studies can often be just as difficult to manage because they often involve a minimum of two classes and the collection of multiple data. Additionally, in both the experimental and quasi-experimental studies, the data collected needs to be statistically analysed to determine the effect of the intervention on participants in the experimental condition. In short, the complexity involved in conducting these types of studies is often outside the reach of most classroom teachers. However, this is not to say that the information obtained from these types of studies should be ignored; definitely not. Teachers need to be mindful of different types of evidence that is available to help them determine whether an intervention is likely to be effective or not and to use that information to help inform their teaching.

QUALITY OF EVIDENCE

The Institute of Education Sciences (IES) (2004) recognises the dilemma that educational practitioners confront and has released guidelines with user-friendly tools to distinguish between practices supported by rigorous evidence from those that are not (Coalition for Evidence-Based Policy, 2003). The guidelines outline the type of evidence teachers need to consider when determining whether there is strong evidence for the effectiveness of an intervention. In assessing the quality of the evidence, teachers need to ask themselves:

– Was a randomised control trial conducted?
– Did the trial involve two or more school settings which are regarded as typical school settings (i.e., they were not specialist settings away from the class or school).
If the answer to both questions is “Yes” then there is strong evidence of effectiveness. However, teachers also need to be alert to the following threats to the effectiveness of a study:

- The intervention should be clearly described (e.g., what the intervention involved, who received it and how the intervention differed from what the control group received).
- The random assignment process has not been compromised (e.g., participants have not moved from one condition to another during the study).
- Pre-intervention testing should show that there were no significant differences between the participants in the Experimental and Control conditions.
- The outcome measures used should be valid; that is, they measure what the intervention was designed to do. For example, if a reading intervention has been implemented, then outcome measures need to measure the extent to which participants reading skills have improved.
- The attrition rate of participants from the study should be small (i.e., < 25% of participants).
- The study should report outcome data on all participants, even those who do not complete the intervention.
- The long term outcomes of the intervention should preferably be reported if they are available. This is important so teachers can see if the effect of the intervention has been maintained.
- If the intervention has led to improved outcomes then the statistical tests showing the significant differences between the intervention and the control groups needs to be reported as well as the size or magnitude of the effect obtained (i.e., how much better or worse the intervention group performed in comparison to the control group). An effect size of 0.20 is usually regarded as small while an effect size of 0.80 is regarded as strong (Gay & Airasian, 2003).
- The results of the study should also be reported in easily understandable terms (e.g., a 20% improvement in school attendance).

Practices with Strong Quality of Evidence

Two practice guides that report strong quality of evidence are: Improving adolescent literacy: Effective classroom intervention practices (Kamil et al., 2008) and Organizing instruction and study to improve student learning (Pashler et al., 2007). Both these guides were produced by the Institute of Education Sciences (IES) to provide teachers with information on the types of strategies that can be used in classrooms to improve adolescent literacy or improve student learning.

The first guide, Improving adolescent literacy: Effective classroom intervention practices (Kamil et al., 2008) recommends five strategies that teachers can use in their classrooms that provide strong or moderate evidence of their effectiveness. Strong evidence is considered to have been provided when one of the following criteria is met: A systematic review of the research that meets the standards of the What Works Clearing-House in the National Center for Education Evaluation has been undertaken; several well-designed randomised controlled trials or well designed
quasi-experiments are reported; one large randomised controlled study is reported, or evidence of reliability and validity that meets the standards for educational and psychological testing is provided. Moderate evidence is evident when one of the following criteria is met: Experiments or quasi-experiments that have been rigorously conducted but lack generalizability because of the small sample size; comparison studies that involve groups that are not equivalent but consistently show enhanced outcomes for participants; or, assessment evidence of reliability that meets the standards for educational and psychological testing.

Given these criteria or strong and moderate evidence of effectiveness, the guide for Improving adolescent literacy: Effective classroom intervention practices identifies that there is strong evidence for providing explicit vocabulary instruction; providing direct and explicit comprehension strategy instruction; and, making available intensive and individualized interventions for struggling readers. Additionally, the guide provides suggestions on how these strategies can be achieved. Moderate evidence for effectiveness is provided by: Making opportunities available for extended discussion of text meaning and interpretation and for increasing student motivation and engagement in literacy learning. Once again, a list of suggested strategies to assist teachers is provided.

The second guide, Organising instruction and study to improve student learning (Pashler et al., 2007) also uses the same criteria for judging strong and moderate evidence for effectiveness. In this case, there is only strong support for two recommendations: Using quizzes to re-expose students to key content and asking deep explanatory questions. Recommendations that are only moderately supported include: Arranging to review key elements of a course after a period of delay; interweaving examples of solutions with problem-solving exercises; combining graphics with verbal solutions; and, connecting abstract concepts with concrete representations.

The advantage of the information provided in these two guides is that it enables teachers to make informed judgments about the potential effectiveness of suggested strategies in their own classrooms for student learning. If the level of evidence is strong for a particular practice, then teachers can be fairly confident that they are likely to obtain similar outcomes if they implement it in their classrooms. In short, the guides provide information on what works and under what conditions. Moreover, if teachers are to make informed decisions about what works, they need to know how to use the evidence that exists to help them with their decisions.

Teachers need to be able to know how to access and utilise existing evidence from the international research and literature to be able to:

− Ask and answer questions about education
− Know where and how to locate evidence using a range of media (e.g., electronic, print)
− Critically appraise the evidence according to professional and scientific standards
− Understand the power of the evidence; and
− Determine its relevance to their educational needs and environment (Davies, 1999).

Furthermore, when such evidence is not available or is weak then education practitioners (this includes teachers) need to be able to plan, conduct, and publish
studies that meet the highest standards of scientific research and evaluation. Such studies need to use research methods from the social sciences, the natural sciences, and the humanities and interpretative disciplines so that educational research is acknowledged as being scientifically valid, of a high quality, and practically relevant. In short, Davies maintains that teachers need to know how to make informed decisions about the evidence available to them while knowing how to conduct their own research when the evidence is not available or clear. This requires them to think more clearly about the problems they confront and use existing evidence appropriately to help them solve these problems.

TYPES OF EVIDENCE THAT CAN BE COLLECTED TO SUPPORT EDUCATIONAL CHANGES

There is no doubt that well planned and conducted randomised controlled trials and quasi-experimental studies have the potential to provide strong evidence on the effectiveness or otherwise of an intervention. However, the reality is that teachers often do not have the means or time to be involved in such large-scale studies but this does not preclude them from being able to make informed judgments about what practices work or do not work in their classrooms. It is important that teachers ask questions about the relationships between different variables that affect the processes and outcomes of education. For example, does resilience training affect students' learning and engagement? How does participation in creative performances affect students' sense of self worth? How do children manage to work together to deal with complex learning tasks? These types of questions often require more qualitative and naturalistic research methods such as design experiments, case studies, classroom observations, and individual interviews. Other type of research questions will involve the collection of different types of data. For example, how do teachers’ and students’ interactions affect learning? Answers to this type of question may involve examining the patterns and structures of interactions, conversation, and discourse.

While teachers often see themselves as applied professionals who implement practices to promote worthwhile outcomes in students’ lives, the notion that they can concurrently be researchers of their own practice is often one that they have not considered even though the best practice in education involves learning to critique and implement research findings with professional judgment and experience (Davies, 1999). Certainly, teachers have a lot of practical wisdom and experience that they can draw on to inform their decisions, but they often lack an understanding of how they can use different research tools (e.g., different methods and ways of collecting and using information) to help them integrate this knowledge and experience to inform their practice (Brown, 2005).

Although much attention has been directed at encouraging teachers to use evidence-based practices, they should not be seen as the provider of ready made solutions to the problems teachers confront. Rather, evidence-based practices should be seen as “… a set of principles and practices which can alter the way people think about education, the way they go about educational policy and practice and the basis on which they make professional judgments and deploy their
expertise” (Davies, 1999, p.118). Consider the following set of principles and practices of good teaching identified by the International Reading Association for which there is strong evidence of their effectiveness.

The Principles and Practices of Excellent Classroom Teachers

The International Reading Association (2000) listed the following research-based qualities of excellent classroom teachers:
- They understand reading and writing development, and believe all children can learn to read and write.
- They continually assess children’s individual progress and relate reading instruction to children’s previous experience.
- They know a variety of ways to teach reading, when to use each method, and how to combine the methods into an effective instructional program.
- They offer a variety of texts and materials for children to read.
- They use flexible grouping strategies to tailor instruction to individual students.
- They are good reading “coaches” (that is, they provide help strategically to help students’ reading).

While the above are examples of the principles of excellent teaching, Blair, Rupley, and Nichols (2007) identified the following instructional practices associated with effective teachers of reading. These practices emphasize the “what” and “how” of effective reading instruction and include:
- assessing students reading strengths and weaknesses,
- structuring reading activities around an explicit instructional format,
- providing students with opportunities to learn and apply skills and strategies in authentic reading tasks,
- ensuring that students attend to the learning tasks, and
- believing in one’s teaching abilities and expecting students to be successful (p. 433)

Taylor, Pressley, and Pearson (2000), in a synthesis of trends in effective teaching, found that reading achievement was higher in those classrooms where the teacher emphasised the actual reading of text rather than drilling of skills; achievement was higher the more reading and writing were integrated; and, the more the children discussed what they were reading, the more the teacher emphasised deep understanding rather than literal comprehension of text. In short, the more teachers emphasised the importance of thinking about reading processes and the more they provided explanations of how to use different reading strategies the higher students’ reading achievement.

DESIGN EXPERIMENTS

Design experiments involve engineering educational environments with an “innovative” intervention and then conducting designed-based research on the innovation. One advantage of design-based research is that it can be implemented in different contexts with the purpose of producing meaningful change to practice;
for example in classrooms, after-school programs, and teacher on-line learning communities. In measuring the outcomes obtained, design experiments blend empirical educational research methods with the theory-driven design of learning environments so it is an important methodology for understanding how, when, and why educational innovations work in practice (Bell, 2004). Another advantage of design experiments is that they enable researchers and teachers to create learning conditions that learning theory suggests are productive, but are not commonly practiced or well understood (The Design-Based Research Collective, 2003). Additionally, it has been suggested that design-based research could be a helpful methodology in generating causal accounts of learning and instruction that could form the basis for future systematic, randomised empirical trials (Levin & O’Donnell, 1999). However, caution needs to be exercised here as it has been suggested that randomised trials may hinder innovative studies by prematurely judging the efficacy of an intervention (The Design-Based Research Collective).

One of the early proponents of design experiments was Ann Brown (1992) who recognised the difficulties of conducting experimental studies in classroom settings where it was difficult to control the variables that were being manipulated and then measure outcomes without considering what else was happening in the classroom. This is because classroom environments consist of various elements in a larger system that are interdependent and dynamic so that changes in one element effects changes in others and within the whole (Hertz-Lazarowitz, 2008). This makes it difficult to measure the effect of the variable that is being manipulated (e.g., a specific learning intervention) unless other aspects of the environment are simultaneously considered. These other variables include the role of the teacher and students, the curriculum that is taught, and the place of technology in learning. It also includes the types of tasks students are asked to solve, the discourse that is encouraged, expectations for students’ academic and social behaviours, the resources that are provided, and finally, the process the class teacher employs to integrate these elements (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003).

Design-based research aims primarily to develop theories or prototheories of learning that can be used to help gain a better understanding of particular learning and teaching processes. The development of theory takes place through continuous cycles of design, enactment, analysis, and re-design so that the cycle is iterative with each new cycle building on the previous one to make changes to enhance learning (see Figure 1 below).

The first stage in a design experiment is to design what will be done. Usually the purpose of this stage is to propose a study that will be conducted in a classroom to test out a new form of learning (e.g., how do students respond to a particular inquiry approach to learning in a unit of science?). The design experiment is implemented in the classroom and detailed data are systematically collected on students’ responses to this innovation. (It should be noted, that the data collection process is rigorously documented so that the research team have a wealth of information to draw on when deciding how or what may need to be changed to explain what happened.) The data collected may include observations of students’ participation, records of their discourse, and products of their learning. Data may
also be collected from the teacher on her reflections of how the students responded to the innovation and ways in which it could be adjusted or improved. Additionally, the researcher who acts as a participant observer in the process may keep detailed field notes of her observations of the innovation as it was implemented in-situ. These data are then analysed and triangulated to ensure that the information obtained is corroborated from different sources.

Objectivity, validity and reliability are required to ensure that designed-based research is scientifically sound, however, “designed-based research relies on techniques used in other research paradigms like thick descriptive data sets, systematic analysis of data with carefully defined measures, and consensus building within the field around interpretations of data” (The Design-Based Research Collective, 2003, p. 7). Based upon the analyses undertaken, the design of the innovation is redesigned and the cycle of enactment, analysis, and re-design continues. In design-based research, a successful innovation is seen as the product of the intervention that has been designed and the context in which it is embedded.

To design iteratively the research team, and this includes the teacher, need to attend to the evidence that emerges with each cycle as this often requires the development of new measures that are sensitive to the changing learning environment. The outcome of a design experiment should not only be the development of an explanatory framework of how learning occurred that builds links between theory and practice, but it should also help to produce meaningful changes in practice contexts (e.g., school programs, professional development forums).

![Figure 1. The iterative cycle of design, enactment, analysis, and re-design typical of a design experiment.](image-url)
An Example of a Design Experiment

Design experiments often involve a mixed methods approach where both quantitative and qualitative data are collected in order to describe the phenomena under investigation. Such an approach in a classroom may involve pre- and post-testing along with some in-depth analyses of some of the students with some additional case studies of specific students (Brown, 1992). Brown argues that this type of approach allows the researcher to see the magnitude of the effect in terms of outcome measures and to get a feel for the phenomenon by looking at a particular student or group in-depth.

While there are many ways in which design experiments can be conducted, the following is an example of how one may be designed to investigate students’ responses to training in inquiry learning in science. In this case, the design experiment may involve one group of students receiving the intervention while a comparison group learn according to the usual mode of classroom instruction. Data are collected at different stages throughout the intervention from both groups of students and the teacher. Data collected may include samples of the students’ discourse, examples of artefacts produced (e.g., authentic work samples, performances), and responses to surveys or interviews of participants’ perceptions of their learning experiences. Based upon the information obtained from the experimental group, the research team may decide to add another component of inquiry learning and then collect data on the changes to students’ responses from the addition of this element. The study continues with a series of iterations (design, enactment, analysis, and redesign) or adjustments to the intervention until there is consensus that the design is promising enough to warrant further exploration or it needs to be abandoned. At the completion of the intervention, post-testing can be conducted to see if there are differences between the experimental and the comparison groups. Researchers will often collect additional information on the effects of the intervention, often some weeks or months later (e.g., post-post-test) to determine if the effects have been maintained.

O’Donnell (2004) argues that evidence for an intervention is credible if the intervention is compared to an appropriate comparison group, the results can be replicated, and the intervention has produced an effect so that an alternative explanation can be ruled out. However, O’Donnell also argues that while the iterative nature of the design can contribute to the production of credible evidence, there are often limits to a researcher’s ability to rule out alternative explanations and limits to understanding what aspects of a design are needed for an effective intervention. Another concern is the difficulties of generalisation across participants, mainly because there are often only small numbers of participants involved so it is impossible to say what worked with one group of participants will work with others. It is also difficult to generalise across contexts because the design study has often only occurred in one context and not multiple ones. Moreover, because changes are continually made to the context in which the design study has been implemented, it is difficult to identify which feature or combination of features contributed to its success. Similarly, it is difficult to generalize over changes in
behaviours as it is often not possible to rule out other explanations for any changes that may have occurred.

In short, the iterative nature of design research requires systematic attention to evidence by the research team which strengthens the validity of the findings. However, there are still concerns about the difficulties of not being able to rule out alternative explanations for the effects seen and the conclusions that can be drawn for generalisation of the findings (Cobb et al., 2003).

CASE STUDIES

Case studies involve trying to understand a particular phenomenon or issue that is evident in a real life context. Case studies may involve collecting detailed information on, for example, how students in a class use multimedia resources to interrogate specific topics they are researching, how children with physical disabilities respond to specialised assistive technology, or how teachers, who are recognised as being exemplary teachers by their peers, teach. The emphasis in case study research is on gaining a greater understanding of the phenomenon under investigation and this involves the systematic collection of multiple sources of evidence. For example, if the researcher is investigating the practices of an exemplary teacher, her first step may be to critique the current literature and use it to help her identify the data she may need to collect. Such data may include observations, interviews, and the collection of physical artefacts from the classroom (e.g., examples of students’ writing, projects, art work). It is important that with any case study that the researcher keeps comprehensive field notes and records of data collected so a clear audit trail can be identified (i.e., data can be traced back to its original source).

Multiple sources of data are also important if the data are to be triangulated; that is, the issue under investigation is confirmed from different data sources. For example, if a researcher is seeking information on the practices of exemplary teachers, she may observe the teacher’s practice, interview the students in her classroom, and collect examples of the teacher’s curriculum plans. If all three data sources converge and corroborate each other then the conclusion can be drawn that the teacher’s practice is exemplary.

It is important to ensure that any data collected are organised and analysed systematically. In the case of an exemplary teacher, the researcher may use the current literature and theoretical perspectives to help her develop a framework of the practices of such a teacher. These practices may include:

– Recognising that students need to work on complex and interesting tasks
– Using a variety of sources to stimulate students’ interests
– Modelling the types of questions that students are encouraged to ask
– Encouraging students to dialogue together
– Creating opportunities for students to collaborate and problem-solve around tasks
– Promoting higher-order thinking
– Ensuring that learning is student-centered
– Encouraging students to actively participate in their own learning
Providing students with explicit feedback on their progress (Blair et al., 2007; Gillies, 2007).

Using the above information, the researcher may then develop a framework to help organise the data she needs to collect. Once this is done, she will then decide how to collect these data. One approach may involve observing the teacher as she teaches and recording the types of questions she asks that promote higher-order thinking (See Box 3 below).

Field notes. In addition to observing the teacher’s use of higher-order questions, the researcher may also keep extensive field notes on the layout of the room, the types of tasks the students are given, the resources available to stimulate their interest in learning (e.g., access to the internet so they can research information) and, the opportunities provided for the children to collaborate. Field notes need to be detailed and objective, that is, they should capture what the observer saw. As it can sometimes be difficult to make comprehensive notes during an observation, it is important that the observer makes every effort to write them up fully as soon as possible after the observation to ensure the integrity of the research. Field notes are only one source of data for a case study but they are critically important for

Box 3: Thought-provoking questions

| Explain why …? |
| Explain how …? |
| How would you use … to …? |
| What is the difference between…? |
| How are … and … similar? |
| What is a new example of …? |
| What do you think would happen if …? |
| How might … affect …? |
| Which do you think is best and why? |
| Do you agree or disagree with this statement? |
| What evidence is there to support your answer? |

Adapted from King (2008).
corroborating other data that may be collected (see the discussion on Triangulation below).

Interviews. Another source of information in case studies is interviews. Interviews provide opportunities for the researcher to explore participants’ responses to a particular issue. For example, in the case study of an exemplary teacher, the researcher may decide to interview students in the class to gauge their perceptions of their teacher’s teaching. Despite the concerns about interviewing children because of the difficulty they may have in understanding abstract concepts, the effect of the adult-child relationship on the responses obtained (i.e., children may say what they think an interviewer want to hear), and children’s lack of understanding of the interview situation, there is now quite a large volume of work (particularly from the field of counselling) that can be used to ensure that the above concerns are addressed. For example, when interviewing children, the interviewer needs to ensure that she enters the interview through the child’s world. Questions, such as the following, will assist in helping to gauge the emphasis that is placed on reading in the classroom: *Can you tell me about the book you’re reading? This looks like a really interesting book. I wonder what it’s about?* These types of questions provide opportunities for children to talk about their reading while enabling the researcher to find out more about their reading habits. Given that research indicates that exemplary teachers actively promote reading, model and explain how to comprehend text by making predictions about what they read, discuss questions that may arise, and highlight the main idea that emerges (Taylor et al., 2000), the astute interviewer will be able to use this information to find out about reading in the classroom. Questions such as the following can be useful when discussing a story the child is reading: *Can you tell me what you think may happen? I wonder what questions you think the teacher may ask about this story? What do you think is the main idea in this story?*

Other questions that the researcher may ask that are designed to elicit more information on the reading habits of the interviewee are: *Tell me about what you do in the school library? When do you visit the library?* A willingness to spend time in the library engaged in independent reading activities is a behaviour exemplary teachers encourage in children.

The advantage of interviews is that they enable the collection of rich data about students’ attitudes, perceptions, feelings, and concerns that are often not accessible from other data sources. Additionally, these data can be collected in a relatively short period of time and, if they are recorded on tape, the researcher has ready access to the original interview ensuring that transcripts can be easily checked for reliability.

While interviews provide an accessible source of rich data, threats to the validity of the data collected can occur from the following sources: Researchers ask questions that elicit the types of responses they require; they allow their initial impressions of participants (positive or negative) to influence their judgment; or, they fail to acknowledge the potential effect they may have on participants’ responses; for example, children respond with answers they think the interviewer may want to hear.
In order to ensure that such data are collected with integrity so the potential threats to validity are minimised, the following guidelines for effective interviewing are provided.

Guidelines for effective interviewing include:
- Listen more, talk less.
- Follow up on what participants say and ask questions if further clarification is needed.
- Ask open-ended questions.
- Let the participant speak. Be careful not to interrupt.
- Ask for concrete details.
- Keep participants focused on the topic.
- Give the participant time to respond to each question.
- Be impartial and avoid passing judgment on what a participant has to say.
- Avoid debating with participants over their responses. (Gay & Airasian, 2003)

Interview data can be analysed in two ways. First, the researcher may use the data collected to identify themes that are evident. For example, if the researcher is trying to identify the characteristics of an exemplary teacher, she will have formulated some understandings from the literature on what these may be so that the data may be examined to identify these themes. Or if the purpose of the interview is to explore the interviewee’s feelings, perceptions or attitudes, then the data may examine what the interviewee had to say about these issues. Alternatively, a researcher may see an interview as the co-construction of understanding that both the researcher and the interviewee undertake together, and, in this case, both need to arrive at common understandings of what the interviewee has discussed. For example, if the researcher is trying to find out how an interviewee feels about a large building development project being undertaken close to his house, the researcher would explore his feelings on the topic. The following is an example of the types of interaction that may occur:

Researcher: John, can you tell me how you feel about this new development project?

Interviewee: I’m really annoyed because I knew nothing about it until about a week before they started on the site—clearing the trees and everything.

Researcher: You feel really angry because you had no knowledge of what was planned?

Interviewee: Yeah! That’s right … (It) makes me mad.

**Triangulation of Data Sources**

It is very important when undertaking qualitative research, such as case study research, that as much data as possible is collected from multiple sources and that these data are triangulated. Researchers triangulate data by using multiple data sources to confirm or corroborate information from other sources. For example, when collecting information on an exemplary teacher, it will be necessary for the
researcher to observe that teacher interacting with her class and to make extensive
field notes on how she interacts with her students, the approaches she uses to teach,
the strategies she employs to motivate her students, and the way her students
respond to her teaching in order to gain a comprehensive understanding of this
teacher’s attributes.

As exemplary teachers tend to have high expectations for their students and will
work assiduously to help these students succeed, it will be important to interview
some of the students in this teacher’s classroom to determine their perceptions of
their teacher and her expectations for them. As mentioned previously, when
interviewing children it can be difficult to obtain information that is reliable,
mainly because children have a tendency to say what they think the interviewer
may want to hear. In order to overcome this bias, it is necessary to focus on the
behaviours that the teacher may expect from the children as they work on a task.
For example, “When you work together on a project, what are the sorts of things
you’re expected to do?” (Possible answers include, work together, help each other,
share resources, make decisions as a group, complete the task); “Tell me about how
you break up the task?” (we share it); “What expectations do you hold for others in
your group?” “Who gives you feedback on your work?” (group members, the
teacher, other children in the class); “How do you work out timelines for completing
your work?” “Where do you get the resources you need for completing your task?”
While these questions focus on the student’s participation in group work, they also
enable the interviewer to gain some insights into the teacher’s high expectations for
her students that can then be corroborated from other sources.

Another source of data on the teacher’s practices can be obtained from
interviewing the teacher herself and asking her about her expectations for the
children in her room. Questions such as the following will often help to provide
insights into this teacher’s beliefs about her expectations for her children. “Can you
tell me how you motivate children in your class?” “What do you do (to motivate)
for children who are not interested in a task?” “How do you work with children
with learning difficulties?” “What expectations do you hold for the children?”
“What are your thoughts about setting homework?” In order to minimise threats to
the validity of the data, it is important to revisit the interview with the teacher at a
later date and show her the transcript of the major themes that emerged from her
interview to see if she is able to confirm that the interviewer’s interpretation is
correct.

Exemplary teachers hold high expectations for the quality of the work the
children complete so by collecting a variety of samples of the children’s authentic
learning it will be possible to determine if these expectations can be confirmed. For
example, “Are the tasks intellectually challenging?” “Do the children have to draw
on multiple resources, including other children to complete them?” “Do the tasks
allow the children to express novel and creative ideas?” Once again, these data are
corroborated with other data to provide a more complete understanding of this
teacher’s attributes and whether they can be regarded as exemplary.

In order to enhance validity and minimise bias in the qualitative data collected
in case study research, Gay and Airasian (2003) suggest that the following
strategies may be helpful, particularly if used in combination:
Collect as much data as possible from multiple sources. This may entail staying in the field longer so earlier and later data can be compared for consistency.

- Build trust with the participants so they feel comfortable having the researcher participate as the participant-observer in the study.
- Recognise one’s own biases and try to minimise them by obtaining feedback from others and working with another researcher to ensure that data collected are reliable and valid.
- Ensure that participants have access to field notes or interview data so they can critique them for accuracy.
- Report observations or conversations accurately without interpretation.
- Examine unusual or contradictory data and check to see that the observer’s bias has not affected the data collection process. Use another researcher to check the data if the anomaly continues.
- Corroborate data through triangulating it with different data sources.

**Artefacts**

Artefacts are another valuable source of data that can be collected to provide information on the phenomenon under investigation. These data may include portfolios, exhibitions of performance, and work samples such as problem-based projects, essays, DVDs, power-point presentations, or creative art work. These data are commonly called authentic tasks. The advantage of collecting authentic samples of the students’ work is that they:

- Involve real life tasks
- Provide information on how students respond to intellectual challenge
- Involve students own research
- Enable the assessment of students’ higher-order thinking
- Provide evidence of engagement with a task
- Demonstrate how students collaborated with others
- Provide information on how specific criteria were met
- Provide opportunities for a multi-faceted approach to evaluation
- Enable teachers to understand students’ different learning styles
- Enable teachers to identify the support required by specific students as necessary (Woolfolk, 1998).

Samples of authentic tasks provide teachers with a wealth of information on students’ performances without the requirements of formal testing. Moreover, because such tasks occur in authentic contexts, Herrington and Oliver (2000) argue that these types of assessment reflect the types of problem situations students are likely to encounter in real-life learning environments where problems are generally complex and ill-defined. Furthermore, in order to solve these problems, students need to have access to a range and diversity of materials that will enable them to explore these topics in depth, apply sustained thinking to them, have access to the critical insights of others, and present their findings as both oral and written reports to their peers. Moreover, students are more likely to engage with the task when they are able to exercise ownership over it and the process required to develop a solution (Gulikers, Bastiaens, & Kirschner, 2004).
PORTFOLIOS

Portfolios are another example of authentic tasks (Darling-Hammond & Snyder, 2000). In classroom situations, teachers often use portfolios to collect examples of students’ work over a period of time. They may include samples of students’ work such as DVDs, power-points, and other multimedia presentations as well as examples of their written work. Portfolios can be assembled by teachers on students, or students can construct their own portfolios. Either way, they are designed to be an ongoing record of work students have attempted or completed and as such they provide insights into progress. They can be used to facilitate communication with parents, students, and other teachers so that successes can be celebrated and difficulties identified enabling strategies to be developed to help overcome them (Gillespie, Ford, Gillespie, & Leavell, 1996).

Portfolios have been used in a range of subject areas and with children of different ages. Micklo (1997) used portfolios with elementary children as a way of encouraging them to think mathematically. He found that when children understood the purpose of a portfolio, it acted as a tool to help them monitor their own learning so they developed an understanding of how to solve problems, complete mathematical investigations, and reflect on their mathematical experiences. Furthermore, Micklo found that portfolios provide insights into students’ abilities to communicate mathematically, to demonstrate mathematical reasoning, and make connections between different concepts and relationships in mathematics. This enables teachers to determine whether they need to review content, extend activities to encourage further exploration, provide additional experiences in areas that need improvement, or modify experiences to suit individual students’ needs.

EXHIBITIONS OF PERFORMANCE

Another type of authentic task involves exhibitions of performance. The advantage of an exhibition is that it allows students to demonstrate particular abilities in ways that include or closely simulate real-life situations. In classroom situations, students can demonstrate the integration of knowledge, behaviours, skills, values, attitudes, and self-perceptions of a topic through an exhibition of performance. For example, if a small group of students is required to present their interpretation of theatre history from a particular period, they may choose to do so by presenting a play or a musical performance, produce and model costumes, or debate the significance or otherwise of the contributions of this period to the overall history of theatre. The advantage of exhibitions is that performances can be evaluated in relation to prescribed standards of practice that have been previously discussed with performers. Interestingly, when novices have to demonstrate competencies through performance, it sharpens their awareness of the knowledge and skills they must integrate in order to meet required standards.
EVIDENCE – WHAT IS IT?

PROBLEM-BASED INQUIRIES

Another type of authentic task identified by Darling-Hammond and Snyder (2000) are problem-based inquiries. When students undertake problem-based inquiries they investigate topics that often require them to collect and aggregate data and information about a problem. Essentially, this type of task is designed to promote higher-level thinking about a topic by helping students learn to pose questions, conduct investigations, analyse and synthesize information, and present findings. In so doing, students learn to provide reasons and justifications for their thesis in response to questions from their peers. The advantage of problem-based inquiries is that students learn how to be both consumers of research and producers of knowledge. These types of inquiries help students to think analytically and to see how problems can be framed in a manner that allows them to be thoughtfully examined (Darling-Hammond & Snyder). If students work in small groups while they are undertaking these types of inquiries, they have the added benefits of the group’s insights and analyses of the problem issue.

PROGRAM EVALUATION STUDIES

Teachers frequently engage in program evaluation because as practitioners that is what they are trained to do. They evaluate the viability of reading programs, mathematics programs, programs designed to promote emotional resilience and so on. Issues that are often considered in evaluating a program involve practicality: Can it be implemented with relative ease into the class context, and if not, what types of changes will need to be made to accommodate this new program? Other issues involve instructional pedagogies. For example, how closely does it align with current classroom pedagogies so implementation can be quite seamless; that is, it can be integrated and implemented with relative ease into the range of pedagogies the teacher currently uses; are the resources needed to implement the program readily available; and, does the program accommodate the learning needs of a range of children in the classroom? This last issue is very important because while teachers are willing to make adjustments to educational programs for children with special learning and behavioural needs in their classrooms, they often express a reluctance to implement a program specific to an individual or a small group because of differential instructional requirements, management and resource issues, and time constraints.

Essentially, teachers want instructional programs that work and this means that they are continually involved in evaluating different programs to assess how students are responding to them and what are they learning. When teachers engage in this process of assessment it is often referred to as formative assessment. Formative assessment is designed to provide information that informs the ongoing teaching and learning process to ensure its effectiveness and to ascertain whether expectations for the task should be changed.
An Example of a Program-evaluation Study

The following is an example of a program evaluation study that was undertaken to investigate the effectiveness of the Microsoft Peer Coaching (MPC) program that was implemented in a number of K-12 schools. Specifically, the study sought to determine: how well the program materials correlated with exemplary practices in peer coaching identified in the literature; if the attitudes and perceptions of the participants towards technology had changed as a result of being involved in the MPC program training; and, the positive outcomes and challenges posed by participation in the program.

Example 3: Peer coaching and technology integration: An evaluation of the Microsoft peer coaching program. This article focuses on an evaluation of the Microsoft Peer Coaching (MPC) program as it was implemented in a number of K-12 public schools in Florida. The purpose of the MPC program was to train teachers who would become coaches and mentors to their teacher colleagues to help them integrate new technology knowledge and skills into their teaching practice so they were able to offer their students technology-rich learning activities. The program evaluation was conducted in two parts: First, the design of the MPC materials was evaluated using the characteristics of exemplary peer coaching and the technology integration models identified in the literature. Second, the facilitators and coaches who had been trained in the implementation of the MPC program were interviewed about the perceived benefits and limitations of the program. The characteristics of exemplary peer coaching that were evaluated were the processes employed, the contextual factors, and the essential conditions of peer coaching for technology integration. A technology integration peer coaching matrix was constructed for the analysis of the program materials and the authors used this matrix to help them develop an implementation rating scale to evaluate the different elements that were identified. The findings suggested that the MPC program design was in close alignment with the literature on exemplary peer coaching. However, the process of peer coaching frequently took precedence over the technology integration component. As a consequence of the evaluation of the MPC program, the authors were able to make some clear recommendation on adjustments to the program for others wishing to implement it in their schools.

FORMATIVE ASSESSMENTS

There are many different ways of conducting formative assessments to provide information on students’ learning, from those that consider students’ responses to tasks, how they interact, types of explanatory discourse they use to facilitate understanding and learning through to those that tap students’ perceptions of how they are learning and so on. Other types of formative assessments include curriculum-based assessments. These types of assessments use a variety of probes or stimulus questions to gauge students’ understandings or progress at some point from participating in the curriculum.
Teachers use many different types of formative assessment approaches. Paris and Hoffman (2004), in a review of the different types of reading assessments teachers use from kindergarten to third grade, found they ranged from observations, anecdotal evidence, informal inventories, and work samples as the main source of evidence for students’ reading achievement and progress. Most teachers reported that formative assessments that they design, select, and embed in the curriculum are more useful for teachers, students, and parents than more sophisticated, commercially produced assessment tools.

Formative assessments are particularly valuable if students are involved in the process. Black and Wiliam (1998a), in a review of several studies that reported on implementing different innovations designed to provide students with informal feedback on their progress in learning reported that formative assessments do produce significant and often substantial learning gains. Moreover, when low-achieving students and students with disabilities are provided with frequent assessment feedback, it not only helps to increase their learning, but it also helps to raise achievement overall (Black & Wiliam, 1998b). In a more recent review of over 250 studies that reported using formative assessments, Black, Harrison, Lee, Marshall, & William (2004) found that there was unequivocal evidence that formative assessments do raise achievement standards and this even applied to scores on state-mandated tests. This occurred because teachers saw formative assessments as providing opportunities for students to:

– Receive specific feedback on how their performances could be improved. Feedback is provided against a set of criteria that identifies what it means to complete the task successfully. Concrete examples are used in modelling exercises to develop understanding.
– Participate with their peers and receive feedback on their work. By interacting with their peers, students learn to be more objective and this is important for effective self-assessment.
– Reflect on their own performance in the light of required expectations for a satisfactory performance and feedback from their teacher and peers.

In summary, the formative assessment process in program evaluation enables teachers to collect information on the viability of specific educational programs. This viability may relate to issues of practicality, instructional pedagogies, ease of implementation, and students’ responses. Formative assessment information collected on students’ responses to the program may include observations of their participation, anecdotal records of progress, and authentic work samples or artefacts that provide a record of what students can do. The advantage of these types of assessments is that they enable teachers to obtain immediate feedback on how students are currently responding to the program and what, if any, changes may need to be made in how they teach.

REDUCING THE RESEARCH TO PRACTICE GAP

While there has been an abundance of research published on strategies that promote teaching and learning, teachers often find research findings difficult to access and of little relevance to classroom practice (Greenwood, 2001). In fact,
many teachers believe it is theory driven and unimportant (Fuchs & Fuchs, 2001). These perceptions of teachers are a concern because advances to teaching and learning practice depend on an active link between researchers and teachers so they can communicate about the issues of mutual concern and interest, discuss the possibility of developing interventions that are usable, and ensure that teachers have opportunities for meaningful professional development that enables them to exercise agency over what they learn in the context of developing knowledge in the field and its relevance to their practice. Unfortunately, professional development opportunities for teachers have often involved the ‘top down’ transmission model of telling teachers what to do rather than actively engaging them in the process of identifying their professional needs and what they would like to do to meet them. The perceived separateness of the research and practice communities, the limited relevance of educational research to practice, the failure of research to produce many innovations that are usable in the classroom, and the lack of ongoing opportunities to receive regular input from each other and to engage in professional development contribute to the research to practice gap that is evident in much educational literature (Greenwood & Abbott, 2001). However, this is not to say that this research to practice gap cannot be reduced. It can.

In a synthesis of five studies that identified the characteristics of research to practice links, Boudah, Logan, and Greenwood (2001) noted that this nexus was successful when:

1. **Up-front commitment to the project.** This commitment was critical and it involved researchers checking out teachers’ commitment to the research project independently of the principal. Furthermore, this commitment was enhanced when teachers felt they could engage in professional dialogues that were open and honest with their colleagues and the researchers so they experienced a general sense of validation for their efforts.

2. **Extensive and sustained effort.** This involved teachers observing and implementing changes in practices over a period of time with the necessary follow-up, feedback, debriefing, and collegial support provided by helpful researchers and other teachers. Interestingly, Boudah and colleagues (2001) noted that the number of teachers involved in research to practice projects often grew as they brought other colleagues into the discussions because of the ‘street validity’ they experienced through their involvement. These discussions gave teachers a shared vocabulary to describe their interventions which, in turn, led to greater communication across grade levels and within the school.
3. **Involvement by the principal and other key personnel.** It is not surprising that the involvement of the principal and key administrative personnel is critically important to the success of any research to practice project. Indeed, research on the characteristics of effective schools, that is, schools that made a difference to students’ outcomes, identified the importance of strong professional leadership by the school principal as one of key factors that affected success (Sammons, Hillman, & Mortimore, 1995; Taylor et al., 2000). Moreover, given the principal’s ability to be able to ensure that teachers have the time to try out interventions and are provided with the necessary resources for implementation, her involvement in the project is critically important for its implementation and sustainability.

4. **Availability of financial resources.** Without the financial resources to support research to practice innovations, it is highly likely that they will not succeed. These financial resources are needed to support a range of requirements, including ongoing professional development and training, a key factor identified in the literature on effective schools (Taylor et al., 2000) and one of the 11 mandated components of a Comprehensive School Reform (CSR) program (CSR, 2004). In fact, effective professional development is a process that continually occurs both within the classroom context through coaching, observing, providing feedback on data collected, and making decisions, and through informal contact with teaching peers (Boudah et al., 2001).

5. **Teachers’ efforts recognised.** It is important to acknowledge and validate teachers’ contributions as this encourages their ongoing involvement and commitment to the project. Experienced teachers are important in this regard because they can take a lead role in nurturing and mentoring less experienced staff. Researchers from universities are also important in mentoring teachers into new approaches to teaching and learning, building consensus within groups, and providing feedback on the results obtained. Moreover, Boudah et al. (2001) observed that when innovations bore success and teachers were invigorated by working with colleagues, their recognition also contributed to further teacher involvement, deeper levels of success, and greater sustainability.

**CHAPTER SUMMARY**

This chapter has outlined:

1. The different types of research that can be undertaken in schools and indicated that the strongest evidence of the effectiveness of an intervention is obtained from an experimental study where students are randomly allocated to conditions. Quasi-experimental studies do not randomly allocate students to conditions so the researcher needs to ensure that the students within each condition resemble each other as closely as possible, hence any changes that occur in the experimental condition can be attributed to the intervention and not to differences in the conditions (e.g., students in experimental condition learning more quickly than students in the...
control condition). Other studies that are designed to help teachers understand how students respond to a particular phenomenon (e.g., approach to teaching) in a real-life context include design studies, case studies, and program evaluation studies.

2. The quality of evidence that is required to help teachers determine the effectiveness of an intervention. This includes being aware of what is required for strong evidence of the effectiveness of an intervention in contrast to moderate evidence of its effectiveness. Teachers too need to know how to use the evidence that exists to help them make informed decisions, including knowing how to locate evidence, critically appraise it, understand the power of the evidence, and determine its relevance to their educational needs. Evidence can be derived from a variety of sources including: interviews, artefacts such as work samples, portfolios, exhibitions of performance, and problem-based inquiries, classroom observations, and different formative assessment tasks.

3. The issues that need to be overcome to encourage teachers to adopt evidence-based practices. These include ensuring that the evidence-based practice is: Relevant to classroom practice; communication exists between teachers and researchers on issues of implementation; and opportunities are provided for meaningful professional development where developments in the field are discussed along with relevance to their practice.

ACTIVITIES

1. Interview a researcher who is engaged in classroom-based research. See if you can obtain information on the following: What is the focus of their research (e.g., reading, problem-solving in mathematics)? Who are the participants? What type of study are they conducting (e.g., experiments, design research, case study etc.)? What is the purpose of the research? What measures are they using (observations, self-reports, interviews, artefacts)? What are some of the difficulties with this type of research?

2. Interview an experienced teacher to find out how the following are valued in the class: Portfolios, exhibitions of performance, inquiry-based project work, and authentic work samples. In particular, find out how these artefacts are used to inform the teacher’s practice (e.g., does she/he adjust instruction to accommodate students’ needs). Are they seen as formative assessment? How are students provided with feedback? Are these artefacts augmented with other types of assessment?

3. Observe an expert teacher (i.e., one who is highly regarded by her peers for her professional competencies) as she interacts with her students. Refer to the section of this chapter that outlines, The principles and practices of excellent classroom teachers, and see if you can identify how the teacher you are observing fulfills some of the qualities outlined. Record some examples of the qualities you see demonstrated and provide evidence to support your observations. For example, this teacher may
use different types of questions to help scaffold and challenge children’s learning. Make a note of these questions and record what she said and how the students responded.

4. Collect some examples of formative assessments that teachers use. Find out how teachers use these assessments to inform their practice and provide feedback to students. Check to see if the teachers discuss these assessments with the children before they are used. In other words, do the children understand the criteria on which they will be assessed? If the teachers do discuss these assessments with the children before hand, what affect does this have on their performances?

5. Interview two teachers on how they use research to inform their practice. See if you can identify some of the difficulties they may have in bridging the research to practice divide. For example, teachers will often say that research is too theoretical and not relevant to their classroom practice while others are keen to try out new ideas to see how they work. The reluctance of teachers to use research to inform their practice is a concern for many researchers who are keen to introduce new evidence-based teaching practices into the classroom that are known to benefit students’ learning. Do the teachers you intend to interview have any ideas on how this the research to teaching practice divide may be overcome (e.g., more professional development, opportunities to work with researchers on projects that are relevant to their classroom)?

SUGGESTIONS FOR FURTHER READING


CHAPTER 2

STUDENT-CENTRED TEACHING: THEORETICAL PERSPECTIVES THAT INFORM RESEARCH

INTRODUCTION AND LEARNING OBJECTIVES

Children have a need to learn, to master tasks, and to be perceived as competent, yet in many learning situations teachers inhibit the fulfilment of children’s needs by restrictive educational practices. These practices which are generally referred to as “traditional instruction” refer to the way information is presented and learned. Teachers who use traditional instruction methods tend to be directive, focus on the whole class as a single unit, and expect children to learn through didactic presentations and student recitations of information, with few opportunities to discuss ideas or present different perspectives. Other teachers, however, recognise that children have a need to learn and for teachers to teach effectively, the process of teaching and learning operates in quite a different way. In these classrooms, instruction tends to be student-centred as children are encouraged to actively participate in the teaching-learning process, to engage in discussion with others, present alternative perspectives, and to co-construct new understandings of what they have learned.

Student-centred approaches to teaching have gained momentum over the last three decades as research has emerged demonstrating that students are more motivated to learn and learn more when conditions are created that encourage them to be active in the learning process (Ryan & Deci, 2000). Furthermore, many teachers who have implemented student-centred learning methods have seen and appreciated how they can be used in classrooms to assist children to cooperate and also to help teachers deal with many of the major issues they confront today. The purpose of this chapter is to provide an overview of student-centred learning and, in particular, the personal and social constructivist theories that have informed these approaches to teaching and learning. The chapter will also present research that demonstrates support for constructivist learning, and the strategies used to promote student agency, engagement, and learning.

When readers have finished this chapter they will know:

- The constructivist theories that underpin student-centred approaches to teaching and learning
- Implications for teachers
- The role of the learner
- Student-centred strategies that can be used in the classroom.
CONSTRUCTIVISM: AN OVERVIEW

One of the leading advocates of child-centred learning of the early twentieth century was the philosopher John Dewey who strongly believed that schools had a responsibility to capture children’s interests and make learning meaningful to them. Dewey believed learning should be an active and dynamic process that should be child-centred and responsive to the child’s developing social interests and activities. He believed that schools had a responsibility to build on students’ naturally developing interests in their social environment by fostering interpersonal communication and group involvement to promote the development of the whole child (Dewey, 1966). Through social engagement with others, children learn new ways of thinking and talking and constructing meaning from their experiences (Mercer, 1996). This process of constructing meaning or making sense of the world can be explained from two theoretical perspectives—personal and social constructivism.

**Personal Constructivism**

Personal constructivism proposes that individuals are continually engaged in a process of cognitive construction which helps them organise their experiences to create order as they adapt to the environment. According to Piaget (1950), the major proponent of this theory, personal constructivism emphasises the intrapersonal dimensions of learning; that is, that learning is mediated through interacting with others. Interactions that expose children to different points of view are likely to give rise to a state of cognitive conflict as children are challenged to keep their own points of view in mind while taking account of other incompatible ones. This dilemma creates a state of cognitive tension and disequilibrium which, if it is to be resolved, forces the child to “decentre” and consider what others have to say.

When children disagree with others two important realisations occur. First, they are forced to re-examine their own points of view and reassess their validity, and, second, they learn that they must justify their own points of view and communicate these clearly if they are to be accepted as valid by others. Individuals are strongly motivated to reconcile contradictions and in so doing will re-evaluate and re-structure their own thinking on the basis of the new information they receive. Interaction with others is a trigger to social and cognitive change, although the change itself is achieved by the individual.

The change that occurs is demonstrated in a series of studies where children with different cognitive strategies for solving problems work together. In the first study, Mugny and Doise (1978) asked children who were not yet able to spatially conserve to reproduce a model village of several houses with each having a different orientation. As the children were not yet capable of the spatial transformations required to preserve the front/back and left/right relations, they produced an egocentric copy of the village. In order to test for the effects of socio-cognitive conflict, Mugny and Doise then paired the children with one of the following types of partners: a child who was able to totally compensate for the 180 degree manoeuvre required (highest performing level), a child who was partially able to
compensate (middle performing level), or a child who was unable to compensate (lowest performing level) for the manoeuvre. The results showed that children made more progress towards solving the problem when they were paired with a child who was only partially able to compensate for the manoeuvre. It appeared that the child who was partially able to compensate became perturbed by the solution offered by the child who could not compensate because she could see it was incorrect but did not yet possess the cognitive capacity to solve the problem. While looking for a satisfactory solution, this child often explicated her strategy and discussed it with her partner. As a consequence both made progress in solving the dilemma as both took part in a search for the correct answer. This, however, did not happen when a child who could not compensate worked with a partner who could (highest performing level). In this case, the partner tended to solve the problem on her own and ignore suggestions from the other child. Similarly, when two children who were unaware of the need to compensate (lowest performing level) worked with each other, the interaction was a simple reproduction of the initial performances so they demonstrated no progress towards making the manoeuvres required. These results led Mungy and Doise to conclude that collaborative performances are superior to those of the individual when the interaction challenges children to reconsider their previously held perspectives.

In a second series of studies, Doise and Mugny (1984) repeated the above experiments using the village to elucidate the superiority of collective performances over individual ones. Once again, children who were not yet able to spatially conserve were asked to reproduce the model village. The children worked in pairs with one child being placed in the ‘easy’ position so he only had to rotate his visual plane by 90 degrees while the other child was given the ‘difficult’ position where he was required to make a front/back and right/left transformations, despite having been selected because he had been unable to do this on a pre-test task. The results showed that when a child in the easy position, for whom the solution was obvious, was confronted by an incorrect placement of the village offered by a child in the difficult position, the child in the easy position became perturbed by the other child’s response. However, previous research has shown that children often did not challenge other children’s solutions, particularly if the child in the difficult position is convinced he is correct. Often the child in the difficult position will impose his solution on the child in the easy position and just ignore what he has to say so there was no real confrontation of views.

To overcome this problem, Doise and Mugny (1984) believed that the “difficult” child must be given a chance to defend his or her point of view and this was done by bringing another child, who was able to act as a social support for the child in the difficult position, into the situation. In so doing, it was hoped that these two children would maintain their initial views so the child in the easy position was confronted by two children in the difficult position who argued vehemently that their incorrect solution was correct, thereby creating a situation of socio-cognitive conflict. The results demonstrated that when children had to consider alternative solutions, even when they were incorrect, they made more progress on follow-up post tests that exposed them to difficult positions. In effect, someone who already
knows the correct answer can still learn from someone, who seeing the problem from a different angle, offers an incorrect answer.

The success of these series of studies on the role of socio-cognitive conflict in children’s cognitive development led Doise (1990) to propose that:

1. Children who learn to coordinate their own actions with those of others are often able to construct new cognitive understandings that they are not capable of individually.
2. Children who participate in various social understandings often become capable of executing these understandings alone.
3. Cognitive operations accomplished in one specific social situation often become generalisable to others.
4. Social interaction which engenders socio-cognitive conflict often becomes a source of cognitive progress.
5. Initial competencies are necessary for individuals to benefit from a specific interaction situation.

These studies have enormous implications for how teachers can establish learning experiences in classrooms so children have opportunities to collaborate and be cognitively challenged by other children’s perspectives. To reduce cognitive tension and re-establish internal equilibrium, children are forced to confront these contradictory ways of thinking and integrate them into more elaborate cognitive formulations (Mugny & Carugati, 1989). Providing children with opportunities to explicate their thinking processes, even when they are incorrect, enables children to reflect on different peer reactions and perspectives, and revise their cognitions in the light of new information and understandings. Damon (1984) believes that peers act as a particularly compelling source of cognitive conflict because children speak to each other on a level that they can easily understand, they speak openly to each other without hedging words, they take feedback from their peers seriously, and they are strongly motivated to reconcile differences between themselves and other children. Dialogue and discussion around contentious issues helps children to generate more sophisticated and creative answers to challenging questions than children working alone (De Lisi & Golbeck, 1999).

**Case Study 2.1: An Example of How Children Can Challenge Each Other’s Thinking**

In this vignette, four children (two Grade 6 & two Grade 4 students) were working together to find information for the food and ecosystem webs they were required to draw as part of their research on a food chain. The children were working in groups of four and the Grade 6 children had been told they were to question the Grade 4 children to ensure they understood the information they had collected while the Grade 4 children were to seek explanations if they were unsure of the information presented. The interaction reported below represents only a few minutes of the total interaction:
1. S1: “What we did was we had them up here...” (first Grade 4 student, begins to explain what she and her co-worker did as they looked at different animals in the food chain).
2. S2: “How come you chose the scavengers rather than organisms that eat dead and dying organisms?” (first Grade 6 student challenges the grade four students to explain why they had investigated this aspect of the topic first).
3. S1: “We did that ‘cause we thought we’d start here and follow them back.” (first Grade 4 student provides a reason for why they started where they did on the food cycle. Both Grade 4 students discuss this issue).
4. S3: “Can you give us an example of how they do that?” (second Grade 6 student challenges Grade 4 students’ understanding).
5. S2: “Can you give us an example ... like a worm ... birds eat worms so they’re scavengers?” (first Grade 6 student probes students’ understanding and prompts them to consider how they might respond).
6. S4: “A wild pig would have to eat a rabbit and the rabbit gets decomposed.” (second Grade 4 student provides an elaborated response).
7. S2: “Right, like a rabbit, like a rabbit gets decomposed. That’s good.” (first Grade 6 student). “Give me an example of a producer. Can you think of a type of producer?” (first Grade 6 student challenges the Grade 4 students to provide an example).
8. S1: “A producer can be like ... fish ... fish produce other fish, and they get eaten by scavengers.” (first Grade 4 student provides an elaborated response).
9. S3: “Can you name three scavengers that you know?” (second Grade 6 student).
10. S1: “Wild pig, a vulture ….” (first Grade 4 students respond together).
11. S3: “That’s a scavenger. Do you know what a scavenger is?” (second Grade 6 student challenges the Grade 4 students’ understanding).
12. S4: “It’s like vultures that come in and eat the zebra. ... they come and eats the dead carcass ...” (second Grade 4 student provides an elaborated response) (all students engage in short interaction about animals that eat dead carcasses).
13. S2: “Can you name three different consumers or organisms that eat other organisms?” (first Grade 6 student).
15. S4: “Okay. Good. (second Grade 6 student). Now we’ll show you our chart. We’ve got to show you four animals on our table. The seal is our first animal. Okay, the habitat of the seal, the food, the competitors and the predators, the climate. Do you know what predators are?” (second Grade 6 student challenges Grade 4 students).
17. S3: “Seals and whales both eat fish, so they’re both competing for the same food. They compete with to get food or, like...like when you run a race they compete to win the trophy or something. Do you understand that?” (second Grade 6 student challenges the Grade 4 students’ understanding).
18. S4: “What’s this mean?” (second Grade 4 student seeking explanation on the habitat of some of the animals) (Children begin an animated discussion of climate change and habitat).

Research indicates that when children are challenged by other children about a topic the responses they give are more detailed and elaborated than the responses generated by peers who are unchallenged (Gillies & Ashman, 1998). In the above extract, the Grade 6 children challenge the Grade 4 children on five different occasions (Turns 2, 4, 7, 11, & 15) and in each instance, the Grade 4 students respond with an elaborated response that involves a reason or a justification for the action they took.

Interestingly, in four of the five responses, the Grade 4 children have used a metaphor to illustrate what they mean. For example, the request for an example of a “producer” (Turn 7) is met with the response, “A producer can be like ... fish ... fish produce other fish, and they get eaten by scavengers.” (Turn 8). Likewise, when the Grade 4 children are challenged to explain what a “scavenger” is (Turn 11), the following illustration is provided by one of the students; “It’s like vultures that come in and eat the zebra. ... they come and eats the dead carcass ....” (Turn 12). Once the Grade 6 children are satisfied that the Grade 4 children understand the information they have been researching, they then present a summary of what they have been doing, and it is then that one of the Grade 4 students asks for an explanation about the habitat of some of the animals, demonstrating that the interrogation is reciprocal and not just for the Grade 4 children.

The interactions reported in the above extract illustrate how children can be led to generate elaborated and creative responses when they are asked questions that challenge them to provide reasons and justifications for the decisions they have taken. It is this interrogation that led to better understanding and learning of the information they were researching. It is also interesting to note when children have opportunities to work with others in an environment that is supportive of each other’s endeavours, they demonstrate a willingness to spend time seeking information from each other and clarifying understandings on issues of mutual interest.

Social Constructivism

Social constructivism, developed by Lev Vygotsky (1978), emphasises the interpersonal dimensions of learning and, in particular, the role more competent adults or children play in helping the child gain mastery over the cultural tools and signs that are important to her or his cultural group. However, although the social context provides the habits and forms these cultural behaviours take, it is the individual who is actively involved in mastering these cultural behaviours and acquiring them as her personal property.

Interaction with others is critical for the development of higher cognitive functions in children because more capable adults and peers mediate the child’s environment by focusing attention on relevant information and providing the tools for problem solving such as speech and other cultural artefacts (e.g., memory strategies) and ways of reasoning. Children are introduced to new ways of thinking and patterns of
thought when they engage in dialogues with more competent others so, eventually, after repeated exposure to these exchanges, the child’s thinking and communication processes become internalised as part of the child’s mental repertoire. By interacting with others, children not only acquire new information but also new ways of thinking that are implicit in the communication (Vygotsky, 1978).

The internalisation of new ways of thinking and communicating occurs through a process of adjustment and accommodation in interaction with others (Wertsch, 1984). For example, as adults use speech and gestures which are tied to the definition of a situation that exists for children, they adjust their understanding of that situation to develop a common understanding of social reality. This process occurs through mediation when adults or more capable peers mediate the environment for children by supplying the culturally available psychological tools of thought which children, through repeated interaction, eventually internalise. Once internalisation has occurred, the child retains the ability to reproduce these jointly produced cognitive performances independently of others (Damon & Phelps, 1989).

The process of internalisation from others regulating the child’s learning to self-regulation was highlighted by Wertsch (1984) who studied the interaction patterns between mothers and their young children. He outlined four levels through which the child progresses beginning with a response that is not related to the task, realising there is some connection to the adult’s speech and the task, accepting more responsibility for responding to the demands of others, and finally, performing the task without any strategic assistance from the adult. Children are motivated to progress from one level to the next because of the need to establish and maintain coherence between their actions and the adult’s speech.

Coherence is created by children adjusting their understanding of situations so they are consistent with their behaviors. Children follow adults’ directions and construct understandings of the relationship between speech, definition of the situation, and behaviour so that they may perform tasks even though they may not understand what they are being asked to do. For example, adults use directions that children do not understand and then guide children’s responses (Wertsch, 1984) and as children’s learning develops, strategies or routines that scaffold their learning are progressively altered and replaced by ones that enhance mastery of complex behaviour (Cazden, 1983). In this way, children learn to understand task situations because they have performed them under the guidance of adults (Rogoff, 1990). Vygotsky (1978) refers to this difference between what the child can accomplish independently and what she can accomplish under the guidance of an adult or in collaboration with more capable peers as “the zone of proximal development” (p. 86). In a tutoring relationship, more capable peers (i.e., tutors) provide the speech, situation definition, and behaviour that mediates or scaffolds the child’s understanding of the task, however, it is the child (tutee) who must act on this information to negotiate meaning and appropriate learning (Palinscar, 1998).
Case Study 2.2: An Example of How a Teacher Can Scaffold Students’ Thinking and Promote Learning

In this vignette, the children are working in a small, cooperative group on a social science activity that is investigating issues related to wildlife preservation. The focus of this activity is on the protection of wildlife habitats for specific animals. The children are discussing how to write an information report on king penguins where they have to work out headings and then decide what information they need to include. The interaction that occurred involved only a few minutes of the teacher’s time as she moved among the groups in the classroom to monitor progress, provide assistance, and actively challenge the children’s thinking and scaffold their learning.

1. T: So you’re doing the King penguin. Right?
2. S1: There’s a long breeding season.
3. S2: Put it under adaptation.
4. T: Long breeding season. So it’s adapting. What makes you think it might be adapting? (T. probes the students to extend their thinking and get them to see if there are other issues that they need to consider).
5. S: Because they don’t...
6. T: Because you think that’s how they cope with the environment and by having a very long breeding season. Did the information you read give you any information? Why? (T. probes the children and helps them to clarify what further information they may need).
7. S: No.
8. T: It was just a point that came out of the video.
9. S: No, it was a book that we read. It just had a dot point, ‘unusually long breeding period’ and that was it. (S. provides detailed response on where the information came from).
10. T: You don’t know whether it’s their adapting to the cold weather. What do you think it should go under? (T. paraphrases to let the children know that she understands what they’re saying. The question that follows is designed to help the children clarify which category the information needs to be included in).
11. S1: Any other feature.
12. S2: Adaptation because it how it gets the penguins to live. (S. provides reason).
13. T: So you think it gives them longer to look after their young so they can adapt. Now that’s what you as a group have to decide whether you want to put it under that or under any other features. (T. helps students to focus on key issues).
15. S2: Same.
16. T: Do you all agree on that?
17. S: Yes.
18. T: So you can develop a sentence around that when you later do your notes.
In the above extract, the teacher focused on extending the children’s thinking to encourage them to consider other issues or alternative solutions to the points they are discussing (see Turns 4 & 6). The children responded by providing a detailed explanation (Turn 9) and reasons for the choice they had made (Turn 12). While the extract is only short, it nevertheless provides a clear example of how a teacher can scaffold children’s understanding to help them clarify their thinking and facilitate their learning.

Scaffolding children’s understanding is not easy as it requires the teacher to know what the children already know, what competencies are now developing, and how she can use this information effectively to prompt the children to consider additional ways of thinking and reasoning about the problems they are confronting (Pressley, Hogan, Wharton-McDonald, Mistretta, & Ettenberger, 1996). Teachers who are good scaffolders are always positive and patient as they prompt children to consider different ways of thinking about a topic because it will take time for children to consider the prompt and incorporate it into their understandings (Noddings, 1984). The teacher in the above extract had a very positive relationship with the children in her class and this enabled the children, in turn, to feel comfortable with sharing their ideas and reasons with her as they discussed the topic.

CONSTRUCTIVISM AND IMPLICATIONS FOR TEACHERS

There are two different constructivist perspectives on how children learn in interaction with others. The first perspective, personal constructivism, proposes that collaborative learning experiences can help participants to discover new knowledge and solutions by challenging their own partial and incomplete perspectives on a problem. When children generate different cognitive approaches for the same problem, a state of socio-cognitive conflict exists which forces the child to decenter and consider the perspectives of others in order to restore equilibrium. By structuring situations in which cognitive conflict is likely to arise, Doise and Mugny (1984) and Mugny and Doise (1978) found children demonstrated different cognitive competencies which they could not perform individually. These changes could not be attributed to imitation because the children were able to generalise them to other related tasks. Children at an intermediate level of mastery showed progress after interacting with a child of less skill, demonstrating that peer interactions work mostly to trigger a change although they do not provide the substance of change. It appears that it is the opportunity to coordinate and co-construct a solution from incomplete perspectives which is an important aspect of peer interactions that contributes to cognitive growth.

Teachers promote cognitive growth in children when they use language that challenges their understandings, confronts discrepancies in their thinking, and requires them to provide reasons for their solutions (see Box 2.1 below) (Gillies & Boyle, 2006; King, 1999). When teachers do this, the cognitive tension it creates in children forces them to revise and reconsider their own understandings, to reconcile contradictions and, in so doing, develop new understandings and learning.
CHAPTER 2

Box 2.1: Teacher’s Language Behaviour that Challenges Cognitive Growth

<table>
<thead>
<tr>
<th>Language behaviour</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Challenges children’s thinking</td>
<td>What do you mean when you say the temperature has to be right for the coral? I’m not sure that I understand what you mean. Can you clarify that again?</td>
</tr>
<tr>
<td>2. Confronts discrepancies</td>
<td>I hear you saying that this is the solution but then you say there are no solutions. I’m not sure I understand what you mean? You said ... but then you decided on .... Can you explain what you want?</td>
</tr>
<tr>
<td>3. Reasons are required</td>
<td>I heard you say that you’d do ... but you need to justify why you chose that approach. Can you explain why you did ...?</td>
</tr>
</tbody>
</table>

The second perspective on how children learn, social constructivism, proposes that more capable peers and adults mediate children’s learning by providing language and strategies for problem solving. These skills are then incorporated into the child’s mental systems where they become part of their own cognitive repertoire. More capable peers also benefit from the interaction with others because they are challenged to restructure and reformulate their own knowledge in order to explain it to their less able peers, which, in turn, facilitates cognitive growth.

Box 2.2: Teacher’s Language Behaviour that Scaffolds Cognitive Growth

<table>
<thead>
<tr>
<th>Language behaviour</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Focus on issues</td>
<td>You need to think about the good things that make the constitution a fair constitution, a fair democracy and some of the things that are not quite fair. Then your job is to think of ways to make it fairer. How could you improve it? Think about what we learned yesterday. How can you use that information to help you with today’s task?</td>
</tr>
<tr>
<td>2. Questioning</td>
<td>What do you think about …? How could … be different?</td>
</tr>
<tr>
<td>3. Tentatively offer suggestions</td>
<td>I wonder if you have considered …? Perhaps you could consider doing it this way?</td>
</tr>
<tr>
<td>4. Scaffold connections</td>
<td>Remember the discussion we had before about .... So how can you use that information and link it to what you discussed before? Perhaps you can try and see how ... and ... may fit together?</td>
</tr>
<tr>
<td>5. Promote metacognitive thinking</td>
<td>Was there anything new that you thought of in your group that you hadn’t thought of before? Is there anything else that we need to think about?</td>
</tr>
</tbody>
</table>
Teachers foster cognitive growth in children when they create situations that enable children to have opportunities to interact with others where they learn to exchange ideas, model patterns of thinking and reasoning, and solving problems. King (1999) argues that as a result of these interactions, individuals learn new ways of thinking and talking and constructing new understandings and negotiating meanings. Gillies (2004b) found that teachers model many of these patterns of thinking and reasoning when they prompt children to focus on issues, engage in questioning designed to tentatively suggest alternatives, scaffold connections between information, and promote metacognitive thinking.

Challenging and scaffolding children’s thinking is not easy as it takes time for children to consider alternative ideas and ways of thinking and to integrate these new perspectives into current understandings. Teachers who are effective at challenging and scaffolding children’s learning demonstrate the following:

1. An in-depth knowledge of the curriculum so they are able to provide flexible responses to students’ misunderstandings and move their thinking in productive directions.
2. They explicitly explain and model the skills students need to learn and they provide opportunities for children to use those skills in situations that will stimulate their thinking.
3. They know in detail the competencies of their students, developed from actively monitoring their progress.
4. They accept that students have diverse competencies and require diverse approaches to education.
5. They care about their students and are willing to invest considerable energies in helping them to learn.
6. They create positive and well managed classrooms for their students.
7. They ask students questions to help them understand how they need to structure their instruction.
8. They wait for students to respond to questions, permitting diagnosis of students’ understandings but also the learning benefits produced by students demonstrating how they construct explanations (Pressley et al., 1996).

THE ROLE OF THE LEARNER

Both personal and social constructivism acknowledge the role that the learner plays in constructing meaning from their learning experiences. By interacting with others, children not only learn new ways of thinking and talking but they also learn to internalise the cognitive processes implicit in their interactions and communication. When peers interact they receive support for their ideas, they learn to plan strategies in advance, and they symbolically act out their ideas in their communication with each other so that after repeated exposure, their thinking becomes influenced. Moreover, as they internalize the communicative experiences they have together, they learn specific strategies for solving cognitive tasks as well as ways of co-constructing ideas to discover solutions and create knowledge.
Damon (1984) argued that both individual and social constructivism emphasise the following:
1. Peers motivate each other to abandon misconceptions and search for better solutions when they interact together.
2. Peer communication can help children master social processes such as argumentation and debate.
3. Collaboration with others can encourage creative thinking as children work on finding solutions together.
4. The atmosphere that is created from working together encourages kindness, fairness, and respect for others.

However, while it is well recognised that peers can benefit from working together, teachers need to be mindful that they structure the experience so all children benefit from the interaction that occurs. This includes ensuring that:
1. Students have been taught appropriate ways of communicating with each other. This often involves teaching children the appropriate social skills of sharing, giving others the opportunity present their ideas, accepting feedback, and learning to resolve difficulties democratically. Both Piaget and Vygotsky emphasised the importance of children understanding each other so they learn to exchange ideas and, where appropriate, demonstrate a willingness to adjust their own understandings in the light of the opinions and ideas of others.
2. Students have been given specific instructions about the task they are to undertake together. Giving clear and explicit instructions helps children to understand the extent of the task and the expectations the teacher has for its completion.
3. All students understand the role they are expected to undertake in the group—who is going to be the helper and who is the helpee. In a tutoring dyad, the roles of the tutor and tutee are usually clearly defined with the tutor regarded as the expert while the tutee is seen as the novice so while this relationship is low on equality, it is nevertheless designed to ensure that both the tutor and the tutee will benefit from the instruction that occurs. Tutors benefit because when they teach others they are forced to restructure their own understandings, fill in gaps in their own learning, and explain the information in such a way that they often learn it better than they would have by themselves (Bargh & Schul, 1980). Tutees benefit from the interaction because of the opportunity it provides for them to interact with a more able peer who can provide the additional instruction needed to help understand the material (Allen, 1976; Topping, 2005). In collaborative learning (a slightly different variation of peer tutoring), students work with a peer of similar ability to discover solutions and create knowledge together by sharing, discussing and challenging their own partial and incomplete perspectives on a problem. The roles students undertake are more egalitarian so when children disagree with each other, they are forced to decentre to consider the perspective of the other child. The cognitive conflict they experience acts as a catalyst for cognitive change and growth (Foot, Morgan, & Shute, 1990). In cooperative learning, groups of 2-4 students are allocated roles that are interdependent and complementary so the group derives the maximum benefit from the contributions of all members (Johnson & Johnson, 1990).
4. Groups should never exceed 3-4 members to enable all members to be able to hear and see what others are saying and doing (Gillies, 2007). Children are often
more willing to participate in smaller groups than larger ones where they can try out ideas and receive feedback from their peers without fear or favour.

5. The task should be intellectually challenging so children are motivated to talk and share ideas. This often involves children working on complex tasks where there are no clear cut answers so every group member is required to contribute their ideas or skills to finding a solution to the problem at hand (Cohen, 1994). Moreover, the degree to which students are motivated to pursue academic goals is related directly to their engagement in learning tasks (Ryan & Deci, 2000). (See Chapter 5 on developing complex tasks to promote thinking and learning.)

6. Groups should be kept intact until they have completed the task they were assigned. For some groups, this may mean that they work together for 2-3 sessions while for others it may involve a longer term task of 4-6 weeks (working together for 2-3 sessions per week).

7. Children should be encouraged to offer solutions and express their opinions. Discussing ideas with others helps children to clarify their understandings, negotiate meaning, and co-construct new knowledge. Moreover, it is these types of interactions that have the capacity to transform how students think and learn (Wittrock, 1990).

8. The teacher should actively facilitate and monitor the group’s progress, intervening to challenge and scaffold children’s learning when it is appropriate to do so. While the purpose of group work is to encourage students to accept more responsibility for their own learning, the class teacher will need to actively monitor the progress of all groups to ensure that they are working well together on the assigned task.

9. Feedback is provided to both the tutor and tutee on their performance. This should include feedback on both the mastery of the task and the processes they followed. Comments such as the following illustrate how this can be achieved:

   Teacher feedback on task: “I like the way you did …. but I think you need to provide more details about … to demonstrate you really understand this topic”.

   Teacher feedback on the process of learning: “I was very impressed with the way you shared your ideas and discussed the topic together before making a decision. This tells me that you both listened to each other and decided things democratically”.

When feedback is constructive, children are more likely to respond positively to it, remain engaged with the task, and make any changes suggested.

STUDENT-CENTRED STRATEGIES THAT CAN BE USED IN THE CLASSROOM

Given the large body of research that demonstrates the benefits of student-centred approaches to learning, including enhanced discourse (Gillies & Boyle, 2006), higher-level thinking (King, 1999), and positive learning outcomes (Rohrbeck, Ginsburg-Block, Fantuzzo, & Miller, 2003), attention has been directed at the strategies that help to promote these benefits. Student-centred learning focuses on helping students to construct meaning from their learning experiences and this involves ensuring that they have opportunities to work with their peers to discuss information and share ideas. In order to reap the benefits widely attributed to these
approaches to learning, teachers need to structure these experiences so students understand what they are required to learn and how they can negotiate the processes involved.

Three prominent student-centred approaches to learning that are reported in the literature are: peer tutoring, peer collaboration, and cooperative learning. While all three approaches involve students working with peers on problems at hand, each is designed to achieve different goals.

**Peer Tutoring**

Peer tutoring involves more able peers scaffolding the learning of their less able peers. It requires the tutor to have specific content expertise that has the potential to be consolidated through the tutoring process and that she is able to work with the tutee to help extend her understanding of the task. For tutoring to be effective, tutors need to be trained in the types of behaviours that are needed to guide and encourage learning, although they themselves may not have total mastery of the information or task. Most training focuses on mediating learning; that is, providing explanations and asking procedural questions because these skills are important for scaffolding new understandings and promoting learning.

Training that works most efficiently involves two processes (Fuchs et al., 1997). First, students must learn to use the following procedure to help each other master the material:

- The tutor models and gradually reduces the prompts he gives the tutee about the steps needed to complete the task.
- The tutor provides step by step feedback to confirm and praise correct responses and explains and models strategic behaviours when the answers are incorrect.
- Both the tutor and the tutee engage in regular written interaction on the problem.
- Tutor and tutee reverse roles during each session.

Once students learn these steps, the second part of the training involves teaching students how to seek elaborated help in conjunction with conceptual understanding. Elaborated help includes such behaviours as asking for help and continuing to ask for help until understanding is attained (Webb & Farivar, 1999). It also includes listening to one’s partner and giving detailed help if required, not just giving the answer. Conceptual understanding is enhanced when students have the opportunity to:

- Relate the material being learned with real-life examples that are easy to imagine;
- Use visual marks or pictures to represent specific facts;
- Use materials that can be manipulated by both partners to represent information being learned;
- Discuss the problem and how to solve it; and
- Ask questions that require elaborated responses and not just a single response. These questions usually begin with: how, what, when, where, and why (Fuchs et al., 1997).
Using students with learning disabilities to tutor each other. Research over the past three decades has consistently shown that children with learning disabilities benefit academically and socially from tutoring and that this is true whether they function as tutors or tutees, or both (Scruggs & Mastropieri, 1998). Academic gains have been recorded in reading, spelling, and mathematics, and social gains have included improved attitudes towards learning, school, and other students (Rohrbeck et al., 2003). Overall, however, tutoring can be expected to benefit tutors and tutees academically and socially only if students are appropriately selected and trained in their roles, if the content of the tutoring is appropriate to both tutor and tutee, and if progress towards specified goals is continually monitored.

To optimise on the benefits to be derived from tutoring, Scruggs and Mastropieri (1998, pp. 167-168) have suggested the following guidelines for establishing tutoring behaviour in tutors and tutees:

– Be nice to your partner and sit facing each other;
– Decide who will be the tutor first, then take turns asking and answering questions in an orderly fashion: reverse roles when all questions have been answered correctly;
– Speak in a pleasant tone when asking questions or responding
– Encourage your partner by using such statements as “Great job; Good answer” or “Not quite. Can you think of something else?”
– Record the correct and incorrect responses; and,
– Review any incorrect answers several times.

Peer Collaboration

Peer collaboration involves students of similar ability working together to solve a problem that neither could solve independently (Damon & Phelps, 1989). While previous research (Doise & Mugny, 1984; Mugny & Doise, 1978; Mugny & Carugati, 1989) has demonstrated that children can challenge each other’s thinking and in doing so, make progress cognitively as they adjust their understandings in the light of newly acquired information, examples of how this is achieved can often be difficult to find. The following information on Scripted Cooperation illustrates how teachers have used peer collaboration to promote student learning in different educational settings.

Scripted Cooperation: An example of how peers can collaborate to enhance each other’s learning. Scripted cooperation involves children working in pairs on an academic task with each partner being asked to play a specified role such as listener or recaller and to play these roles in a specific order (O’Donnell, 1999). It is argued that the scripted role plays are very important because they help to prompt the use of cognitive processes that may not necessarily occur otherwise. Simultaneously, they help to limit negative social interactions as the children focus on the cognitive requirements of the scripted roles they are asked to perform.

In scripted cooperation, the children work together to acquire information on the task such as reading a particular passage and discussing it or seeking background
CHAPTER 2

information from a text. The children work collaboratively together to obtain the information, sharing ideas and resources to promote each other’s learning. Once this is achieved, they put their notes aside and one partner assumes the role of the recaller while the other acts as the listener. The recaller then summarizes the information that both students have collected while the listener tries to detect any anomalies and seeks clarification on any aspects of the recall that are unclear. Both students then work together to elaborate on the material under discussion until they develop a common understanding of what they have been reading and discussing. Roles are then changed so the recaller is now the listener and vice versa. The process of reading, recalling, listening, and elaborating is repeated many times as the children work their way through the task. The opportunity for the children to engage in the role of the listener where they have to actively monitor the recall for accuracy and understanding and the role of the recaller where they have to reorganise and restructure their thoughts in order to explain them to their partner, ensures that the children engage in a range of metacognitive activities that challenge them to think about their thinking and facilitate learning (O’Donnell, 1999).

Scripted cooperation has been used with students in elementary, high school, and college settings in a range of lessons involving text comprehension through to the retention of procedural and technical information required in college courses. While the original research into scripted cooperation was conducted with university students to test out the viability of different scripted and non-scripted dyads in dealing with learning procedural information (see O’Donnell et al., 1990), research in recent years has focused how this approach works in elementary, middle, and high schools with students to enhance their acquisition of information in specific subject or content areas, including text comprehension.

Meisinger, Schwanenflugel, Bradley, and Stahl (2004) used scripted cooperation to investigate the interactions of Grade 2 students during partner reading sessions. During these sessions, students alternated the role of reader and supporter with each role requiring a specific cognitive activity such as taking turns, reading along, staying on task and providing help to their partners. In this context, the children were asked to play certain roles in a particular order which imposed a script on how they interacted about the passage. The results showed that the script helped to promote high quality interactions among partners, better social cooperation, and enhanced thinking and meaning-making about the text.

Kollar, Fischer, and Slotta (2007) investigated the effects of differently structured internal and external scripts on the learning outcomes of high school students’ collaborative argumentation during learning in a web-based inquiry learning science environment. Prior to the commencement of the study, the students were identified as having either high or low structured internal scripts by assessing their performance on a test in which they were asked to identify “good” and “poor” argumentative moves in a fictitious discourse excerpt about a science topic. This led to the students being identified as either having a low-structured or a high-structured internal script on collaborative argumentation. The students then worked in homogeneous dyads to determine how they responded to either the high-structure or the low-structure use of the external script. For example, the high-structured external script condition provided students with guidelines on how to construct an argument.
and sentence starters to help them develop their arguments for the topics under discussion. In the low-structured external condition, students were not given any additional guidance on how to structure their arguments. The results showed that all students benefited from a high-structured external script, irrespective of whether they had been identified as having a high- or low-structured internal script. The authors concluded that high-structured external collaborative scripts can be designed to help even students with high-structured internal scripts enhance their collaborative argumentation skills.

In a study that examined the role of different types of scripts to help college students dialogue together on a computer-based activity, Weinberger, Ertl, Fischer, and Mandl (2005) found that social scripts rather than epistemic scripts which specified how students work on a given task, were substantially more beneficial for individual acquisition of knowledge. In fact, epistemic scripts can at times, impede knowledge acquisition. The authors proposed that social scripts may serve to reinforce collaborative learning mechanisms where students learn to contribute and discuss divergent perspectives and to refine and restructure their own ideas in order to evaluate and eventually integrate the various perspectives. In contrast, epistemic scripts appear to function more as checklists so students do not need to integrate divergent perspectives but focus only on the strategy they have been given for solving the problem at hand.

In sum, scripted cooperation involves children working together to acquire information on a task. Each partner alternatively plays a specified role such as listener or recaller where they each have opportunities to read, recall, listen and elaborate on the task. The listener has the job of monitoring each other’s recall for accuracy and understanding while the recaller is often forced to reorganise and restructure his or her thoughts in order to explain them to a partner. Each of these roles involves a range of metacognitive activities known to enhance student understanding and contribute to learning. Scripted cooperation is a structured way of dialoguing together to enhance understanding of a task.

**Cooperative Learning**

Cooperative learning involves students working together in small groups to accomplish shared goals. Structuring groups so that each member is required to contribute to attaining the group’s goal is critical to the success of this approach to learning because research has shown that placing students in groups and expecting them to work together will not necessarily promote cooperative learning (Gillies & Ashman, 1998). Some children will defer to the more able children in the group who may take over the important roles in ways that benefit them at the expense of other group members. Similarly other students will be inclined to leave the work to others while they only make a token commitment to the task (Gillies, 2003c).

In cooperative learning, each group member is required to complete their part of the task but to ensure that others do likewise. The technical term for this dual responsibility is “positive interdependence” and it is the most important element in cooperative learning (Deutsch, 1949). Positive interdependence exists when students
perceive that they cannot succeed unless others do and they must coordinate their actions to ensure that this occurs. As group members realise that no one will succeed unless they all succeed, cohesiveness develops among them as a direct result of the perception of goal interdependence and the perceived interdependence of group members. Once this happens, group members understand their efforts are indispensable to the success of the group. In short, they learn that they will either sink or swim together so the impetus to survive kicks in and motivates group members to cooperate.

While cooperative groups often consist of children of mixed competencies, the relationship among them is more egalitarian than it is in peer tutoring where one student is the expert and the other is the novice. Moreover, this egalitarianism is further promoted by ensuring that each group member accepts a role (i.e., a specific task) that is important for group’s overall goal. For example, in producing a school play, it will be necessary for one student to accept the role of director of the performance while another student may be responsible for costume design, another for set design, and another for lighting. In class, where students are working on a group project, one may accept responsibility for collecting the resources (resource manager), another may be the desk-top publisher another child may be responsible for the artistic presentation of the product and so on. Although group members have a specific role they are required to perform, all group members are still expected to contribute to all aspects of the group’s project; that is, all members would be expected to contribute their ideas on desk-top publishing while the member who has accepted that role would have responsibility for coordinating the ideas.

The interaction that occurs among cooperating group members is a result of the group’s sense of cohesion and identity so that members understand they are to work together to promote their own and each other’s learning. In so doing their interactions are multidirectional rather than unidirectional as occurs in peer tutoring or bi-directional as occurs in peer collaboration. In cooperating groups, students learn to listen to what others have to say, share ideas, correct anomalies in what is said, challenge each other’s perspectives, and scaffold each other’s learning. As group members try to grapple with ideas and new information, they are forced to decentre, consider the points of view of others, and either reconcile their own understandings so they are more aligned with the group’s or justify their perspective in relation to those of others, clarify misunderstandings, and provide responses that others will perceive as credible. This coupled with the intimacy of the small group appears to provide a psychological environment that motivates members to be more willing to resolve contradictions between themselves and others, test out ideas, and work to construct new cognitive understandings (Johnson & Johnson, 2003).

Benefits low-achieving students derive from cooperative learning. Concern is often expressed by teachers as to whether low-achieving children are likely to benefit from working with others in cooperative groups. In order to allay some of these concerns, information is reported on a number of studies that involved either
low-achieving students or academically handicapped students who participated in different cooperative learning experiences. In the first study, Stevens and Slavin (1995) report on a two-year investigation that was conducted to determine the long-term effects of a comprehensive cooperative learning approach to elementary reading and language arts instruction on students’ achievement, attitudes, and metacognitive awareness. In the study, 635 students, including 72 academically handicapped students, in grades 2-6 from three elementary schools participated in the Cooperative Integrated Reading and Composition (CIRC) program and 664 students, including 65 academically handicapped students, at four matched schools that used traditional instruction. The CIRC program involved the children working in cooperative, mixed-ability groups on reading and writing activities related to stories they had been reading as part of their language arts program. The results show that at the conclusion of the two year study that not only did the CIRC students have significantly higher achievement in vocabulary, comprehension, language expression, and metacognitive awareness but the academically handicapped students in this program also achieved significantly higher achievement in reading vocabulary, reading comprehension, and language expression than their academically handicapped peers in traditional settings. The study provides strong support for the benefits academically handicapped students derive from working in mixed-ability cooperative learning group.

In the second study, Gillies and Ashman (2000) investigated the behaviours, interactions and learning outcomes of children with learning difficulties who participated in structured (trained) or unstructured (untrained) cooperative learning groups. Of the 152 Grade 3 children who worked in mixed-ability, four-person groups, 22 children were identified as having learning difficulties and requiring up to three hours of specialist teacher support for their learning each week. The children worked in their groups for one six week social studies unit of work each term for three terms. The results showed that the children with learning difficulties in the structured groups were more involved in group activities and provided more directions and help to other group members than their peers in the unstructured groups. Furthermore, the children with learning difficulties in the structured groups recorded a significantly higher score on the comprehension questionnaire than their peers in the unstructured groups. This study also provides support for the benefits that students with learning difficulties derive from participating in cooperative learning activities.

In the final study, Shachar (2003) reports on a review of seven studies conducted in elementary and junior high schools on the effects of cooperative learning in comparison to whole class teaching on students’ achievements across the different curriculum areas of English, science, mathematics, chemistry, and social studies. The studies included in this review were school-based studies that compared classes that implemented cooperative learning in comparison to classes where students were taught with traditional whole class instruction. Before the studies were implemented, the participating teachers were trained in the skills and concepts needed to implement cooperative learning. Training extended from three to eight months and only at the completion of their training did the teachers implement cooperative learning in their classrooms. Data were gathered on the
students’ achievements and their behaviours prior to the implementation of each study and again at the completion of each study. In all studies there were noticeable improvements in low-achieving students’ academic achievements across the different curriculum areas in the cooperative learning classes in comparison to their peers in classes where whole class teaching was employed. Interestingly, while the high- and average-achieving students in the cooperative classes also outperformed their peers in the traditional classes, it was the low-achieving students who consistently emerged as those who derived maximum benefit from their cooperative learning experiences.

**Guidelines for including students with learning disabilities in cooperative group activities.**

- Carefully explain the procedures that the cooperative group will follow.
- Make sure that all group members understand that different group members have different strengths that they bring to the group. Highlight the strength that the student with the learning disability has; for example, artistic skills, multimedia skills, and so on.
- Train normally achieving children in helping, tutoring, and sharing skills. The use of prompts and praise are easily taught and will encourage children with learning disabilities to remain engaged with the task.
- Make reasonable academic demands on the children. Requirements for different tasks can be adapted so that children with different achievement levels can participate in the same cooperative group through: the use of different criteria for success; varying the amount of information each group member is expected to master; giving group members different subtasks to complete and then using the average percentage worked correctly as the group’s score; and, using improvement scores as a measure of success, especially for students with learning disabilities.
- Ensure that the students have the academic skills needed to complete the group’s task. If not, teach first.
- Pre-train the children with learning difficulties in the skills they will need to cooperate successfully with other. For example, listening to others and being prepared to manage disagreement with others.
- Give the children with learning difficulties a role they can manage in the group. For example, if they have difficulty writing they may be able to collate information from others on the computer (Gillies, 2005).

**Including students with severe learning disabilities in cooperative group activities.**

Although there is a large volume of research on cooperative learning as a strategy that can be used to promote inclusion, most studies have focused on students with mild disabilities while children with higher support needs have been ignored, with two noticeable exceptions. In the first of these two studies, Putnam, Rynders, Johnson and Johnson (1989) examined the effects of cooperative skills training on interactions between students with severe disabilities who had never participated in regular classes and their normally achieving peers as they worked on cooperative science activities over three weeks. The children were placed in three person
groups and were trained to share ideas and materials, encourage everyone to participate, speak positively to each other, and check to see if all group members understood and agreed with the answers. The teachers of the children in the cooperative groups identified the skills to be practised and provided descriptions and examples of each skill, and monitored the children as they practised the use of these skills in their small groups. Putnam et al. found that the normally achieving students who were trained to use these skills in their cooperative groups interacted more with their peers with a disability by looking at them, talking to them, and working cooperatively with them than those children in the untrained groups. The results led Putnam et al. to conclude that:

The fear that moderately and severely handicapped students will be openly ridiculed and rejected by non-handicapped peers, a fear sometimes expressed by those who oppose social integration of mentally handicapped students, may not be well founded, especially for those situations in which interaction procedures are structured properly (1989, p. 554).

In the second study, Hunt, Staub, Alwell, and Goetz (1994) investigated the extent to which three, second grade children with multiple severe disabilities could acquire basic communication and motor behaviours from their involvement in cooperative learning activities in regular classrooms. In addition to ensuring that the cooperative learning activities were established so that all students would be required to participate and work towards achieving the group’s goal, group members were trained to provide the cues and prompts to the student with the disability to enable him or her to generate the targeted communication and motor response. They were also taught to provide positive feedback to the student when these behaviours were attempted. The students worked together in their groups on different mathematics tasks once a day for a period of eight to ten weeks. The results showed that the students with severe disabilities were producing, independently, the targeted communication and motor responses during the cooperative learning activities. The non-disabled students in the cooperative learning groups consistently and accurately provided cues, prompts, and consequences to facilitate the acquisition of the target behaviours by the member with disabilities. Furthermore, follow-up mathematics achievement tests demonstrated that group members without disabilities achieved as well as their peers in groups that did not have a member with a disability. In other words, the facilitative interactions by group members without disabilities did not negatively affect their achievement.

Both the Putman et al. (1989) and the Hunt et al. (1994) studies demonstrate that children with severe disabilities can be successfully included in cooperative groups to achieve targeted objectives. Furthermore, provided that the non-disabled group members are trained in the specific help they are to provide, they will willing help their disabled peers to help them achieve. Both studies show clearly that children with disabilities are not rejected and, in fact, that their peers will actively praise, facilitate, and encourage their efforts. Interestingly, in a survey of more than a thousand middle-school and high-school students, Hendrickson, Shokoohi, Hamre-Nietupski, and Gable (1996) found that students were very willing to form
friendships with students with severe disabilities and to include them in learning situations. Students perceived themselves, teachers, and youth organisations as primarily responsible for facilitating these friendships. The specific strategies that students suggested would facilitate friendship and inclusion included:

- Students working together in cooperative groups.
- Teachers presenting information on disabilities to students, other teachers, and parents.
- Teachers and parents arranging social events for all students.

Although teachers acknowledge the benefits that accrue from students working together, they often express concern about how they can adapt the curriculum to enable students with disabilities to experience success in cooperative groups. Nevin (1996) proposed that the following adaptations could be considered:

- Change response modes so that students can demonstrate in different ways how they have learnt the material. For example, students could be allowed to write an answer rather than have to report orally to the class, use sign language to summarise a story, talk about a topic rather than write about it, or create an object such as a diorama to demonstrate knowledge and understanding of a particular topic.

- Develop functional equivalents so that one student might be required to complete a mathematics worksheet with 90% accuracy, whereas another might be required to determine that he or she had received the correct change when purchasing the item.

- Allow for different amounts of work and completion rates for different students.

CHAPTER SUMMARY

This chapter has outlined:

1. The two different theories on constructivism—personal and social constructivism. 
   Personal constructivism proposes that as individuals interact with others in their environment, they are continually exposed to states of cognitive tension, where they are challenged to consider the points of view of others, reconcile contradictions, and restructure their own thinking on the basis of the new information they receive. However, while the interaction with others is a trigger for social and cognitive change, the change itself is achieved by the individual. Social constructivism proposes that adults and more capable peers mediate the child’s learning by focusing on the relevant information in the environment and providing the tools of problem-solving and reasoning so that over a period of time, internalisation occurs as the child adjusts and accommodates this new information.

2. Implications for teachers. Teachers have the capacity to influence children’s thinking and promote cognitive growth by using language that challenges their understandings, confronts discrepancies in their thinking, and requires them to provide reasons for their solutions. Additionally, teachers can foster cognitive growth in children when they create situations where children have opportunities
to interact with others—exchanging ideas, modelling patterns of thinking and reasoning, and solving problem.

3. The role of the learner. Peers play a key role in facilitating each other’s learning by: motivating each other to search for better solutions; helping each other to master the social processes in communicating with others (i.e., argumentation and debate); and, agreeing to collaborate to find new solutions and ideas. Teachers can enhance students’ involvement with each other by ensuring that they are provided with: (a) specific task instructions, (b) appropriate social skills training, (c) a clear understanding of their role in the group, (d) tasks that are intellectually challenging, and (e) feedback on their performance.

4. Student-centred strategies for the classroom. Strategies that have been used successfully include peer tutoring, peer collaboration, and cooperative learning. Peer tutoring involves a more able-peer scaffolding the learning of a less-able peer. Peer collaboration involves peers of similar ability working together to solve a problem that neither could solve independently. Cooperative learning is an extension of peer collaboration and involves students working together in small groups to accomplish a shared goal.

ACTIVITIES

1. Reflect on personal and social constructivist approaches to learning as outlined in this chapter. What are the similarities? What are the differences? What are some practices that you could adopt as a teacher in your classroom to enhance students’ learning?

2. Observe two children as they work on a problem-solving task together (e.g., math task). Note how they interact. Does one do most of the talking or do they discuss the task in a more egalitarian way? How do they help each other, resolve differences, and share resources? Try and write down examples of some of the questions they ask and the responses they provide? Discuss your findings in the light of what you know about personal and social constructivism.

3. Observe an exemplary teacher (i.e., a teacher who is regarded as being very professionally competent) and write down some of the language she uses as she interacts with children in the class. What types of questions are asked? Does she help children to link information so they can develop a better understanding of the material? Write down examples of how this teacher challenges children and scaffolds their learning. Discuss your observations in the light of what you have read about student-centred practices.

4. Interview a teacher who uses different student-centred practices. Identify and list these practices. Discuss why this teacher has chosen these practices and how they are used in this class. Find out what benefits children derive from student-centred
learning approaches. What are some of the difficulties with implementing these practices in the classroom?

5. Interview two children who have been working in either a peer tutoring or a collaborative peer dyad. Ask the children about their experiences. For example, what did they think of this working arrangement? Did they work well as a group and, if so, ask them to provide an example of how they worked well. Similarly, if they did not work well together, what were some of the difficulties they experienced? Ask them to provide examples of these difficulties?

6. Observe a child with learning disabilities as he works in a small group with their peers. What arrangements did the teacher make to ensure that the student was included? How was the group structured? Were any adjustments made to the work this student was expected to undertake in the group? Did this student have a specific role to undertake in the group? How were roles assigned in the group? How did the other students react to the student with learning disabilities? Was he included in the group’s activities and if so, how was this achieved? Write down any examples of the language the group may have used to demonstrate that they were including this student.

7. Interview a child with learning disabilities and ask him/her about his/her experiences of working with other children? These experiences could include working in a pair or in a small group. Ask the child about the types of tasks he/she undertook. For example, was he working with other children on a task where they had to seek information or solve a problem or where they reading a book or completing questions (e.g., comprehension questions)? Ask the child if he enjoyed this experience and if so why. If he did not enjoy the experience, ask the child what it was that he did not like. What were some of the social skills that he needed to know in order to be able to work successfully with others?

SUGGESTIONS FOR FURTHER READING