Self-assessment:

A means to enhance academic self-efficacy

in year 12 mathematics

A thesis presented in partial fulfilment of the requirements of the degree of

Master of Education in Teaching and Learning

at Massey University, Manawatu,

NEW ZEALAND

Taryn Johnson

2012

Abstract

Ahakoa he iti, he pounamu

Although it is small, it is greenstone

Māori Proverb

Motivation has a significant impact on learning. Self-efficacy, a subconstruct of motivation, has been established as one of the best predictors of achievement. If students have high self-efficacy they are more likely to perform well, if they have low self-efficacy they are less likely to perform well. If ways can be found to enhance students' self-efficacy this is likely to have a significant impact on learning and achievement.

One of the major concerns of stakeholders in education is raising student achievement. The emphasis in the New Zealand Curriculum (NZC) on preparing students to be confident, lifelong learners makes any means of enhancing self-efficacy a priority for schools and classroom teachers. The NZC also emphasises the importance of student centred learning and developing students' assessment capabilities. The intention of this action research project was to investigate the feasibility of training students in self-assessment to enhance self-efficacy. The research involved working in one year 12 mathematics class in an urban secondary school, in the North Island of New Zealand.

The results of the research suggest that when students self-assess, their self-efficacy is enhanced. The research found that giving students specific worked examples against which to judge their work helped them to generate feedback, which in turn enabled them to assess their performance. Another aspect of the process of developing students' self-assessment skills involved relating specific achievement criteria to individual assessment problems. This supported self-assessment capabilities as students felt they understood what was required of them and so were more equipped to meet those requirements. The final stage of equipping students in self-assessment involved training them to self-mark practice tests done in exam conditions using assessment schedules. The study found that self-assessment contributed to enhanced self-efficacy.

Acknowledgements

Ehara taku toa, he taki tahi, he toa taki tini

My success should not be bestowed on me alone, as it was not an individual success but success of a collective

Māori Proverb

My appreciation goes to numerous people who, though some have never met, together form part of the collective that has been the mainstay of my success in completing this thesis.

Thank you to the year 12 mathematics class who willingly participated in the research. Your enthusiasm to contribute your ideas, and to improve yourselves and your learning, has been inspirational. I have never met students who are as friendly or as appreciative as the students at this school. Value that and continue to believe in yourselves… you can do it!

Thank you to the Massey University Human Ethics committee for approval for the research described in this thesis. My appreciation goes to the Board of Trustees who allowed me to conduct the research within the school, the Principal who acted as advisor, the specialist classroom teacher who introduced the research, and the classroom teacher for allowing me access to his class. My group of "critical friends" consisted of Dr Peter Rawlins, Dr Alison Kearney, Joanne, and Cherie. Thank you for your patience, support and understanding. I have valued your willingness to challenge my ideas and my work in order to bring out the best in me. Above all thank you for your confidence and belief in me, which have helped me to believe in myself.

I go to seek a vast perhaps

Francois Rabelais

Table of Contents

List of Figures

List of Tables

CHAPTER ONE

Introduction

They are able who think they are able

Virgil

1.0 Introduction

Most of us can identify with the significant influence that self-belief has on our success in performing a task. If we believe we can do well, we are more likely to succeed. If we do not believe we can do well, our performance is likely to reflect this belief. Put another way, the higher our self-efficacy, the better our performance is likely to be. Another key aspect of any performance is the way the performance will be judged. If we know how our performance is going to be judged, we can monitor our progress, adjust our performance to align with the required standard for success, and feel more confident that we will succeed. Thus the ability to judge our performance is likely to enhance self-efficacy, which in turn is likely to improve performance.

The relationships between assessment, motivation, learning, and achievement have been established, as has the relationship between self-efficacy and academic achievement (Black & Wiliam, 1998; Crooks, 1988; Harlen, 2006; Pajares, 1996). Researchers advocate strengthening student assessment capabilities to increase self-efficacy and achievement (Black & Wiliam, 1998; Crooks, 1988). The strong link between assessment and learning, in which assessment is not only for learning but is learning, and the influence assessment has on self-efficacy points to self-assessment as a powerful means of building students sense of “can do it” (Brookhart, 2008; Rawlins, 2008; Zimmerman, 2000). If students want to do it and think they can do it they learn more (St. George & Riley, 2008, p. 145).

This project investigated the effect, if any, that students’ self-assessment has on their self-efficacy using action research in one year 12 mathematics class in an urban secondary school. Interventions on the use of feedback and achievement criteria formed the foundation for teaching students to self-assess by marking their practice tests using assessment schedules. This thesis describes the background to the research and the research process, presents the findings, and discusses these findings before making some conclusions. This chapter presents

the rationale behind the study, the objective of the study, its context and nature, definitions, and the organisation of the thesis as a whole.

1.1 Rationale

The New Zealand Curriculum (NZC) outlines the vision for education as "young people who will be confident, connected, actively involved, lifelong learners" (Ministry of Education, 2007, p. 7). This vision is expounded with phrases such as motivated and reliable, positive in their own identity, and informed decision makers. Managing self, which includes students' assessment capabilities, is one of the five key competencies that support the vision (Hipkins, 2006; Ministry of Education, 2007). The NZC puts "benefits students" and "involves students" (Ministry of Education, 2007, p. 40) as the first two characteristics of effective assessment. Expanding on the latter, it states the need to develop students' capacity for self-assessment, which leads to increased self-direction. In order to accomplish this vision, students need to have a healthy sense of competence and the ability to assess their learning status and progress.

My learning and teaching experiences confirm the vital role that self-efficacy plays in learning and achievement. I believe all students can learn and most failure results from poor motivation and, more specifically, from poor self-efficacy. I have witnessed the change that takes place in students after they feel they can do the work. At first these students do not, and will not, engage in learning because they think they cannot do it. On being persuaded to engage they find they can do it and become highly focused and motivated… even evangelical in their zeal for learning. This understanding is supported in the literature (Bandura, 1997; Black & Wiliam, 1998; Pajares, 2008; Zimmerman, 2000).

During my postgraduate study I became aware of the significant impact that both assessment and motivation have on learning and achievement. Assessment is an integral part of learning and drives much of what is taught and learned in high school. Motivation is made up of, and contributed to by, many different factors, including self-efficacy. As a result of their study into the effects of academic self-efficacy, Chemers, Li-tze, & Garcia (2001), concluded that "researchers need to establish the factors that encourage the development and maintenance of positive self-perceptions and beliefs, particularly academic self-efficacy..." (p. 63).

Research has established the significant influence of self-efficacy and self-assessment on learning and achievement. There is some research on self-assessment and self-efficacy at tertiary level and in work settings and a limited amount on the effects of strategy training on self-efficacy. Very little research seems to have been done into the effect of self-assessment on raising self-efficacy in the context of secondary school students. If self-assessment is found to raise self-efficacy and students respond to training in self-assessment then the relationships between self-efficacy, self-assessment, and achievement means there are significant implications for educational practice and policy.

1.2 The objective of the study

This study set out to gain insights into whether supporting students to develop self-assessment skills would increase their self-efficacy. Both self-efficacy and self-assessment are closely linked to achievement and researchers have established a link between the two (Black & Wiliam, 1998; Crooks, 1988). This thesis seeks to explore this link to provide more insight to fill the gap in knowledge in this area.

Self-assessment, at secondary school and at a level that is likely to enhance self-efficacy, is a complex activity. This research investigates the question

- What effect does students' self-assessment have on their self-efficacy?

It does this by addressing three subquestions

- What role does feedback play in students' ability to self-assess?
- What role does understanding problems in terms of achievement criteria play in students' ability to self-assess?
- What is the effect of self-assessment on self-efficacy?

1.3 The nature of the research

The research seeks to describe meanings and perspectives from the standpoint of the students. This makes it most compatible with, and best served by, a constructivist epistemology within an interpretivist theoretical framework, which is concerned with people and their perceptions and the influence of these perceptions. In particular this research

focuses on students' perceptions of their capabilities and how these can be improved. The qualitative methodology of action research is suited to looking into classroom practice and the theoretical underpinnings of that practice. Action research provides a way of engaging in dialogue with students that is essential in order to come to an understanding of their perspective and the factors that influence their sense of capability. It also allows flexibility in adapting interventions in response to feedback and data collection throughout the research process.

1.4 The context of the research

There are two main aspects to the context of this study. They are the school in which the research took place and the participants within the school.

1.4.1 The school

The research is based in the school where I am currently employed. For the two years prior to the research, I have been Head of the Department of Mathematics and classroom teacher. The school is a decile two[1], central North Island, urban secondary school with a high Māori-Pacific[2] roll. Although this study does not target Māori students (action research with such small numbers has limited generalisability) it is worth noting, in order to help establish context, that one of the on-going concerns at secondary school level in New Zealand (NZ) is the traditional low achievement of Māori students. Schools with a high Māori roll also tend to be lower decile. Although schools receive extra funding according to both of these factors there are on-going concerns in NZ in terms of Māori achievement (New Zealand Ministry of Education, 2010).

The school has a proud history of high achievement in sports and cultural activities, including a group of year 11, mostly non-academic, students winning the national chess championships in 2010. In spite of huge success in other areas, many students lack a sense of academic competence. There is an emphasis on collecting credits, in part a by-product of the National

[1] Decile refers to the socio-economic status of the students' families. Decile one is the lowest socio-economic level and decile 10 the highest.

[2] Māori refers to the native or indigenous Polynesian people of New Zealand and includes all who identify with this group. Pacific refers to students whose families identify in ethnicity as being from one of a number of Pacific Islands.

Certificate of Educational Achievement (NCEA),[3] that has bred student confidence in their ability to get credits whereas they lack a sense of can do it with regard to academic learning.

1.4.2 The participants

The participants are year 12 students. They have some familiarity with, and success in, external assessments with a theoretical prerequisite entry into the class of 10 achievement standard credits[4] in mathematics at level one. Due to the small size of the school and timetable limitations this is not strictly adhered to, so the range of ability levels and past achievement is, in reality, more spread out. Past experience of assessments enabled students to have a better sense of what helps their sense of can do it and to more accurately provide information on self-assessment and self-efficacy. The group is a mix of gender and ethnicity with similar numbers of Māori, Pacific, and European. This has ethical implications as does the fact that I am conducting the research and have taught most of the students and am known by those I have not taught. These ethical issues will be discussed further in section 3.7.

1.5 Definitions

It is important that concepts are defined to ensure they are understood by the reader in the same way as I have used them throughout the study. The key constructs used are motivation, self-efficacy, formative assessment, self-assessment, feedback, and achievement criteria.

Motivation is an important construct in learning (St. George & Bourke, 2008; Harlen & Deakin Crick, 2003; Zimmerman & Moylan, 2009). It is "the process whereby goal-directed activity is instigated and sustained" (Schunk, Pintrich, & Meece., 2008, p. 4). The complexity of motivation has led to the development of a variety of subconstructs to help explain and understand it. These include, but are not limited to, self-belief, self-concept, attribution theory, and learning orientations. Expectancy-value theory is a way of organising all of the constructs that make up motivation.

[3] NCEA is the main qualification available to students in secondary schools in NZ. It is explained in more detail on p 18.

[4] NCEA is made up of achievement standards and unit standards. Although reforms are being introduced over the next few years to bring about equality between the two, currently unit standards are seen as less academic than achievement standards. NCEA is explained in more detail on page 18.

Self-efficacy beliefs are foundational for all motivation and motivational constructs (Good & Brophy, 2010; Pajares, 2008; St. George & Bourke, 2008). It has been defined in various ways, though all definitions emphasise beliefs about one's capabilities to perform a task or act in a way that accomplishes a goal. Schunk's (2000) emphasis is on a designated level of performance, although others emphasise the confidence aspect of self-efficacy (Ng & Earl, 2008; Seifert, 2004). Although there are intricate overlaps and commonalities between many of these, self-efficacy is distinguished from other constructs by its concern with performances that are yet to take place and "because of the specificity and close correspondence to performance tasks" (Zimmerman, 2000, p. 89).

The main source of self-efficacy is mastery experiences or past performance (Bandura, 1997; Pajares, 1996). Bandura advocates guided mastery as the "principal vehicle of personal change" (p. 329) and the most effective means of increasing mastery experiences and thereby enhancing self-efficacy. Guided mastery involves structuring learning to develop coping skills and reinforce for students that they can control outcomes and minimise risk. In guided mastery difficult tasks are broken down into subtasks within students' capability and students have access to support from the teacher.

Assessment is the gathering of information about learning that is used for either summative purposes, which is evaluation, or for formative purposes, which is to support further learning, or for both of these. By definition formative assessment improves learning by enabling students to identify what they know and what they have yet to learn (Absolum, Flockton, Hattie, Hipkins, & Reid, 2009; Hall & Burke, 2003). Rawlins and Poskitt (2008) go so far as to equate improved learning with improved self-regulation of learning by identifying this as the "ultimate goal" of formative assessment (p. 46). Black and Wiliam (1998, 2003) emphasise raising achievement as the crucial qualifier for formative assessment and provide international support for its efficacy in doing this. Successful formative assessment, which involves effective feedback, active student involvement, and self-assessment, leads to an adjustment of teaching and learning (Alton-Lee, 2003).

Although self-assessment can have a range of meanings varying in degree of specificity and complexity, all of these involve students' acceptance of responsibility and control for their learning (Bourke, 2000; Cassidy, 2007). Bourke (2000) identifies six different conceptions of self-assessment held by students. These are, from the least sophisticated to the most sophisticated, seeking an opinion, getting marks and grades, performing, using criteria, setting learning goals, and evaluating learning content. In the current study self-assessment involves

the last three as students are involved in making self-judgements regarding the degree to which criteria have been met, setting learning goals in terms of those criteria, and evaluating their learning content (Boud, 1995b; Bourke, 2000).

Feedback is a key element in formative assessment and must involve the assessor identifying the gap in learning and the student understanding and seeking to close that gap (Black & Wiliam, 1998; Hattie, 2009; Sadler, 1989). Feedback can promote thinking in learners to contribute to effective formative assessment (Black & Wiliam, 2003). Absolum and colleagues (2009) stress the importance of students knowing how to access, interpret, and use evidence in their learning for feedback to be effective. Sadler (1989) quotes Ramaprasad to define feedback as "information about the gap between the actual level and the reference level of a system parameter which is used to alter the gap in some way" (p. 120). This study uses Sadler's (1989) emphasis that it is only feedback when it is used to close the gap in learning.

An essential part of the process of generating feedback, in the context of learning goals and boosting self-efficacy, is giving students clear, specific, descriptive criteria and equally clear explanations of the criteria (Andrade & Valtcheva, 2009; Boud, 1995b; Brophy, 2010; Hattie, 2009; Sadler, 1989; Taras, 2008). In this study the term achievement criteria is used to describe the specific, detailed, descriptive criteria that students are required to achieve in order to pass the standard. When students have a clear understanding of what is required of them and know what constitutes success they feel more in control of their learning, more capable of achieving, and do better (Harlen, 2006; Sadler, 2009; Wilson, 2007).

1.6 The organisation of the thesis

This chapter has provided an outline of the thesis and set the direction for what follows. The objective of the study has been considered along with the research subquestions and rationale. The context, of the school and the research class, has been described. Both self-efficacy and self-assessment are closely linked to achievement and there appears to be a link between the two. This thesis seeks to explore this connection and provide a little more insight in this area.

Chapter two examines the literature related to the topic. The broad construct of motivation provides the basis for examining self-efficacy and how to enhance self-efficacy. Literature on

assessment provides the basis for more in-depth consideration of frequent testing, feedback, achievement criteria, and self-assessment.

Chapter three goes into the epistemological and theoretical framework of constructivism and symbolic interactionism as the support for the chosen qualitative methodology. It describes and justifies the choice of action research, and it outlines and justifies the intervention and data collection techniques used.

Chapters four and five respectively present findings and discussion of these findings with reference to the literature. Chapter six provides a summary of the main findings of this study. It includes conclusions with implications for practice, applicability, and suggestions, as well as direction for future research.

CHAPTER TWO

Literature Review

Te manu ka kai I te miro nōnā te ngahere. Te manu ka kai I te mātauranga, nōnā te ao

The bird that partakes of the berry, his is the forest. The bird that partakes of knowledge, his is the world

Māori proverb

2.0 Introduction

Research has shown that self-efficacy and self-assessment have a significant influence on student learning (Black & Wiliam, 1998; Crooks, 1988). Research also supports self-efficacy as one of the best predictors of student achievement (Hattie, 2009; Latu, 2010; Schunk et al., 2008; Wigfield & Eccles, 2000). Student achievement is a priority for students, teachers, parents, boards, and policy makers. Therefore, any means of significantly boosting self-efficacy and achievement is of interest to all stakeholders in education.

As Berg (2009) points out, "even when there is little literature on a specific topic, there is often considerable work in some related area" (p. 205). Although there is limited research that links self-assessment and self-efficacy, there is ample research in the two areas individually and in related areas. This chapter looks at the literature that relates to self-efficacy, enhancing self-efficacy, and self-assessment. It begins with motivation, the overriding construct, and then considers self-efficacy as a subconstruct of motivation. Research into ways of enhancing self-efficacy precedes a focus on self-assessment in the context of the broader domain of assessment. Frequent testing, feedback, and achievement criteria, which contribute to self-assessment, are given specific attention.

2.1 Motivation

Motivation is multifaceted and all-encompassing stemming primarily from personal beliefs and feelings (Harlen & Deakin Crick, 2003; Zimmerman & Moylan, 2009). Motivation for learning is a vital educational construct. It is "the process whereby goal-directed activity is

instigated and sustained" (Schunk, et al., 2008, p. 4). Motivated students do better because they have better attitudes and strategies and they put in more effort for longer on more challenging tasks (Alderman, 2004; St. George & Bourke, 2008). The variety of theories that have arisen to help explain and understand motivation is indicative of its complexity. Self-concept, self-esteem, effort, self-efficacy, interest, learning orientations, locus of control, attributional beliefs, self-regulation, outcome expectations, concepts of ability, goals, and goal setting are all subconstructs of motivation (Harlen & Deakin Crick, 2003; Maddux & Meier, 1995; Schunk, 2004; Weiner, 2000).

Self-concept, one of the closest constructs to self-efficacy, is integral in the development of motivation to learn (Hattie, 2009; Margalit, 2010). It refers to global perceptions, basic models, and conceptual knowledge or beliefs that individuals possess about themselves and their self-esteem reactions to those perceptions (Alexander, 2006). Self-beliefs about ability, and associated goals, influence where people focus attention and how they process information and interpret behaviour (Mangels, Butterfield, Lamb, Good, & Dweck, 2006). Self-efficacy is usually considered as a context-specific assessment of competence to perform a specific task. Self-concept is "one's collective self-perceptions" (Schunk, 2004, p. 373). As self-concept becomes more domain-specific it more closely resembles self-efficacy (Alexander, 2006; Schunk, 2004).

Learning orientation is one aspect of motivation that is related to self-efficacy. As Bourke (2008) states, "conceptions of learning held by students influence the way they approach a learning task" (p. 160). Students with a mastery-task-incremental approach to learning have a strong sense of self-determination, feel more self-efficacious, believe that effort will enhance ability, and adapt their behaviour and goals accordingly (Schunk, 2004; Webb, Ing, Dersting, & Neme, 2006). Mastery-task-incremental goals have a significantly different impact on learning than performance or ego oriented goals with an entity approach (Alderman, 2008; Dweck, 1986; Harlen, 2006; Hattie, 2009). Students with performance or ego orientations and an entity approach are focused on comparison with other students and more concerned with keeping their ego intact than with mastering tasks (Dweck, 2002). They tend to believe ability is fixed and unrelated to effort and consequently learn and achieve less. However, students may have both mastery and performance goals for one learning task and different types of goals for different tasks.

Attribution theory is another construct that is linked to self-efficacy. Attributional beliefs are interpretations of the past, whereas self-efficacy beliefs, which are formed in part by

attributions, are future focused (Alderman, 2008; Alexander, 2006). Attributions are causal judgements that individuals make about conditions that underlie apparent success and failure, and the theory seeks to explain the reasons for learners' responses to these judgements (Hareli & Hess, 2008; Seifert, 2004; Weiner, 2000). Ability attributions correlate positively with self-efficacy (Stanton, 1999). Locus of control, stability, and controllability are the determining characteristics. When learners feel they have control over their learning, that success is related to effort rather than innate ability, and that a change in behaviour on their behalf will affect outcomes, they are motivated to learn (Alderman, 2008; Schunk, 2004).

Expectancy-value theory is a model for organising and explaining the various constructs of motivation. It is connected to, but not the same as, self-efficacy. It focuses on the combined influence of expectation of a successful outcome and the value placed on gaining that outcome. These two factors influence choices directly and indirectly, via performance, effort, and persistence (Schunk, 2004; Wigfield & Eccles, 2000). Learning behaviour will follow if there is an expectation of success and the outcome is valued highly (Stipek, 2002; Wigfield & Eccles, 2000). Expectancy and value in turn are influenced by self-efficacy (Wigfield & Eccles, 2000).

Albert Bandura (1986, 1992, 1997) wrote extensively on the influence of human agency on social development and behaviour. He positions self-efficacy within personal and collective agency, which operate with other factors to regulate human well-being and achievement. Self-efficacy is a key for all motivational constructs, many of which have intricate overlaps and commonalities between them, and it is distinguished from other constructs because it is task specific (Pajares, 1996; St. George & Bourke, 2008; Zimmerman, 2000).

2.1.1 Self-efficacy

Self-efficacy beliefs are foundational to all motivation (Good & Brophy, 2010; Pajares, 2008). Bandura's (1997) definition, "beliefs in one's capabilities to organise and execute the courses of action required to produce given attainments" (p. 3), is used by many researchers. Seifert (2004) focuses on performance level in his definition, "a person's judgements about his/her capability to perform a task at a specified level of performance" (p. 137), and says it is synonymous with confidence. Schunk (2000) defines self-efficacy as "personal beliefs about one's capabilities to learn and perform actions at designated levels" (p. 108). Self-efficacy permeates most aspects of people's lives and operates with other factors to influence

learning. These beliefs or interpretations of reality are seen by some as more powerful than reality. As Dweck (1986) points out doing well in the past is not sufficient for students to feel competent in facing future challenges because self-efficacy beliefs interpret and filter information (Bandura, 1997; Zimmerman, 2000).

Self-efficacy beliefs have a potent effect on what is ultimately achieved (Black & Wiliam, 1998; Hansen, 2000; Pajares, 2008). A strong sense of self-efficacy is vital for on-going participation in learning (Maddux & Lewis, 1995; Schunk, 1995). Therefore, investing time and resources to increase self-efficacy is likely to be effective in raising student achievement and cost-effective in reaching educational goals. Higher self-efficacy means students have more confidence in their ability to succeed, higher expectations of success, and a greater interest in, and sense of control over, learning (Aleksiuk, 1996; Deemer, 2010; Good & Brophy, 2010).

Self-efficacy plays an integral part in Bandura's social cognitive theory (Bandura, 1997). Bandura maintains that people establish beliefs about consequences of future actions on the basis of personal experience and observation. He argues that learners are self-organising and proactive and need to take responsibility for their learning behaviour. Personal agency develops through interaction with the environment, particularly the social environment. In a setting that encourages personal responsibility, students feel more competent and are more motivated (Bourke, 2008; Eisenberger, Conti-D'Antonio, & Bertrando, 2005; Seifert, 2004). The associated sense of self-government is imperative for effective learning (Alderman, 2008; Brophy, 2010; Pajares, 2008; Ryan & Deci, 2000). Self-efficacy improves when students perceive they have control (Black & Wiliam, 1998; Harlen & Deakin Crick, 2003). The more self-determined students become through self-regulation the higher their self-efficacy and achievement (Absolum et al., 2009; Bishop, 2008; Brophy, 2010; Winne & Hadwin, 2008).

Most research into self-efficacy has been done from the perspective that it is a domain-specific construct. In other words, self-efficacy is considered to be dependent on a particular task or behaviour in a specific context. When considered in this way it has higher predictive accuracy with regard to achievement (Bandura, 1997; Maddux, 1995). McCarthy, Meier and Rinderer's study (1985), into self-efficacy and writing, yielded data about students who either over-rated or under-rated their ability. The study focused on generality[5] of self-efficacy. The researchers believed that efficacy beliefs of one's ability to write effectively in a general sense play an important role in specific writing situations. The major purpose of their study was to

[5] Generality is one of the three dimensions of self-efficacy. The others are magnitude and strength (Bandura, 1997; Smith, 1989; Zimmerman, 2000). Generality refers to the degree to which self-efficacy applies across domains, situations, and time.

investigate whether there was a relationship between strength of efficacy expectations and quality of writing. Working with 137 freshman students, they provided lists of examples of correct and incorrect skills to help students make accurate judgements. They asked students to rate their ability in writing. They found that accurate self-efficacy correlated with better writing. Some good writers have accurate efficacy expectations that correspond with the quality of their writing, as do some poor writers. They also found that many students either overrated or underrated their writing ability. There was some evidence to suggest that a general sense of efficacy in writing contributed to good performance in specific situations.

Smith (1989) was also interested in generalised self-efficacy as opposed to context-specific self-efficacy in his investigation involving 42 college students. Attrition left 19 in the control group and 17 in the trained group. Smith found that training in cognitive coping strategies led to positive changes in anxiety levels and in academic performance. When students were trained in the use of appropriate strategies their expectancy regarding their own efficacy for tasks in general rose. A high level of generalised self-efficacy is associated with high self-esteem, internal locus of control, and high emotional stability (Brophy, 2010).

Sources of self-efficacy

In order to increase self-efficacy the factors that contribute to it first need to be identified (Williams, 1995). Researchers agree on four major sources. These are vicarious experience, verbal persuasion, physiological reactions, and the most important one (which will be considered last) personal past performance or mastery experiences (Bandura, 1997; Pajares, 2008; St. George & Bourke, 2008).

Firstly, vicarious experiences provided by models are a powerful source of self-efficacy (Margalit, 2010; Pajares, 2008). Casas (2011) identifies vicarious experiences as “in effect, using the instructional strategy of modelling” (p. 117) in which students’ sense of capability grows as they observe. When students see successful adult models achieve at a task their self-efficacy is enhanced. Peer coping models are powerful if there are cues that suggest similarity between the observer and the observed and the model overcomes obstacles to succeed (Pajares, 2008; Schunk, 2000). Self-efficacy is increased when peers vocalise both their inability to successfully complete a task and recognition of the need for them to do something, and then follow this through to achieve mastery.

Physiological reactions are another main source of self-efficacy. Williams (1995) goes further to refer to imaginal experiences, or visualisation, as an additional source. He also distinguishes between physiological and emotional states as separate sources of self-efficacy. Most researchers however, place these in the same category. In a paper prepared to advise the NZ Ministry of Education on assessment (Absolum, et al., 2009) the authors address the important role of emotions. They refer to the influence of both previous learning experiences and self-efficacy as contributors to emotional factors that, in turn, affect performance and self-efficacy. Anxiety is a significant emotion in the development of self-efficacy.

Williams (1995) suggests that anxiety has an emotional influence on self-efficacy even though he asserts research has yet to confirm this. Bandura (1997) argues that while past performances do not directly affect anxiety they have an indirect influence via their effects on beliefs. If there is no sense of belief in being able to change a poor past performance then this leads to anxiety. Bandura contends that too much anxiety is caused by, and leads to, an even greater lack of a sense of personal control that lowers self-efficacy. Anxiety needs to be minimised in order to maximise performance. Smith (1989) found a strong inverse correlation between generalised self-efficacy and anxiety levels. He found no evidence to suggest a causative relationship in either direction but suggested the relationship is likely to be reciprocal. Less anxiety leads to higher self-efficacy and the higher the self-efficacy the lower the levels of anxiety. Other researchers support this inverse relationship between self-efficacy and anxiety (McCarthy, et al., 1985; Zimmerman, 2000).

A third source of self-efficacy is verbal persuasion (Bandura, 1986). Verbal persuasion often works in a negative sense as persuaders, either other people or self-talk, undermine self-efficacy. Verbal persuasion however, can also be positive. When teachers communicate positive belief about students' ability to succeed students' self-belief may increase. Most attempts to change self-efficacy "begin and end with communication" (Maddux & Lewis, 1995, p. 55) as, for example, teachers urge students toward successful experiences. Most interventions rely on verbal persuasion. Casas (2011) sees verbal persuasion as providing "students with information they can use to solve problems or complete a learning activity" (p. 56). Pajares (2008) says persuaders have an important role to play as young people depend on others to provide judgements on their academic performances and notes this is particularly so when students lack self-appraisal skills.

Previous mastery experiences complete the list of four main sources of self-efficacy and are the primary contributors to establishing beliefs one has about one's capabilities (Gage &

Berliner, 1998; Good & Brophy, 2010; Pajares, 2008; Stanton, 1999). Self-efficacy is "rooted in mastery experiences provided by parents and caregivers" (Alderman, 2008, p. 74). Aleksiuk (1996) argues that ideally a strong sense of self-efficacy is acquired in childhood. As students experience life outside the home more independent experiences of success contribute to their self-efficacy (Dweck, 2002; Zimmerman, 2000). When students have done something well, they are confident in their ability to repeat the performance in the future. Alexander (2006) includes current performance with past performance of mastery experiences in the list of most influential sources of self-efficacy. She refers to the nature of tasks and the conditions that guide engagement, which seems to be another way of saying that self-efficacy is domain, context, and task specific.

Andrade, Wang, Du, and Akawi (2009) investigated the use of rubrics on self-efficacy and found evidence that confirmed the important influence of mastery experiences. Using a convenience sample of 268 students from 18 schools the researchers split them into a control group and a group who received training in the use of rubrics to self-assess. They used a 0 to 100 scale to measure self-efficacy, which is considered more accurate than the likert-type scale that usually has only five levels of response options (Bandura, 1997). They took into account students' previous exposure to rubrics. While the results did not show an increase in self-efficacy as a result of rubric use, with no significant statistical difference between the two groups, they did demonstrate that both groups increased in self-efficacy. The investigators concluded that the more students wrote successfully the more their self-efficacy for writing increased. In other words mastery experiences enhance self-efficacy.

Enhancing self-efficacy

Researchers agree that one of the main tasks in teaching is supporting students to assume control of their learning to change what they know, think, and believe (Harlen, 2006; Nuthall, 2007). As self-efficacy beliefs come primarily from mastery experiences these experiences need to be cultivated for students to grow in their sense of competence (Eisenberger, et al., 2005; Pajares, 2008). Although increasing mastery experiences is the most powerful way of increasing self-efficacy, these experiences cannot be separated from the other major contributors to self-efficacy, namely verbal persuasion, modelling or vicarious experience, and emotional or physiological responses. Emotional and cognitive self-regulation strategies

enable students to manage their motivational and cognitive states, which is essential for developing self-efficacy (Absolum, et al., 2008; Roeser, Peck, & Nasir, 2006).

According to Bandura (1997), guided mastery is the chief means available for people to change their thinking and beliefs about their abilities. To do this, guided mastery must be structured to develop coping skills and reinforce for students that they can control outcomes and minimise risk. Along with these two features, difficult tasks need to be broken down into subtasks within their capability and students need to be able to get support from the teacher. Although Bandura is writing in the context of phobic behaviour, the principles for supporting classroom learning are the same. Despite the fact that, arguably, teachers are dealing with milder forms of phobia the obstacles students experience in learning are the same in nature, but at the lower end of the scale, as those with phobias.

Bandura asserts that a belief in ability as incremental, not fixed, is important for enhancing self-efficacy and his concept of guided or enactive mastery as the principal means for increasing self-efficacy embraces this. Others (Brophy, 2010; Casas, 2011) support enactive mastery in which students need to "set and strive to attain reasonable proximal goals and approach ultimate goals through successive approximations, and in the process, to appreciate their developing expertise" (Brophy, 2010, p. 111). Put another way, as students recognise their incremental success self-efficacy is enhanced and achievement increased.

Guided mastery through self-regulation leads to the development of self-efficacy as it accelerates students learning of content and skills and increases their effort, persistence, and emotional fortitude (Bandura, 1997; Eisenberger, et al., 2005). In other words, if persistence and self-efficacy can be learned the self-regulatory, metacognitive practices of forethought, performance, and reflection enable students to acquire these behaviours (Pajares, 2008; Zimmerman & Moylan, 2009). Self-regulatory interventions lead to improved academic performance as students' beliefs become more strategic and self-efficacy is enhanced. Researchers advocate various strategies and interventions that teachers can use to increase self-efficacy. Self-regulatory training in terms of evaluation of previous performances, goal setting, feedback, implementation of strategies, monitoring progress, self-instruction, modelling, and training in managing motivational schemas are some of these (Alderman, 2008; Zimmerman, 1996).

Strategy instruction can produce positive results when it is done "to enhance students' belief in their self-efficacy, the ability to exercise control over academic progress" (Eisenberger, et

al., 2005, p. 21). Training students in self-evaluation using cognitive comparison, in which they have a standard to make judgements against and knowledge of their performance level, is a powerful catalyst for boosting self-efficacy (Bandura, 1992). From extensive research Zimmerman and Schunk (2008) concluded that training students in the use of self-regulatory processes increased self-efficacy.

Jackson (2002) agrees that teachers can enhance efficacy beliefs by using systematic interventions. In a study involving 123 participants split into three ability level groups, in the interval between two exams, he offered a one credit point incentive if students sent him an email. A similar percentage of each group responded. He sent the responders an efficacy-enhancing email that included emphasis on their past success, a reminder that students similar to them had succeeded, encouragement to work hard, and stress-reduction tips. He concluded that his efficacy-enhancing email had a notable impact on self-efficacy and outcomes.

In summary, motivation is an important construct in education. Self-efficacy is not only one of the many subconstructs of motivation, it is foundational to it. Although there are several sources of self-efficacy, the main one is mastery experiences. Bandura (1997) advocates guided mastery, which seeks to increase mastery experiences, as the chief means of enhancing self-efficacy. Strategy instruction is one form of guided mastery. In this study strategy instruction is linked to assessment, which is a significant indicator of mastery and therefore is likely to have a major influence on self-efficacy.

2.2 Assessment

Crooks (1988) asserts that “assessment is one of the most potent forces affecting students’ learning” (p. 88). Crooks also says that the summative function of assessment has been too dominant. Research has established the relationship between assessment, motivation, and learning (Black & Wiliam, 1998; Casas, 2011; Crooks, 1988; Harlen, 2006). High stakes assessment creates anxiety, lowers self-esteem as students see results as indicative of their intrinsic worth, and has a negative impact on motivation and achievement (Black & Wiliam, 2006; Bourke, 2000; Harlen, 2005). Good assessment supports the development of strategies, including generation of feedback, self-regulation, and self-assessment competence, and it boosts achievement and motivation (Aitken & Sinnema, 2008; Black & Wiliam, 2003).

Lowering the stakes of assessment promotes a mastery-task-process-incremental approach to learning, which raises self-efficacy and achievement (Harlen & Deakin Crick, 2003).

The most effective way to lower the stakes of assessment is to change the focus from summative to formative (Black & Wiliam, 1998; Brown, Irving, & Keegan, 2008). The former, which is assessment *of* learning, has a focus on final evaluation, while the latter is assessment *for* learning. Summative assessment puts the emphasis on performance without any consideration of contributing to further learning (Boud, 2000). Formative assessment emphasises judgements about the quality of learners' performances, identifies learning needs, and helps the learner to adjust their behaviour to improve competence while at the same time generating motivation (Black & Wiliam, 1998; Gardner, 2006; Hill, 2008; Sebba, 2006). Rawlins (2008) argues that an assessment system built around formative assessment can be effectively used for summative purposes also. Improving formative assessment reaps "significant and often substantial learning gains… and tangible benefits in terms of national assessment" (Black, Harrison, Lee, Marshall, & Wiliam, 2003, pp. 9, 29).

One of the anticipated effects of NCEA was a shift to a formative focus in assessment, with associated lower stakes (Hipkins, Vaughan, Beals, & Ferral, 2004; Meyer, Weir, McClure, Wakley, & McKenzie, 2009). Although the potential exists, in reality, this potential is yet to be fully realised. NCEA is the predominant qualification in the majority of secondary schools in New Zealand and is indexed to internationally recognised qualifications (Brown et al., 2008). It consists of three levels approximately corresponding to the final three years at school. Each level consists of achievement and unit standards for which students gain credits when they have shown they can meet the detailed criteria described within each standard. In an increasing number of assessments it provides opportunity for re-sits after feedback and further learning. This formative aspect is a shift in the *why* of assessment, from measurement of learning only, to supporting learning and significantly lowering the stakes (Alison, 2008; Black, et al., 2003).

Effective formative assessment encourages students to take responsibility for their learning and has the greatest potential to direct and enhance learning and to improve students' motivational and emotional states (APA Work Group, 1997; Crooks, 1988; Kabernick & Newman, 2006; Walsh & Sattes, 2005). NCEA's standards base empowers students and supports their involvement in managing their learning (Rawlins & Poskitt, 2008). Formative assessment is a powerful motivational tool internationally (Lord, 2005). On a national scale promoting learning is vital to assessment (see Figure 2.1) and the authors of the Ministry of

Education position paper on assessment (2010) state that "assessment not used formatively at some level of the system is not worth doing"(p. 20). When assessment is learning it builds students' sense of competence (Black & Wiliam, 1998). Researchers agree on the motivational and achievement values of such assessment experiences, on a direct link between students' assessment capability and their sense of competence, and self-assessment as a key component of formative assessment (Black & Wiliam, 1998; Black, et al., 2003; Boud, 2000; Casas, 2011). Use of assessment for learning through self-regulation and self-monitoring by self-marking, empowers students and builds self-efficacy (Harlen, 2006).

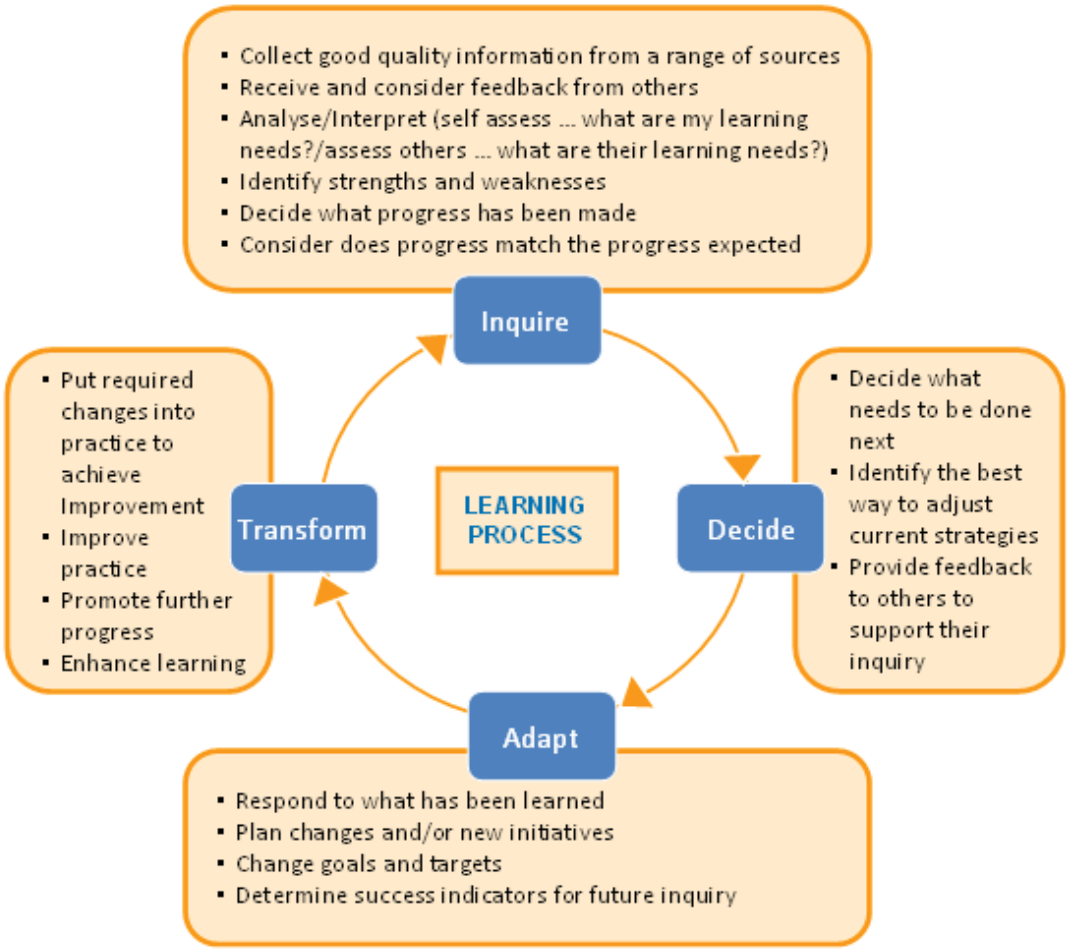


Figure 2.1 Assessment is a process of learning, for learning (New Zealand Ministry of Education, 2010, p.18).

Self-assessment as used in this study is a type of formative assessment. Although formative assessment has advantages for high achievers, one of the main concerns for New Zealand is the significant number of low achievers (Harlen & Deakin Crik, 2002; OECD, 2005; PISA, 2009;

Strategy & System Performance Group, 2009). By supporting students to assume a lead role in assessment, they are empowered and, as confidence is built, empower themselves (Hill, 2008; Leach, Neutze, & Zepke, 2001; Ryan & Deci, 2000). This active involvement of the learner seeking out and using good feedback develops a lifelong learning skill, and formative assessment becomes self-assessment (Andrade & Valtcheva, 2009; Black & Wiliam, 1998; Black, et al., 2003; Boud, 2000).

2.2.1 Self-assessment

Assessment is central to student experience and research supports increasing students' control and involvement in learning, including assessment (Clarke, Timperley, & Hattie, 2003; Davies & Hill, 2009; Harlen & Deakin Crick, 2003). Although Tan (2004) cautions against the assumption that any and all self-assessment is beneficial for students, the important role of student control, the strong link between assessment and learning, and the influence assessment has on self-efficacy point to self-assessment as a powerful means of building students' sense of can do it (Black & Wiliam, 1998; Crooks, 1988; Harlen, 2006).

Self-assessment can be used as a context for student discussion about establishing positive motivational schemas and a tool for supporting them to do so (Boud, 2000; Cassidy, 2007; Meyer, et al., 2009; Taras, 2008). Consciously aiming for, and sustaining, the development of assessment capabilities is an effective way to make students feel more equipped and more capable i.e. more self-efficacious (Boud, 2000; Crooks, 1988; Sadler, 1989; Sebba, 2006). Smith (1989) noted that self-efficacy is most likely to increase when students are involved in critiquing their learning and developing better skills for future learning (see also Bangert-Drowns, Kulik, Kulik, & Morgan, 1991).

Students need awareness of their cognitive processes in order to actively, and effectively, self-monitor to take charge of their assessment. Such metacognition, or thinking about thinking, is critical (Airasian, 2008; Artzt, Armour-Thomas, & Curcio, 2008; Serra & Metcalfe, 2009; Tobias & Everson, 2009). Zimmerman and Moylan (2009) define metacognition as the "knowledge, awareness and regulation of one's thinking" (p.299) and identify the close link between metacognitive processes and motivation. Strategy use, self-monitoring, and other self-regulatory processes are characteristic of students who learn more and have higher self-efficacy (Crooks, 1988; Taras, 2008; Zimmerman, Bonner, & Kovach, 1996). Pajares (2008) also identifies the link between higher academic self-efficacy and greater use of cognitive and

metacognitive strategies, and he supports helping learners develop and use metacognitive processes to improve the accuracy of self-efficacy judgements (Pajares, 1996).

Self-assessment has benefits for student learning (Black & Wiliam, 1998; Boud, 2000; Bourke, 2000). One significant benefit is that all students, regardless of ability, can learn, and gain, from strategies of self-assessment (Cassidy, 2007; Wilson, 2007). Self-assessment also helps students look to themselves and sources other than the teacher for standards by which to judge their work (Taras, 2008). Casas (2011) recommends that students be given regular opportunity to assess their performance and that of their peers. She supports this recommendation with a section on peer assessment. She does not include a section on self-assessment, which seems to contradict her claim regarding its importance. Although there is other support for peer assessment (Sadler & Good, 2006), Black and Wiliam (1998) found that it was difficult to come to any conclusion as it was hard to separate peer assessment from other learning activities.

Ng and Earl (2008) looked at accuracy in self-assessment giving particular attention to the role of ability, feedback, self-efficacy, and goal orientation. They worked with a group of 94 students with an average age of 17 years eight months and used questionnaires to gather data about feedback, self-efficacy, and goal orientation in relation to English assessments. They recruited volunteers as participants and offered a prize draw entry for participation, which may have provided a biased sample. They define confidence as a person's certainty that they have given the correct information, which, in the context of the study, refers to assessment answers. They define self-efficacy as "the belief individuals have that they are able to perform successfully at a task specific level or more generally across different situations" (p. 4). The students were split into three groups, referred to as accurate estimators of performance on the assessments, overestimators, and underestimators. The researchers found no significant difference in self-efficacy between the three groups. In their conclusions however, they seem to move from treating confidence and self-efficacy as distinct constructs to combining them. The main finding was that overly high confidence levels were positively related to poorer performance and overestimation. In other words, too much confidence is not a good thing for raising achievement. Conversely, those who were confident in their ability and slightly overestimated how well they thought they would perform made the greatest improvement. Ng and Earl concluded that overestimation was optimum for raising achievement although the level of overestimation was crucial. They found the optimum level of self-efficacy seems to be

a level that is just beyond the actual ability level of the student. This agrees with earlier research findings (Bandura, 1997; Zimmerman, 2000).

It is interesting to note that Ng and Earl (2008) add a codicil to their definition of self-efficacy saying it is "formed following self-assessment" (p. 4). Although this is inferred in any definition of self-efficacy, giving it added emphasis brings clarity. Self-assessment is a crucial element in self-efficacy. These researchers used a reliable self-efficacy scale but they did not provide any form of criteria for the assessments against which students could judge their own performance level. The use of such a schedule or standard, for students to assess their performance against, may have modified the degree of overestimation made by the highly over-confident.

In other research involving medical students in an elective course (Sobral, 1997), self-directed learning was shown to increase self-efficacy. The main purpose of the course was to enhance students' capability for independent learning by increasing responsibility, study skills, decision making, and self-monitoring and self-appraisal capabilities. Sobral asserts that all students, those who took the elective course and those who did not, had similar learner characteristics to begin with. Nevertheless, students who elected to do this course are likely to have been more motivated to begin with. Sobral used self-report analogue scales from 0 to 6. Such scales have been shown to be less reliable than 0 to 100 scales (Bandura, 1997). The study revealed significant differences in perceived self-efficacy on all of the self-directed learning tasks for most students, with a later statement that two thirds of students attained the expected self-efficacies, which seems contradictory. Sobral suggests a lack of expertise in self-monitoring may have been to blame for the disparity between self-efficacious expectations and actual achievement, which reinforces the potential value of training students in self-assessment against a specific standard.

Ross and Starling (2008) undertook a study to ascertain whether self-assessment would lead to higher self-efficacy in technology rich classrooms. They worked in three schools with six teachers and 164 students who were split into a control group and a treatment group, which were tested for equivalence to support validity and reliability. They found that self-assessment training had a positive, significant effect in moderating self-efficacy. Self-assessment gave students a more realistic sense of their ability in a way that encouraged learning. The self-assessment training included defining assessment criteria, teaching how to apply assessment criteria through teacher modelling, feedback, and goal setting.

Nbina and Viko (2010) looked at the difference in self-efficacy of students exposed to instruction in metacognitive self-assessment strategies in chemistry and those not exposed, as measured by mean scores on a self-efficacy scale. The study involved 293 senior secondary students in Nigeria, all of whom were also using metacognitive self-assessment strategies in their mathematics classes. They concluded that the effect of providing elaborate feedback, teacher modelling, goal setting, and assessing progress at every step was significant in its effect on self-efficacy. Instruction in self-assessment skills significantly enhanced chemistry self-efficacy. However they used a scale from 0 to 4, which is narrow and less reliable (Bandura, 1997). Kobus, Maxwell, and Provo (2008) also included a focus on student self-assessment in their research into increasing the motivation of elementary and secondary school students. They spent three weeks training 80 students, from third, fourth and eighth grades, in the use of journals and self-rating likert scales. They concluded self-assessment enabled students to personally connect with their success, which enhanced their sense of competence and motivation.

A final study that warrants consideration in the context of self-assessment as a means to enhance academic self-efficacy is Lebler's (2007) study. His non-elective programme involved music students managing their learning through self-monitoring using standards and criteria-referenced assessment. Associated with this were huge quantities of what he called horizontal (peer to peer), as opposed to vertical (teacher to peer), feedback. Feedback had to be "realistic, specific, descriptive, non-judgemental, goal oriented, non-comparative, direct and positive" (p. 213). Lebler used surveys, formal and informal student feedback, and interviews to collect data from 41 of the 75 enrolled in the course. He concluded that self-assessment resulted in greater self-efficacy. The generic principles that underlie the approach include recognition of student expertise, recognition of the influence of assessment on learning, a range of learning approaches, self-directed activity, reflection, improvement opportunities, and monitoring of capacity building.

Some strategies are more effective than others in ensuring that assessment experiences are successful and therefore contribute to mastery. Due to the debate around the effect and value of frequent testing on students' motivation and achievement, the next section of the literature will examine research in this area. Following this the literature will look at two strategies that appear to have significant impact on students' achievement levels and self-efficacy. Feedback and clear achievement criteria working together in the context of self-assessment are integrally related and cannot be separated from the overall purpose of

assessment, which is “the process of seeking and interpreting evidence for use by learners… to identify where the learners are in their learning, where they need to go and how best to get there” (Gardner, 2006).

Frequent testing

Frequent testing has been criticised as promoting teaching to the test (Harlen & Deakin Crick, 2003). However, in response to a limitation in NCEA on the amount of summative re-testing, many schools are increasing emphasis on ensuring students have mastered knowledge through repeated formative tests prior to summative testing. Is this teaching to the test, or is it supporting students in achieving mastery by “adapting assessment tasks to meet the needs of diverse students” (Rawlins, et al., 2005, p. 111)? Harlen and Deakin Crick’s criticism assumes that assessment and learning are a dichotomy whereas in a learning milieu with the focus on self-assessment, assessment *is* learning and no such dichotomy exists. Harlen (2005) suggests that repeated practice tests reinforce low self-image in low achievers. Elsewhere he seems to qualify this referring to repeated failure from summative tests as the problem (2006). When it is clear to students that tests are formative as opposed to summative, and students use assessment schedules to generate feedback and help close gaps, the advantages of frequent testing as part of the learning process minimise if not negate disadvantages (Black & Wiliam, 1998; Sadler, 1989).

Frequent formative tests in exam conditions reduce emphasis on summative high stakes tests. They demystify and familiarise the testing process, decrease anxiety and the “high” of high stakes one off assessment, and increase long term retention, content focus, learning orientation, task related feedback, self-regulation, intrinsic motivation, and self-assessment capabilities (Brophy, 2010; Harlen & Deakin Crick, 2002). They reduce the sense of teacher control and raise metacognition, autonomy, competence, and relatedness (Bishop, 2008; Ryan & Deci, 2000). These strengthen students’ assessment capabilities and raise self-efficacy. A review on the literature around standards based assessment found many gains from this form of assessment (Rawlins, et al., 2005). The closest reference to any negatives of frequent testing is that “the assessment of pre-specified skill *may* lead to… over-assessment” (p.108) (italics added). Frequent practice or formative assessments provide opportunity for students to exercise and develop self-assessment capabilities. Black & Wiliam (1998) concluded that

frequent testing, with appropriate feedback and dialogue in relation to the assessments, was positive in its impact on enhancing self-assessment capabilities, self-efficacy, and learning.

Feedback

Feedback is one of the most powerful components of learning and assessment and involves strategic thinking and metacognitive strategies, which are critical for developing self-assessment capabilities and self-efficacy (Harris, Irving, & Peterson, 2008; Hattie, 2009; Hattie & Timperley, 2007; Sadler, 1989). Feedback that enables learning is an important part of formative assessment (Sadler, 1989). It allows students to access information on the task being learned, helps them to improve their process, and helps them with their behaviour strategies providing information that equips them to accurately assess learning evidence and increase their positive attributions and control (Hattie & Timperley, 2007). Thus, feedback provides evidence that students use to self-assess. Wilson (2007) found that feedback and self-assessment are inextricably linked. Immediate, corrective feedback in the context of incremental process goals and clear criteria also increases self-efficacy (Eisenberger, et al., 2005; Hattie & Timperley, 2007; Schunk, 1995).

Feedback encourages effort and persistence, especially when it comes directly from the previous performance of a task, which students factor into their self-efficacy beliefs (Harlen & Deakin Crick, 2003). A feedback-efficacy cycle operates in which efficacy expectations precede and influence performance and are followed by feedback. This feedback is then used to adjust efficacy expectations. Effective feedback provides direction for students learning and plays a significant role in self-efficacy (Harlen & Deakin Crick, 2003; Walsh & Sattes, 2005; Zimmerman & Moylan, 2009). Students increase in confidence in their ability as they learn how to generate specific, relevant, descriptive feedback related to their learning goals (Absolum, 2006; Crooks, 1988; Harlen, 2006).

Bourke (2000) worked with a group of 26 students from three different classes in year seven for the first year of her study, and with the same students in year eight for the second year. She used ethnographic methods to investigate conceptions of learning and self-assessment, in school and out of school. Bourke recognised that any difference between these two settings would be partially due to the voluntary nature of out-of-school activities compared to the compulsory nature of school. She found that feedback in out of school activities focused on the task and was more effective than most school feedback. The latter focused on surface

features such as accuracy, presentation, and completion. Good feedback focuses on the task, process, and regulatory behaviour of the students in the context of learning goals and strengthens students' self-efficacy (Black & Wiliam, 1998; Hattie, 2009).

Feedback is effective when linked to learning goals, which are crucial for assessment and motivation. Students with learning goals are likely to feel that they can achieve those goals. In a meta-analysis on the relationship between higher levels of goal attainment and self-efficacy Hattie (2009) found the effect size was d=.92, indicating a very strong, positive relationship between goal attainment and self-efficacy. Bourke (2000) found a positive relationship between self-efficacy and goal setting and that identifying goals and the criteria for reaching goals increased motivation. Out-of-school activities had goals "embedded into the activities" (p. 213), such as badges, examinations, and performances. These activities were also more prescriptive than school activities.

Covington (1992) identified the improvement in motivation that occurs when goals are realistic and achievable. Sound learning goals are mastery or task oriented with an incremental approach to learning. They differ significantly in their impact from performance or ego oriented goals, which place more importance on comparison with others than mastering tasks (Boud, 2000; Bourke, 2000; Dweck, 1986). Ego goals are usually associated with an entity approach to learning. Students with this approach believe that intelligence is fixed. When students engage in effective action, employing strategies such as setting mastery goals and utilising feedback, they develop self-efficacy. Hattie (2009) found that challenging learning goals were better than "do your best" learning goals as they focused student attention on clear, specific criteria.

Achievement criteria

Clear achievement criteria are often associated with feedback and can strengthen mastery learning goals and self-assessment. Andrade and Valtcheva (2009) found little evidence that criteria enhanced self-assessment and self-efficacy however, research overwhelmingly supports students' need for a clear understanding of what is required, feedback on their current performance, and strategies for improving their work to meet the required standard in order to self-assess effectively (Black & Wiliam, 1998; Boud, 1995b; Sadler, 1989). Tan, Teo, and Ng (2011) studied 15 students from three secondary schools to investigate ways in which students of various ego types experienced self-assessment. Using scales, checklists, and

questionnaires related to ego on three different levels of low, moderate, and high, they found that the most confident students are aware of and understand the value of self-assessment. They also found that it was "important for teachers to possess and present clear and unambiguous standards for students to practice self-assessment to their own benefit" (p. 6).

Rawlins (2008) stressed the importance of establishing links between specific problems or assessment questions and the relevant assessment criteria. He points out that working with students to unpack or break down achievement criteria helps them to generate feedback. Research supports his claim (Black & Wiliam, 1998; Ginsberg, 2005; Hattie & Timperley, 2007). Breaking down the achievement criteria in the standards based assessment environment of NCEA builds self-efficacy (Alison, 2008; Corno, 2008; Kearney, Bevan-Brown, Haworth, & Riley, 2008; Meyer, et al., 2009; Rawlins et al, 2005). NCEA also supports the mastery-task-effort-incremental approach in which students focus on effort as the means for successfully completing learning tasks to meet criteria one step at a time. This orientation lowers the stakes of assessment, provides vocational and educational pathways for students that add context and relevance, and increases motivation (Alison, 2008; Rawlins, et al., 2005). NCEA reduces the normative performance-ego-ability orientation where students think in terms of fixed ability and focus on themselves relative to others.

Research has shown that access to feedback in terms of clearly expressed criteria makes students think about and identify what they already know, recognise gaps in their learning, and work out how to meet the criteria (Black & Wiliam, 2003; Boud, 1995a; Harlen & Deakin Crick, 2003). As Hattie (2009) puts it, students need to know "where they are at, where they are going, what it will look like when they get there, and where they will go to next" (p. 165). Sadler's (1989) three aspects of formative assessment reinforce this.[6] Bourke (2000) observed that when students set goals with criteria they not only took more responsibility for their learning but were more confident. Brown (2008) states that students "who believe the purpose of assessment is to mark or grade them against standards or criteria actually do better" (p. 158). Tan's (2009) future-driven self-assessment is based on standards based criteria against which students can make self-judgements, which gives students confidence and belief in their ability to advance their learning (Black & Wiliam, 1998; Corno, 2008).

Wilson (2007) worked with primary school students to look at peer and self-assessment as strategies for motivation and achievement. She used questionnaires, a strategy evaluation

[6] Sadler stressed that feedback needs to provide information about the level students are at, the level they need to be at, and how to close the gap between the two.

form, semi-structured interviews, and students' workbooks to find out which strategies are effective for developing peer and self-assessment in written language, which of these strategies are effective in raising achievement, and how these affect motivation and achievement. One of her findings was that even students who lacked confidence in their ability identified the value of criteria.

If self-efficacy is enhanced by guided mastery in which clear criteria and feedback play a crucial role, then it follows that instructing students in the use of these strategies will increase self-efficacy (Eisenberger, et al., 2005). Interventions based on strategy instruction can change students' approaches to learning, helping them to move away from entity thinking and performance goals toward incremental learning (Brophy, 2010). Strategy training increases self-efficacy and performance (Smith, 1989). Zimmerman and Moylan (2009) designed a study to train struggling students in self-correction strategies by teaching them to use academic grades as self-reflective feedback. The researchers used an experimental group, who received training in self-reflective processes and feedback, and a control group. They found, as in previously mentioned studies, a significant level of over-confidence associated with low achievement levels. As a result of the intervention there was closer alignment between self-efficacy beliefs before solving problems and in self-evaluation after solving problems.

Thus research supports that good feedback and clearly expressed achievement criteria are fundamental to effective self-assessment and that training students in the use of self-assessment strategies improves students' self-efficacy.

2.3 Summary

Research has established the significant influence of self-efficacy and self-assessment on learning and achievement. There is agreement among researchers that the major source of self-efficacy is mastery experience. Feedback, achievement criteria, and self-assessment are accepted as having an impact on self-efficacy. Although there is debate on the value of frequent testing in contributing to self-efficacy and achievement, there is support for this if it is done in the context of formative assessment. There is some debate about separating self-assessment from peer assessment; however, there is clear research evidence to support the value of self-assessment in its own right.

Some research has been done into self-assessment and self-efficacy at tertiary level and in work settings, and some research has studied the effects of training students in strategies to increase self-efficacy. In the New Zealand context Wilson (2007) and Bourke (2000) have done studies into self-assessment and self-efficacy at primary and intermediate level. In the context of secondary school students very little research involves the effect of self-assessment, and training students in self-assessment strategies, on raising self-efficacy.

Therefore, this research addresses the question

- What effect does students' self-assessment have on their self-efficacy?

It does this by seeking to answer the three subquestions

- What role does feedback play in students' ability to self-assess?
- What role does understanding problems in terms of achievement criteria play in students' ability to self-assess?
- What is the effect of self-assessment on self-efficacy?

If self-assessment is found to raise self-efficacy and students respond to training in self-assessment then the relationships between self-efficacy, assessment, and achievement means there are significant implications for educational practice and policy.

CHAPTER THREE

Methodology

We must place ourselves inside the heads of our students and try to understand as far as possible the sources and strengths of their conceptions

Howard Gardner

3.0 Introduction

This chapter provides a theoretical framework for the research and is structured around epistemology, theoretical perspective, methodology, and methods. A description of and justification for the interventions used in investigating the effect of self-assessment on self-efficacy is included with methodology. Ethical issues are considered with particular attention to the conflict of interest created by my roles as Head of Department and classroom teacher. Consideration is given to matters related to data collection including validity, reliability, and triangulation.

3.1 Epistemology

The purpose of all research is to generate new knowledge (McMillan & Wergin, 2010). Research often arises in response to a question, and anyone who seeks to undertake effective research is faced with a multitude of strategic decisions (Denscombe, 1998). Although the decisions about data collection seem paramount, they are the apex of a pyramid of decisions whose foundation is an epistemology (see Figure 3.1)

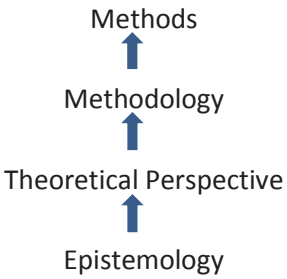


Figure 3.1 Pyramid of research adapted from Crotty, 1998

Epistemology, the philosophy of the nature and origin of knowledge, answers the question of how we know what we know and forms the basis of all research.

> Two archetypes pervade Western thinking on the subject of how reality is best apprehended, archetypes that have their ultimate origin in Plato and Aristotle. For Plato sense data were at best a distraction from knowledge, which was the province of unaided reason. For Aristotle, knowledge…[was] derived in the first instance from information gathered from the outside world. These two models of human thinking… formed the major intellectual legacy of the West… the twin poles of epistemology (Berman, n.d.).

From Plato and Aristotle arose the two philosophies known as subjectivism and objectivism. In subjectivist thinking knowledge arises in the mind of the individual, but objectivist truth exists in objects and events. Constructivism[7] arose out of, and merges, the two historical positions. For the constructivist knowledge and meaning are formed through interaction between, and in the union of, subjective human beings and inanimate objects. Knowledge and meaning are then developed and transmitted primarily through, and in, the social context (Crotty, 1998). When knowledge is seen as arising in this way the perspective of the individual or community is paramount and there is no single correct interpretation or definition of truth or meaning.

This study, "Self-assessment: A means to enhance academic self-efficacy in year 12 mathematics", is constructivist in essence. Self-efficacy refers to people's beliefs in their ability to organise and carry out specific tasks, beliefs formed as a result of their interaction with the world of people and events around them. These beliefs result from the meaning people attach to their experiences of interaction and may have little resemblance to the experience itself, or to others' definitions of those experiences.

3.2 Theoretical perspective

A constructivist epistemology gives rise to a range of theoretical perspectives including interpretivism. Interpretivism looks for culturally derived meanings within a historically situated perspective in which individuals and their actions form the basic unit (Crotty, 1998).

[7]Constructivism is used to refer to the unique experience of each individual in forming meaning and constructionism denotes the collective or community generation and transmission of meaning (Crotty, 1998). This study will use constructivism (and constructivist) as it is most applicable to the context of the study.

In other words meaning arises in a specific context as individuals interact with, and within, that context. For the interpretivist social reality is a product of collective negotiation based on the subjective ideas that individuals have about reality. These ideas change as individuals alter, examine, build, and strengthen their perceptions (Blumer, 1969). A key assumption in interpretivism is that for meaning to be discovered it must be understood from the participants' perspective because this is the reality (Crotty, 1998; Silverman, 1993). This is in contrast to what is seen as the scientific empiricism of objectivist positivism, in which meaning is given or posited.

Symbolic interactionism, a form of interpretivism, focuses on the impact of meanings of events rather than the impact of those particular events (Silverman, 1993). The premise is that "people act toward things on the basis of the meaning that these things have for them, not on the basis of the meaning that these things have for the outside scholar" (Blumer, 1969, p. 51). For example if a student thinks that contributing to class discussion means they may look stupid in front of peers they will react accordingly, in spite of the value that others place on such contribution for extending their social and communication skills. This study focuses on self-efficacy, which results from the meaning learners attach to experiences, rather than from the experiences themselves or from the meaning others attach to them.

3.3 Methodology

Constructivism provides the philosophical underpinnings for the theoretical perspective of symbolic interactionism, which in turn informs and supports the methodology (Crotty, 1998). To be appropriate the methodology needs to reveal the situation as understood from the participants' perspectives. Qualitative research works with naturally occurring data in natural settings, and it uses thick description to allow the voice of others to inform the researcher (Bourke, 2000; Denscombe, 1998; Ezzy, 2002; Mills, 2007; Silverman, 1993). It is more concerned with meaning and understanding than with measuring (Harding, 1987). The researcher, to the best of their ability and in the context of the influence of the meanings, beliefs, and interpretations they have developed from their life experience, has to find a way to take the viewpoint of those under study. The researcher becomes a research instrument constructing meaning out of interaction with, and observation of, the participant community (McMillan & Wergin, 2010; Silverman, 1993).

3.3.1 Action Research

Action research is a qualitative research methodology that comes out of, and is consistent with, symbolic interactionism and constructivism (Crotty, 1998). It is hands-on, related to practical issues arising in real life contexts, and based on the premise that the best way to learn about social issues is to try to change them (Denscombe, 1998; Ezzy, 2002). Originating with Kurt Lewin (1890-1947) and used in a range of community situations, the combination of collective action and understanding makes it a suitable approach in educational settings. Action research involves deep engagement in issues embedded in classroom life (Huang, 2010; McMillan & Wergin, 2010; McNiff & Whitehead, 2006). It enables careful attention to collating data on what students say, do, and produce from within their community, which enhances the likelihood of informed interpretations based on genuine learning behaviour (Guilfoyle, 2008).

Action research is rigorous, systematic, reflective, and interpretive. It is based on empirical evidence to create change and involves spiralling steps or cycles of reflection, practice, and improvement (Denscombe, 1998; Kemmis & McTaggart, 1988; McMillan & Wergin, 2010; Noffke, 1992; Poskitt, 1994; Schmuck, 2006). Theory arises in the context of practice and is licensed by it, uniting rather than dichotomizing the two, as theory and practice feed into cycles of reflection, observation, and action (Berg, 2009; Carr & Kemmis, 2005; Elliot, 2005; Mills, 2007). Action research has been compared to feminism in its striving for change, equity, and liberation (Cresswell, Hanson, Clark Plano, & Morales, 2007; Crotty, 1998; Mills, 2007). Researcher awareness and triangulation[8] provide a defence against an excessive focus on rigour that neglects the flexibility necessary when working with people and collecting data primarily via dialogue (Carr & Kemmis, 2005). On-going collaborative reflective practice facilitates the discovery of new knowledge that is "a constant process of dialogue between what is already known and the as yet unknown" (Ezzy, 2002). In action research, this knowledge is understanding and practice that is specific to the local context (Kemmis, 2006; Somekh & Zeichner, 2009).

An issue for action research, which exists in spite of its wide international use, is the lack of agreed upon procedure (Creswell et al., 2007; Mills, 2007). Limitations include the inability to control factors within the natural environment and the constraints required by moral and ethical obligations present when working in such conditions. Some of these will be addressed

[8] Triangulation is the process whereby data is collected from three or more sources to strengthen accuracy and validity through comparison of data.

later in the chapter. It is vital that action researchers provide clearly articulated procedures to show objectivity and rigour to minimise the effect of these limitations and to support validity, reliability, and generalisability. In reality any action research has issues of generalisability as it is done for the benefit of the participants with limited potential for extending beyond the research group. Findings may be sufficiently encouraging to stimulate wider application within the school and also to warrant further research to ultimately develop theory beyond the immediate context (Berg, 2009; Cresswell, et al., 2007).

Beginning with Lewin, there have been a multitude of models for teacher action researchers to follow. Mills (2007) defines action research as "any systematic inquiry conducted by teacher researchers, principals, school counsellors, or other stakeholders in the teaching/learning environment to gather information about how their particular schools operate, how they teach, and how well their students learn" (p. 5). Mills' dialectic research spiral (see Figure 3.2) involves a four step process built around several elements that are shared by all models of action research:

1. Identifying an area of focus
2. Collecting data
3. Analysing and interpreting data
4. Developing an action plan

This research project is based on Mills' model of action research using these four steps.

Smaller scale research in 2010 led to the action plan that provided a starting point for this research. Self-marking using assessment schedules significantly increased self-efficacy for the students involved in the 2010 research. They valued the access they had to the assessment information, in terms of the schedules and their performance, which boosted their self-efficacy. Observations and interviews during that research revealed a high level of engagement and students' enthusiasm for the process of self-marking using schedules.

Mills' (2007) first step in the dialectic research spiral for this study, the focus area, is improved self-efficacy with self-assessment as the strategic intervention. This guided mastery approach includes lessons on worked examples, achievement criteria, and self- assessment using assessment schedules to support students in developing self-assessment skills (Lopez 2008).[9] This involves in-depth consideration of both practice and its theoretical underpinnings and is consistent with action research, as is the purpose of equipping students with a greater sense

[9] These are described in detail in section 3.5.

of can do it to empower and liberate them from restrictive mind-sets and practices (Berg, 2009; Cresswell, et al., 2007; Mills, 2007; Pyrch, 2007). The second step of Mills' dialectic action research spiral, data collection, is described in section 3.6 and in chapter four. The third step of analysing and interpreting data is found in chapter five, and the action plan is in chapter six.

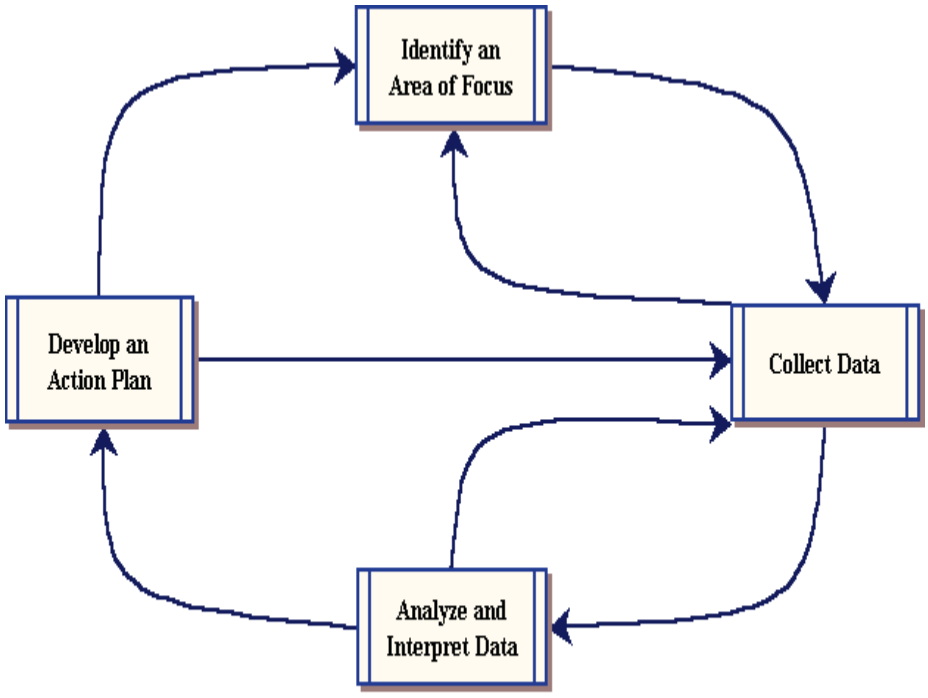


Figure 3.2 Dialectic action research spiral (Mills, 2007, p20.)

3.4 Participants

The students in a year 12 mathematics class at an urban secondary school make up the research cohort. A year 11 class was considered but due to their lack of experience with NCEA assessments and the changes to NCEA assessments being introduced at that level I decided year 12 would be more suitable. Having studied level one NCEA year 12 students are familiar with NCEA achievement standards. This past experience of assessments enabled them to have a better sense of what helps their sense of can do it and to more accurately provide information on self-assessment and self-efficacy. The group is a mix of gender and ethnicity

with similar numbers of male and female, and similar numbers of Māori, Pacific, and European.

Interviewees were selected from the information provided in a questionnaire that was completed by students on the first day of the research (see section 3.6.3 for more detail).

3.5 Interventions

This action research project involved three interventions of strategy instruction that formed part of the normal classroom teaching and learning programme. Guided mastery using strategy instruction is a means of enhancing self-efficacy (Bandura, 1997; Jackson, 2002). Teachers can increase self-efficacy in students by enhancing academic skills and self-regulatory practices (Pajares, 2008). Interventions can stimulate change and improvement (Brophy, 2010). Researchers have found that effective interventions to improve achievement and learning for secondary students are based on metacognitive strategies and self-monitoring (Clarke, 2009; Zimmerman & Moylan, 2009). Metacognitive strategies and self-monitoring are integral to self-assessment.

Each intervention lesson related directly to one of the research subquestions (see Table 3.1). The first two interventions were foundational to the third one on how to self-assess using assessment schedules and comments to indicate what they had to learn to close the gaps (Black & Wiliam, 1998; Butler, 1988). Intervention lessons and data collection took place alongside each other throughout the research process (see Table 3.1). Data collected from questionnaires, interviews, observations, and practice assessments provided information for all three subquestions. The combined information from the various data sources has revealed patterns and themes that help to address the research subquestions and thus accomplish the purpose of the study.

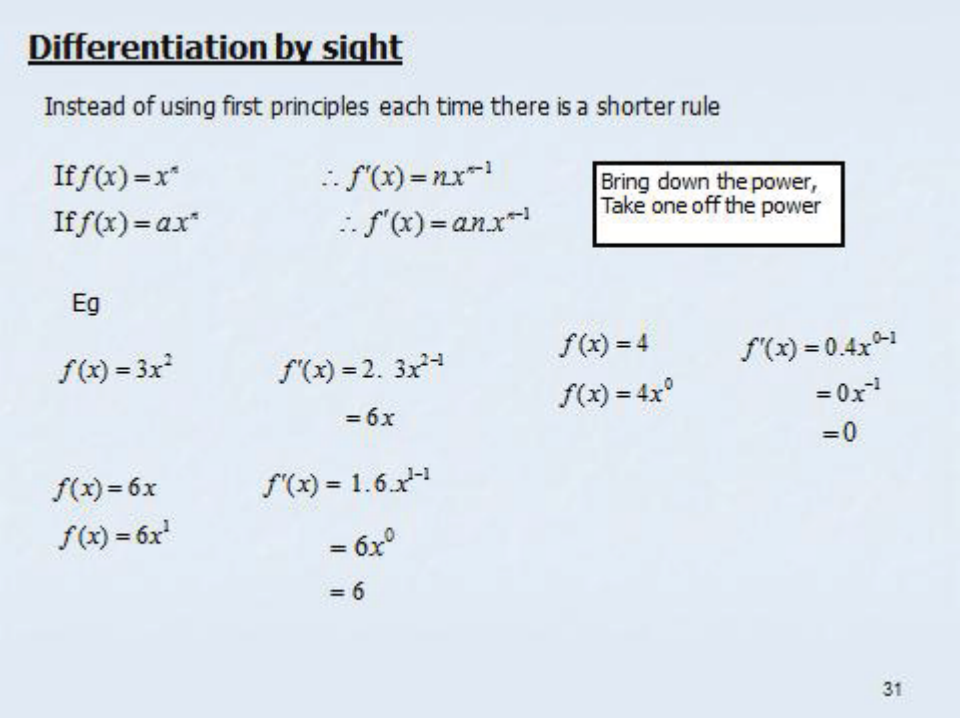
Table 3.1 Relationship of interventions to research questions and timeframe of interventions and data collection

Date	Research Question	Intervention	Data collection
2nd August	What role does feedback play in students' ability to self-assess?	1.Lesson on worked examples to help students to purposefully seeking out feedback to identify what they are doing right, what they are doing wrong and how to close the gaps	Questionnaire
3rd August			Observation
24th August	What role does understanding problems in terms of achievement criteria play in students' ability to self-assess?	2. Lesson on unpacking achievement criteria and relating them to specific assessment problems	Observation
26th August	What is the effect of self-assessment on self-efficacy?	3. Lesson on self-assessment against criteria and schedules using comments and grades	Observation
29th August	What is the effect of self-assessment on self-efficacy?	3. Self-assessment against criteria and schedules using comments and grades	Observation Practice assessments Interviews
30th August	What is the effect of self-assessment on self-efficacy?	3. Self-assessment against criteria and schedules using comments and grades	Observation Interviews Practice assessments
31st August	What is the effect of self-assessment on self-efficacy?	3. Self-assessment against criteria and schedules using comments and grades	Questionnaire Interviews Return transcripts of interviews for checking

3.5.1 Intervention one: Worked examples (see Appendix A)

This lesson taught content with emphasis on working out problems using specific steps and specific setting out. I worked through examples on the board/smartboard showing students how to set out each step of each problem. Students copied the worked examples and used these as templates (see examples below) to generate feedback as they worked through other problems of the same type. They set out problems using the same pattern and steps of the worked examples. By referring to the worked example and comparing their problem they could ascertain whether they were following the pattern correctly and completing all the necessary steps. If their working matched the pattern of the examples this was an indicator that they were on track. If their working digressed from the pattern, they needed to adjust

what they were doing. This helped them recognise what they had done right, what they had done wrong, and what they needed to do to close learning gaps, which is feedback. Thus, the worked examples helped students to generate feedback and move forward in their learning. They could choose to use a different method but they needed to check with me to ensure the method was valid, and then use it in a similar manner to monitor their work. I taught this immediately after, and in the same lesson as, I administered the initial questionnaire.



3.5.2 Intervention two: Achievement criteria (see Appendix B)

Achievement criteria describe the specific, detailed, descriptive criteria that students are required to achieve to pass the standard. An example of this, taken from the NCEA achievement standard relating to the topic studied during the research, is:

> Find and use straightforward derivatives and integrals

with accompanying explanatory notes:

> Assessment will involve finding derivatives and integrals of expressions given in expanded form with terms that have natural number exponents (e.g. $3x^2+2x^2-5x+2$).

The second intervention taught students how to relate achievement criteria to specific assessment problems, which were taken from past NZQA[10] summative assessment papers and commercially produced tests made for use in school summative testing. I taught this lesson after students had a reasonable grasp of content. We looked at past assessments and linked individual problems with specific criteria. The following question, taken from the 2010 NZQA exam, was matched against the criteria given above:

> Another function *f* is given by $f(x) = 4x^3 - 3x^2 - 4x + 10$.
> Find the gradient of the graph of $f(x)$ at the point where $x = -2$.

Students used the skills learned from intervention one to work through and identify problems in terms of achievement criteria. I worked through each problem on the board immediately after students. This began during intervention two but the most significant evidence of student engagement in this practice occurred during the self-assessment lessons. Students spent time at the beginning and end of lessons relating criteria to problems to establish what they had already mastered and what they needed to learn to help them close the gaps.

3.5.3 Intervention three: Self-assessment using schedules (see Appendix C)

This lesson was at the end of the topic and involved students doing past assessments in exam conditions. At the end of the practice assessment, I marked the assessment marking from the assessment schedule one problem at a time while students monitored their papers and asked about variations or their answers. Assessment schedules were then passed out and students worked in pairs or individually, marking their papers using the schedule.[11] I moved around the class discussing what students were doing and giving advice as needed.

3.6 Methods of data gathering and analysis

The methods used in this research project derive from qualitative methodology, which is based on symbolic interactionism and constructivism. This put the focus on understanding

[10] The New Zealand Qualifications Authority (NZQA) administers NCEA and is responsible for ensuring that "New Zealand qualifications are valued as credible and robust both nationally and internationally" (Welcome to the NZQA website). These assessments were also used for the practice assessments.
[11] If they marked on their own they had to get a peer to check mark.

meaning from the participants' perspective. Questionnaires, interviews, observations, and practice assessments were used to gather data on each of the subquestions to give insight into students' perspectives and provide diversity of techniques, which helps to authenticate the research.

Data collection and analysis were designed to detect change in the form of improved self-efficacy and occurred concurrently as, for example, observations gave rise to insights and questionnaire information provided the basis for interviewee selection. This facilitated organising and sorting data and the identification of patterns and themes. The use of the computer table function supported transcription of interviews and the recording, sorting, and grouping of data from all sources.

3.6.1 Observations

Observation is fundamental to understanding culture, including the classroom culture, and essential in constructivism and symbolic interactionism (Blumer, 1969; Silverman, 1993). The advantages of observations include the preservation of the natural setting, a greater emphasis on depth, ecological validity, a holistic sense of the situation, and insight into the participants' perspective (Denscombe, 1998). The disadvantages include limited reliability in terms of repetition and lack of generalisability. The small scale of the study within the natural boundaries of a classroom of 14 students facilitated detailed description to provide a fuller narrative of classroom life (Berg, 2009; Mills, 2007). Field observation notes of conversations, practices, and connections between and among people were recorded with time and date (Berg, 2009). Informal observations are especially beneficial for recording overheard exchanges and comments, which are less likely to occur in the presence of a formal observer but are often more revealing. Field notes included questions students asked, levels of engagement, and attitudinal responses as they engaged with the intervention activities.

I conducted informal observations as participant observer during, and in the lessons immediately following, each of the interventions. I did not use a formal observation sheet but recorded descriptions of conversations, interactions, and events as they occurred in the classroom (see Appendix D). I was aware of my own beliefs and persona but allowed the descriptive process to be permeated and interpreted through my perspective. Observations helped identify changes in student behaviour and provided a context for, and different perspective on, the information provided in the interviews. Observations were used to gather

data on all three research subquestions and analysis was continued throughout the data collection process. I needed to interact with participants in the environment to be able to interpret patterns, interconnections, and themes from their perspective. This cannot be done without some form of dialogue (Crotty, 1998). This involved conversations during the informal observations in intervention lessons and the conversations that formed the interviews. Questionnaires, another form of dialogue, and interviews, described in the next two sections, are rich sources of data that require significant clarity of thought and effective questions and accomplish a similar purpose in attaining participant opinions, feelings, and perspectives.

3.6.2 Questionnaires

Questionnaires are an effective means of collecting large amounts of data in a relatively time-efficient manner and are a "good scientific technique" (Ezzy, 2002, p.81). They are an effective complement to both participant observation and interviews (Denzin & Lincoln, 1994). Questions related to learning in general, feedback, how people achieve high levels of competence, students understanding of their self-efficacy, achievement criteria, and the influence of self-assessment on self-efficacy, and included a variety of open and closed questions, rating scales, and a ranking question (Denscombe, 1998; Kemmis & McTaggart, 1988; Mills, 2007; Schmuck, 2006) (see Appendix E). Scales from 0 to 100 were used for students' self-efficacy judgements as these have been found to be more effective than smaller scales (Bandura, 1997).

The same questionnaire was used twice during the research. The first time it was conducted at the start of the first lesson that I was with the students, which included the first intervention. It was repeated at the end of the research. This provided a comparison of student beliefs and behaviour before the interventions with their beliefs and behaviour after interventions, especially with regard to changes in self-efficacy.

3.6.3 Semi-structured Interviews

Interviews, including semi-structured interviews, are focused encounters that give access to students' ideas and thoughts regarding their capabilities, expressed in their words and their ways of defining their world, and allow for deviation from the planned questions. Interviews

are compatible with symbolic interactionism and constructivism (Ezzy, 2002; Schmuck, 2006; Silverman, 1993). Interviews are similar in purpose to a questionnaire but avoid two potential obstacles for the student; students do not have to use the formal language of writing and they do not have to write their responses. One disadvantage is that students may say what they think the interviewer wants to hear. Bourke (2000) found interviews to be very effective for data gathering in schools. In this study interviews provided more in depth information, from the students' point of view, on all three research questions (Denscombe, 1998). [12]

Semi-structured interviews, using an interview schedule (see Appendix F), allowed flexibility and freedom to probe in response to student contributions and to adapt to, and encourage, fuller contributions to gain deeper insight (Berg, 2009). The interviews began with warm up questions on how students felt about how they were going in maths, how good they thought they were at maths, and why they thought this. Students were also asked to describe what had been happening during the research. They were then asked about the value of relating achievement criteria to assessment problems, the feedback from the practice tests, and marking from assessment schedules. The final questions related to self-efficacy.

Interviewees were selected on the basis of high, middle, and low self-efficacy, according to data from the first questionnaire and in response to the following questions:

> How strong is your sense of "can do it" when learning new things in maths? (q 15)
>
> How strong is your sense of "can do it" with regard to learning what you need to in maths this year? (q14)

Students had to choose between 0 (*lowest*) and 100 (*highest*). The students were then ranked in order from highest to lowest. Of the two students with the highest responses of 90 for q15, one attended only two of seven classes during research and the other was Sonny who had joined class late in the topic, so Tom and Nike, with the next highest ratings of 80 and 70 respectively, were chosen as high self-efficacy. Tom and Nike's responses to q14, which were used to support the placement of all students into a self-efficacy level on the basis on q15, were 60 and 90 respectively, putting Tom in the high-medium (H-M) category and Nike in the high-high (H-H) category. Middle and low self-efficacy students were chosen according to respective positions on the ranked list (see section 4.3.2 for more detail).

[12] Focus group interviews were considered but due to issues surrounding confidentiality in a small school and small community, and the influence of dominant personalities within the class, the risks outweighed potential gains.

Immediately following the interview, interviewees were given a blank copy of the interview schedule to fill in if they thought of anything after the interview that they wanted to add. Interviews were recorded and transcribed for accuracy. Transcripts were given to students to check and correct if necessary. The use of the computer table function and the sort facility helped to group, compare, and analyse responses for both questionnaires and the interviews.

3.6.4 Practice assessments

Practice assessments, completed following the interventions and marked by students from assessment schedules, were collected to monitor students' progress in applying the skills they acquired from the interventions (see Appendix G and H). As part of self-marking from schedules, students generated feedback by writing comments to themselves on specific skills they needed to work on to meet missed criteria (see Appendix G). The comments and results provide an alternate data source, which focused on revealing change in a practical sense by showing any improvements in students' generation of feedback, understanding of achievement criteria, and self-assessment skills as they practiced testing and self-assessing. This also added authenticity and credibility (Denscombe, 1998; Schmuck, 2006).

3.7 Ethical considerations

The initial step to ensure ethically sound research was an application to the Massey University Human Ethics Committee (MUHEC). Approval indicates that the study conforms to the Massey University Human Ethics Code of ethical conduct (see Appendix I). Included in the application were major ethical principles, which are now considered. The letter of request to the Board of Trustees included an information sheet, consent form (see Appendix J), and copies of all intervention lessons and data collection materials.

3.7.1 Respect for persons

"Respect for democracy, respect for truth and respect for persons" (Bassey, 1999, p. 73) provide the basis for all sound research, and include recognition for personal dignity, beliefs, privacy, and autonomy. Recognition for cultural and ethnic beliefs was important due to the

high Māori-Pacific roll. Special provision was made for this through an advisor (see section 3.7.6). Students had the right to choose to, or choose not to, participate and to withdraw at any time without giving a reason. The exercise of their rights had no impact on the teaching they received or on their grades. Assurances to this effect were given verbally and in information sheets (see Appendix K).

3.7.2 Minimisation of harm

Participation in research should not expose people to pain, stress, emotional distress, cultural dissonance, or any other kind of harm. Initially there was potential for students to experience embarrassment or emotional distress in the face of self-assessment. Due to my past involvement in the school (see section 3.7.5) and its small size, I had taught most students and was known by all. My reputation for fairness and honesty enabled students to feel more secure in expressing their opinions with less risk of negative consequences, such as me ridiculing them in class or during interviews or telling others what they said during the research. This provided a good foundation for an emotionally safe environment as did good relationships, which are strategic to academic, physical, and psychological well-being, and both supported written assurances given in information sheets (Bassey, 1999; Noffke, 1992).

This focus of the study, students assessing themselves against criteria and not against each other, and a supportive learning community within the classroom reduced social comparative and psychological risk. Informed voluntary consent was sought in the context of potential benefits to the students in their learning and achievement, which further supported participant safety.

3.7.3 Informed voluntary consent

Informed voluntary consent retains participant autonomy, is “central to research ethics” (Mills, 2007, p. 107), and involves competence, voluntarism, full information, and comprehension (Bourke, 2000). Students need to know they will not lose out academically as a result of participating in the research. Assurance that neither participation nor non-

participation would affect learning or grades was given to students, parents,[13] and teacher in comprehensive information sheets in appropriate lay language (see Appendices K, L, and M). Written consent was sought from these parties, received, and stored securely (Berg, 2009; Mills, 2007)(see Appendices N, O, and P). Separate consent was obtained from interviewees for the interviews (see Appendix Q).

3.7.4 Respect for privacy and confidentiality

When any research is conducted there is often a risk of a breach of confidentiality. An assurance of confidentiality and anonymity can only be given to the extent allowed by law (Mills, 2007). There was a clear expectation however, that all participants, including myself, treat any information shared through the research process with confidentiality. No information was collected without the knowledge of participants (which also ensured the avoidance of unnecessary deception). Good relationships, essential for action research, support confidentiality as they enable trust to undergird verbal assurances (Berg, 2009; Bourke, 2000). Non-identification of participants is ethically important and was achieved by the use of pseudonyms (Berg, 2009; Mills, 2007). Data was kept securely and confidentially throughout the research in my locked apartment in a swipe entry complex. Consent forms and collected data remain stored in a filing cabinet in a locked room with the supervisor, Dr Peter Rawlins. He will destroy these after five years.

3.7.5 Avoidance of conflict of interest

In the classroom environment, students are expected to conform. This authority structure creates a conflict of interest that must be addressed to ensure sound research (Denscombe, 1998). Added to this power dynamic was the conflict of interest caused by my employment in the school as Head of Department, which had the potential to affect students through fear of negative consequences as a result of their participation or non-participation, or modification of behaviour and responses to please or displease. As well as reassurance provided by good relationships, and in a further effort to reduce the conflict of interest, the specialist classroom teacher introduced the research and gave out information sheets and consent forms and

[13] Students were old enough that their consent was sufficient but parental consent was sought and gained as this was the preferred practice of the school.

answered any questions that arose. Study leave helped reduce conflict between research and teaching roles. Voluntary involvement and the students' right to withdraw, not answer questions, or withdraw answers to questions reduced the potential role conflict.

3.7.6 Social and cultural sensitivity

Sound research is sensitive to the perspectives and cultures of others (Mills, 2007). As the most recent Education Review Office report states regarding the students at this school "the majority… identify as New Zealand Māori or Pacific" (Education Review Office, 2009). I am of Māori descent and my previous involvement in the school meant I was familiar with the research environment. To support culturally and ethically appropriate research procedures the Principal of the school acted as advisor. He is Cook Islander and Māori, well-known, well respected, and a long established member of the local Cook Island and Māori communities.

3.7.7 Justice

Justice places responsibility on the researcher to ensure fair dispersal of the workload and gains of research. The participants received potential lifelong benefits as they learned to self-assess and enhanced their self-efficacy. Students had not been subject to over-researching and the selection process was not based on ethnicity, race, age, disability, religious affiliation, gender, sexual orientation, or beliefs. The principles of the Treaty of Waitangi were respected, with the help of the advisor (see section 3.6.7), and parental consent was obtained to ensure student and community interests were protected.

3.8 Data collection considerations

3.8.1 The researcher role

The researcher's role, which is determined by the research questions, is vital throughout the research process (Berg, 2009; Bourke, 2000; Mills, 2007). Teachers and researchers are often unaware of the effect of the theories and assumptions that underlie their practice (Elliot, 1994). The discrepancies between what they think they do, what they say they do, and what

they actually do have implications for action research (Gillham, 2000). I had to start with an open attitude and an awareness of my beliefs, philosophical and theoretical biases, interests, experience, and expertise (Berg, 2009; Denscombe, 1998). From that position, my task as researcher was to gain an understanding of students' perspectives on self-assessment and self-efficacy and to describe this clearly and accurately.

3.8.2 Validity and reliability

Validity ensures the research is measuring what it claims to be measuring, in this instance self-efficacy (Mills, 2007; Silverman, 1993). Reliability is the degree to which the study consistently measures what it is measuring (Berg, 2009; Silverman, 1993). In the case of action research the measuring is qualitative rather than quantitative and therefore meanings and descriptions must be accurately portrayed from the participants' perspectives to ensure validity and reliability. The question of whether the same data collection techniques would result in consistent data over time contributes to reliability and must be considered. However, as action research implies change, some variation in data would be expected and, in fact, adds to reliability and validity.

My personal involvement in the classroom put me in a position to record things as they happened, using detailed, accurate description of events and conversations. Another aspect of my presence in class that enhanced validity was the relative lack of interviewer effect.[14] Student familiarity with me and established good relationships encouraged normal behaviour to strengthen representativeness and validity, as well as ecological and relational ethics (Hipkins, 2006; Ministry of Education, 2007; Nuthall, 2007; Sewell & St. George, 2008). Good relationships are also vital for change to occur, which is the critical test of validity (Berg, 2009). Students were enthusiastic about putting into practice the new learning, which facilitated change adding validity. A positive change for students appears to have occurred as a result of the research (Mills, 2007).

[14] Interviewer effect is used to describe the way participants modify behaviour or answers to interview questions merely to please, or displease. This affects the accuracy of the research and may be more likely to occur with an unfamiliar person. In this study my past and future involvement in the school, established relationships, and student awareness of the need for honesty in the research process made this less likely to occur. However, it could not be discounted.

3.8.3 Triangulation

Triangulation is when data is collected from at least three different sources, or by at least three different people. The information is then used for crosschecking or validation of data. Along with detail and accuracy in descriptions, it increases the value of the methodology, validity, and reliability of data. The questionnaire, and its repetition, interviews, observations, and student assessments, provided multiple data sources for each research question to strengthen consistency and validity. Interviewees checking transcripts strengthened validity. Triangulation helped establish balance between subjectivity and objectivity and contributed to identifying strengths and weaknesses of observed patterns and connections to help develop insight, theories, and explanations (Mills, 2007; Poskitt, 1994). It reduced the possibility and influence of random and methodological error to add to validity and reliability, and highlighted inconsistencies (Mills, 2007; Poskitt, 1994). Triangulation, thorough attention to related research, detailed and accurate descriptions, self and collaborative reflection, dialogue among participants and with teachers outside the research setting, helped minimise the impact of my assumptions and beliefs (Foulger, 2010; Gillham, 2000).

3.9 Summary

This chapter has provided a description of and justification for the theoretical basis of the study. Constructivism is the foundational epistemology, which undergirds and informs symbolic interactionism as a specific branch of interpretivism. This supports action research as the most suitable qualitative methodology for this study. Ethical considerations included the high proportion of Māori and Pacific students in the school and provision to ensure, as far as legally possible, the rights of all participants. Attention has been given to issues of validity and reliability. The data collection tools have been described as have the intervention lessons. The next chapter will provide a detailed description of the findings of the study.

CHAPTER FOUR

Findings

A man who doubts himself is like a man who would enlist in the ranks of his enemies and bear arms against himself. He makes his failure certain by himself being the first person to be convinced of it

Alexandre Dumas, fils

4.0 Introduction

This project investigated the question

- What effect does students' self-assessment have on their self-efficacy?

This involved three subquestions

- What role does feedback play in students' ability to self-assess?
- What role does understanding problems in terms of achievement criteria play in students' ability to self-assess?
- What is the effect of self-assessment on self-efficacy?

This chapter presents the information collected from questionnaires, interviews, observations, and practice assessments in a year 12 mathematics class in a New Zealand urban secondary school. The data analysis has revealed specific information on feedback, achievement criteria, and self-assessment, and the contributions students perceive these make to their learning and self-efficacy.

When students completed the first questionnaire they were given the opportunity to choose a pseudonym[15] to enable confidentiality to be maintained. This was a good way to increase their enthusiasm for the research and a good opportunity to explain the research process.

Throughout the remainder of this thesis codes are used for the various data collection tools.

Q1 refers to the first questionnaire given on the first day of the research

Q2 refers to the second questionnaire given on the final day of the research

[15] Sonny joined the class half way through the research and I picked his pseudonym.

` q1, q2, q3 etc. refer to questions in the questionnaires

Iq1, iq2 iq3 etc. refer to questions from the interviews.

Student comments are italicised and questions from the questionnaires and interviews are underlined.

4.1 The role of feedback in student self-assessment

Feedback is a key aspect of effective learning (Hattie, 2009; Sadler; 1989). Feedback is normally understood to be given by one person, who acts as the assessor, to another person who is being assessed. In this study, feedback and self-assessment work together as one person undertakes both roles. Self-assessment, as defined for this study (see section 1.5), is students involved in making self-judgements regarding the degree to which criteria have been met, setting learning goals in terms of those criteria, and evaluating their learning content. Students generate feedback for themselves to make judgements about and evaluate how well they have done in practice assessments, what they know, what they need to learn, and how they will close gaps in their learning. Students then work on setting learning goals and closing gaps before completing the next practice test, which is the next opportunity for self-assessment. Therefore, the role of feedback in self-assessment appears to be a crucial one as it enables students to evaluate their learning content, identify what they know in terms of criteria, and what they need to learn to meet those criteria.

Consequently, one of the key questions that this project sought to investigate was what role does feedback play in students' ability to self-assess? Information on feedback was collected from the questionnaires (q4-9, q16, and q20), interviews (iq7), observations, and assessment papers.

4.1.1 Sources of feedback

Feedback comes from a variety of sources. It can come from teachers and peers or be self-generated by, for example, assessments and comparison of work with worked examples and achievement criteria. Although all students in this study were definite about the importance of feedback and most got feedback when learning (q7), most saw their primary source of feedback as the teacher. Three of the 12 students who completed the first questionnaire added peers, family, and friends as other sources. The responses were the same in the second

questionnaire. Some students referred to the teacher's role in giving verbal encouragement, one to the teacher's belief in the students' ability to succeed, and others referred to information on the accuracy of their process and answers.

During the lesson on worked examples, which was intended to support students in generating feedback, students responded positively using the given worked examples as a comparison for their work to establish what they were doing right, what they were doing wrong, and how they could improve. In the subsequent lesson the classroom teacher omitted one of the steps when he worked through an example on the board. When he suggested putting in the extra step (one we had used in the intervention lesson) to clarify the process, several students responded with such comments as *yeah, that's better.*[16] Field notes were made during this lesson.

> One student, Saloma, is constantly referring to the worked examples… as she works through problems… Beaver is teaching The Hulk, who was absent yesterday [during the lesson on worked examples], using the worked examples/models method…[17] (see Appendix K).

In the questionnaire students were asked <u>do you think you can get feedback for yourself from your own work?</u> (q8). Seven gave a clear *yes* answer, one replied with a definite *no* and the remainder were unsure, with responses such as; *I guess you can*; *perhaps, if you knew what to look for*; and *teachers help by pointing those things out.* Responses were similar in Q2, although The Hulk's *I suppose* in Q1 became a definite *yes* in Q2. The uncertainty indicated by almost half of the research cohort in reply to q8 is in contrast to both the fact that all responded to q9, <u>if you answered yes to question 8, what are some of the ways you might be able to get feedback for yourself from you own work?</u>**,** and the actual responses. In Q1 Ana's response *proof reading stategising notes reading out loud* and Ben's *going through my own work and seeing where I am going wrong* are typical of those who had answered *yes* to the previous question and imply self-generated feedback. The Hulk, who had answered *maybe* to the previous question, replied *you can correct mistakes you find or improve your answers.* Nike, who had replied *I guess you can* to <u>do you think</u> <u>you can get feedback for yourself from your own work?</u> (q8), seemed more definite in response to <u>what are some of the ways you might be able to get feedback for yourself from you own work?</u> (q9)

[16] This was feedback in a different role, students to teacher, which is as valuable to the teacher for improvement as teacher feedback to students.
[17] This was in spite of the classroom teacher not referring to the lesson on worked examples at all.

Stuff like you know you don't know something so that's telling you that you need to do more work. If you've passed everything it means that your feedback is positive and shows your hard work.

Question seven in the interviews focused on feedback that students had written themselves: which is most helpful for giving yourself feedback on practice assessments? Ticks and crosses only, grades only (A,M,E), comments on what to do to improve…other? Five of the seven students referred to the comments they wrote to themselves.

Ana: *what I… like the comment on what I have to do to improve to get a better result or a better… um understanding of what…where I went wrong*

Tom: *probably the comments to show you what you need to work on*

Bob*: comments I write for myself, coz I know what to work on… how to do it…for the next time I do it*

Brian: *working on the marking schedule if I notice something is off I will write comments and when I look back at it I will remember that's what I did wrong and see what I have to do*

Saloma: *um…getting the questions right… and writing comments beside it*

During observations and from students' practice assessments it was apparent that students had written clear and specific comments or instructions to themselves with regard to what they had to work on to improve (see Appendix P). These written comments included

Saloma: *what I did wrong in this problem is I forgot the dy/dx but I got the right answer… I need to know how to do this… I need to work on this problem over and over until I get it*

Brian: *when integrating you don't x f/out number![18] It stays as it is*

Nike: *message to myself; must practise finding the equation of the curve and x coordinates when gradient is given. Integrating and when to use +c*

Students also valued the instant and direct feedback they got from self-marking practice tests in the same period as, and immediately following, sitting the test in exam conditions. In response to how important do you think it is to be able to self-assess in order to learn what you need to learn to reach your learning goals?(iq11)

[18] Although this note may not make sense to some mathematicians, it was correct as this student understood it and explained it to me. This self-comment made sense for her, which is the point of self-comments. A teacher's comment may not have been as effective for the student.

Beaver: *Um yeah I think it's important coz then you can understand how good you are doing for yourself coz normally when we get tested we have to wait for a couple of weeks to get the results and we don't know what we can improve on in that time*

This comment indicates the importance of students' understanding how they are progressing in their learning, the contribution that this makes to improving learning, and the importance of immediate feedback.

4.1.2 Student perceptions of feedback

In the current study, students perceived that feedback, whether it was from a teacher, a peer or something they had generated themselves, made a positive contribution to their learning. Students were asked a number of questions to ascertain their perceptions of feedback. In response to do you think that feedback helps you to learn? Why or why not? (q4), all students answered *yes* on both questionnaires, with one stressing *definitely* on the second. Bob added the explanation that *with feedback I figure out what I can improve on if nessasary.*

Reynor: *helpful to understand your strengths and weaknesses* (Q1)

Reynor: *helps you to understand where and what you got right and wrong* (Q2)

Tom: *it shows what you are weak in so that you can improve on it* (Q1)

Brian: *it helps reinforce to me what I am doing right and what I need to work on to correct mistakes* (Q1)

The Hulk: *to get a better understanding of your work…* (Q1)

The Hulk: *so I can fix whatever I was told to fix* (Q2)

Question five asked do you want to get feedback when you are learning? Why or why not? Again all students replied in the affirmative in both questionnaires. In Q1, Beaver supported her response with *it helps me understand more* and then abbreviated this to *it helps me* in Q2. Other explanations were made to support affirmative responses:

Saloma: *because then I will know that I'm learning something* (Q1)

Saloma: *so that I can do what I did wrong and what I did right* (Q2)

Tom: *so that you know if you are on the right track* (Q1)

The Hulk: *so I know what I need to improve* (Q1)

The Hulk: *so that I can fix what I was told to fix* (Q2)

For most students' Q2 responses were more specific than Q1 for questions four and five.

Question six asked do you get feedback when you are learning, (as opposed to did they want to get feedback in the earlier question), Reynor replied *not really, but prefer to receive more feedback* in Q1. In Q2 his reply was *regularly.* Tom's *yea sort of* in Q1 became a definite *yes* in Q2. All but one student answered in the affirmative that they got feedback when they were learning.

Student responses to how good are you at seeking out and getting feedback on learning? (q16) on a scale of 0 (*lowest*) to 100 (*highest*), either stayed the same from Q1 to Q2, decreased, or marginally increased. The average rating remained the same at approximately 58. There was no pattern or trend emerging (see Figure 4.1).

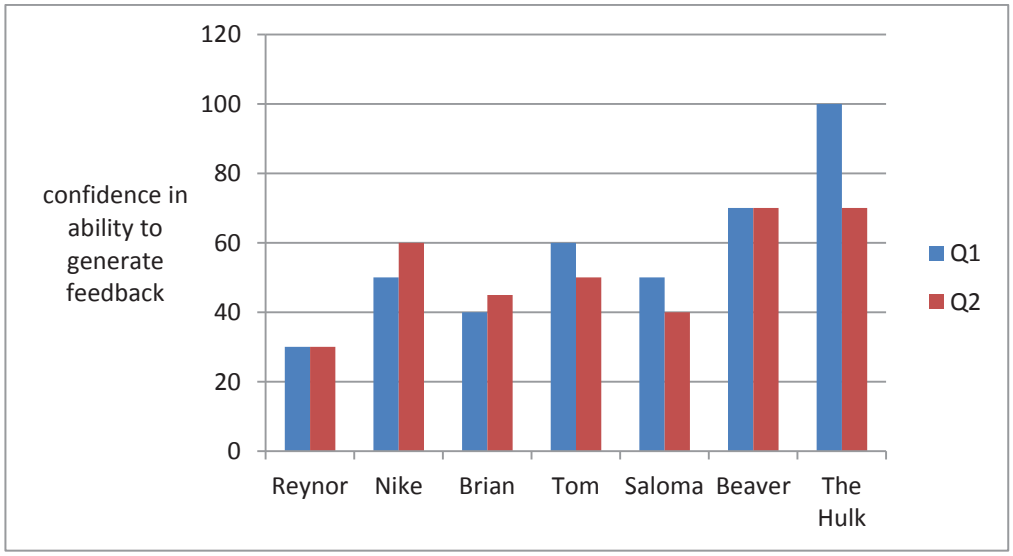


Figure 4.1 Confidence in ability to generate feedback from student responses to rating question 16 (rating from 0-100, 100 being highest)

Related to this was the ranking question, q20, in which ten options were given and students ranked these in order of importance for strengthening their sense of can do it in maths, with the lowest score being the most preferred option (see Figure 4.2). Students did not seem to enjoy this question, or find it easy to complete, with two students ignoring it on the second

questionnaire. Two of these ranking options related specifically to feedback generated by students for themselves; you purposefully seek out feedback from practice tests and you purposefully seek out feedback from normal classroom work. Students seemed to place less importance on seeking out feedback in Q2 compared to Q1. Average rankings for both feedback options increased (the higher ranking indicating students thought it less important). Due to the limited number of students completing both questionnaires and the contradictory data from other data sources, it would be unwise to base any conclusions on this change.

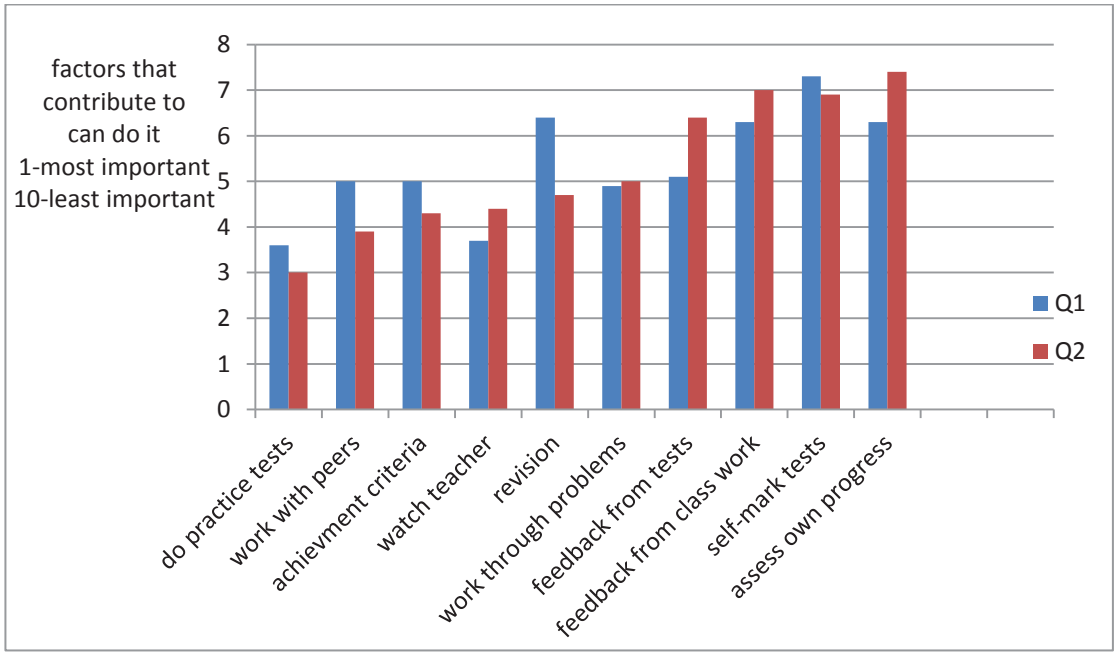


Figure 4.2 Factors that contribute to can do it in maths. In q20, students ranked ten options according to importance for contributing to can do it in maths (1-most important 10-least important)

All students in this study valued feedback for their learning, and most students generated feedback for themselves when learning. However, some of the students who got feedback described themselves as not very good at generating feedback.

4.2 The role of achievement criteria in student self-assessment

Achievement criteria play a significant part in NCEA standards and a vital role in assessment in most New Zealand secondary schools. However, the degree to which students are aware of these criteria varies between schools and between subjects and classes within schools. Data on students' perceptions of the value of achievement criteria was collected from the ranking

question (q20) in the questionnaires, the interviews (iq5 and iq6), observations, and the practice assessments.

Students' perceptions have a significant impact on how they respond to their learning environment and aspects within that environment. If they perceive something is of value they are likely to behave positively toward it. If they do not see something as valuable they are less likely to behave positively toward it, and therefore less likely to receive any benefit from it. Students in this study were positive about the role of achievement criteria in supporting their learning and their ability to self-assess. They felt that understanding the achievement criteria helped them identify what was required of them and what they needed to focus on, as well as helping them in the process of self-assessment. Their positive perceptions helped them to receive benefit from the process of relating achievement criteria to assessment problems.

In the interviews, four of the seven students responded affirmatively to did the lesson on relating achievement criteria to assessment problems help you to learn? (iq5). I realised after the initial three interviews that asking the question specifically in terms of the lesson on achievement criteria was misleading or at the very least restrictive. A lot of the work of relating problems to achievement criteria had taken place in the self-assessment lessons. At the beginning of the self-assessment lessons, students revisited the achievement criteria to identify the ones they already knew and what problems they needed to revise in order to achieve another criterion in the practice test in class that day. They repeated this process after marking their tests at the end of the lesson. After I adjusted the interview question, adding how did it help to relate specific assessment problems to achievement criteria before and after practice tests? all students responded positively.

Informal classroom observations of lessons in which students completed a practice test and self-marked from schedules recorded that students were focused and engaged in the process of identifying the problems they had mastered with specific achievement criteria. Prior to each practice test, and again immediately after marking from schedules, students identified what they needed to work on to improve for the next test and spent time mastering that particular achievement criterion. Field notes were recorded during these observations (see Appendix K).

> Students also working well together to help each other identify achievement criteria with specific problems and mastering how to do those problems.
>
> After marking from schedules, students once again focused on and very engaged in identifying what they can do in terms of achievement criteria and also what achievement criteria they will

work on for tomorrows test. A lot of peer tutoring is taking place at this stage as students work on filling the gaps in their learning. Students also using previous practice tests to revisit and work on same types of problems they are currently working on to cover learning gaps.

Iq5 did the lesson on relating achievement criteria to assessment problems help you to learn? was built on by iq6 if you answered yes to question five how did it help you to learn?

Brian: *coz often the words they say might turn up in the assessment… the words they use to describe problems… their English is quite hard to understand what they mean*

Bob: *coz I know what to focus on… what to work on*

Nike: *coz you know what you have to do*

It is interesting to note that one student, when asked to describe what you have been doing differently in this particular topic? (iq4) replied specifically in terms of the achievement criteria:

Bob: *we've been doing self-assessment we check what we know against criteria and I find that a lot easier to do…*

More data about achievement criteria was collected from the ranking question in the two questionnaires. You work through problems and relate them to achievement criteria was one of the options in q20.[19] Two students considered working through problems and relating them to achievement criteria more important for building their self-efficacy in the second questionnaire, which followed the interventions (see Figure 4.3). The other students thought it less important, but still ranked it relatively important with only two ranking it above five (a lower ranking indicating more importance). This is supported by responses to the interviews, the observations, and the students' comments on their assessment papers.

[19] Six students completed this question on both questionnaires. Sonny was the seventh student to complete this question in both questionnaires but his replies have not been included in the collated rankings as he joined the class part way through the research.

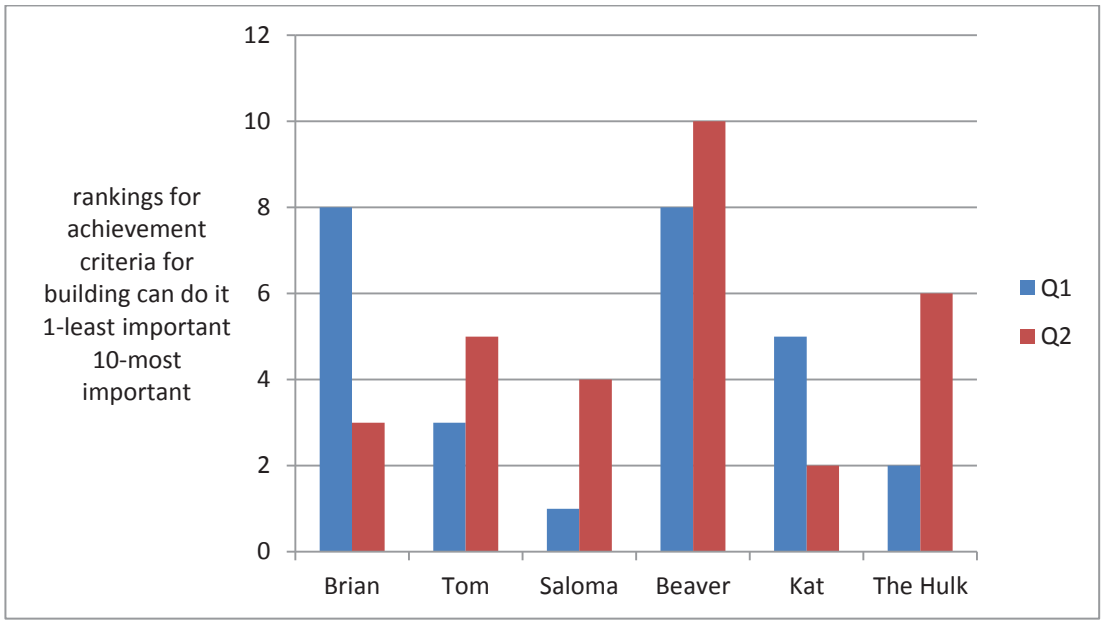


Figure 4.3 Student rankings for relating achievement criteria to problems for building can do it in maths from responses to q20 (1-most important 10-least important)

In summary, this study found that when students understood the achievement criteria in terms of assessment problems it helped them to self-assess. Generating feedback and relating achievement criteria to specific problems provided foundational tools and skills for self-assessment.

4.3 Self-assessment and self-efficacy

Self-efficacy is concerned with beliefs about one's ability to perform a task or act in a way to accomplish a goal. Beliefs about oneself cannot be formed without some form of self-judgement or self-assessment, and thus self-assessment is an inherent part of self-efficacy. At times such self-assessment is informal and unreliable and at other times it is more formal. Whatever form it takes, self-assessment plays an important role in self-efficacy and thus warrants specific consideration. The third subquestion that this study sought to examine is

- What is the effect of self-assessment on self-efficacy?

Information on self-assessment was collected from questionnaires (q8-11, q17, and q20), observations, interviews (iq8), and practice assessments. Information on self-efficacy, and

self-assessment as it relates to self-efficacy, was collected from questionnaires (q10-15, q18-20), interviews (iq1-3, iq9, and iq12), observations, and practice assessment papers.

4.3.1 Student perceptions of self-assessment

Self-assessment is by definition an intrinsic part of self-efficacy. However, the way students view self-assessment, and their beliefs about it, will influence the way it actually impacts on their self-efficacy. In response to describe what you have been doing differently in this particular topic (q4) interviewees had varying perspectives, but these were all positive.

> Nike: *we have been going over things a lot more so we understand it… like with those practice tests… repeating… it's repetitive so like its kinda locking into my memory kinda thing…that's how I feel… I'm doing it over and over and I'm understanding it more so I don't just do it and then forget it*
>
> Brian: *we were shown how to look at what will actually be in the test and what we need for certain grades and compare that to actual problems… that helped a lot*
>
> Bob: *we've been doing self-assessment we check what we know against criteria and I find that a lot easier to do…yeah*
>
> Ana: *we've been going through it slowly and if we don't know it we can ask you for help… um and it's like we are all at our different stages but you have time for each and every one of us…* (Interviewer: like whatever stage you are at…?) *Yeah and you push us to do more… like you push us to do that extra*

In the questionnaires, scales from 0 (*lowest*) to 100 (*highest*) were used for questions in which students had to rate their sense of can do it, confidence, ability, and how much they thought self-assessment had boosted their sense of can do it. Responses to how confident are you that you can accurately assess your own progress in maths? (q17) ranged from 30 to 70 in Q1 and from 40 to 70 in Q2 with an average response of 46.3 and 52.5 respectively (see Figure 4.4). Of the eight students who completed this question in both questionnaires; Beaver increased from 20 to 60, a 200% increase; Saloma from 30 to 40; Brian from 40 to 60; and Tom from 50 to 70. Of the remaining four students, Kat decreased from 70 to 40, Reynor decreased from 50 to 40, and Nike and The Hulk remained the same.

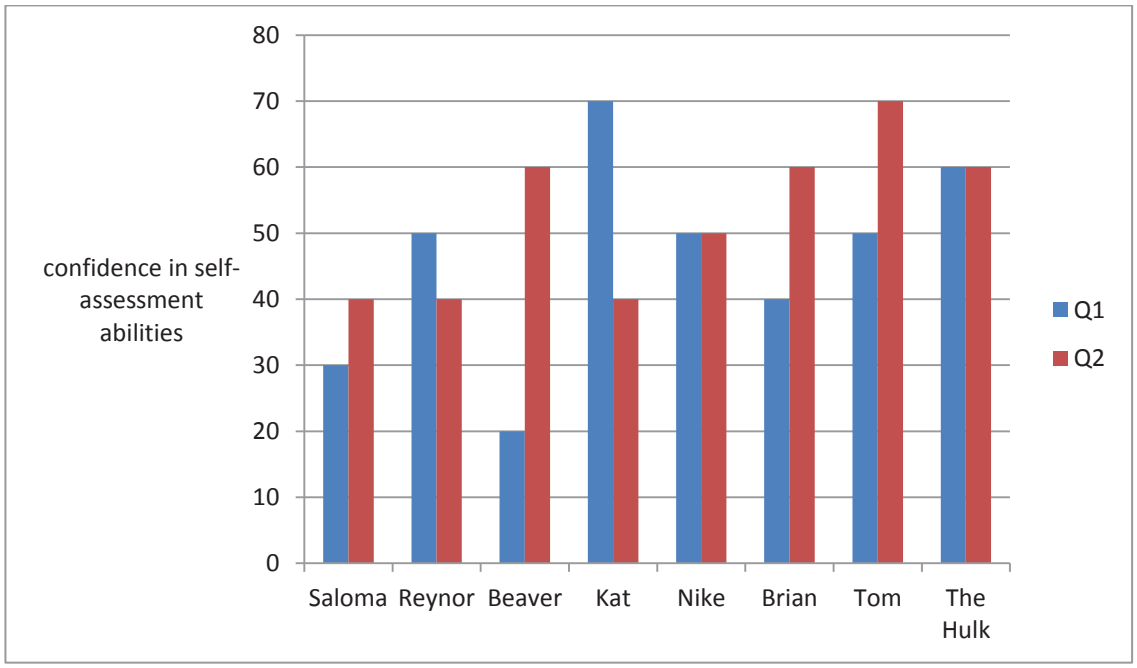


Figure 4.4 Confidence in self-assessment abilities from student responses to rating question 17 (rating from 0-100, 100 being highest)

In response to iq11 How important do you think it is to be able to self-assess in order to learn what you need to reach your learning goals?, five of the seven replied positively (two made no comment).

> Nike: *veeery important*
>
> Brain: *I've never used this self-assessment that we've been doing lately but in this topic it's shown…it's really quite helpful…I've done a lot in a short space of time*
>
> Beaver: *um yeah I think it's important coz then you can understand how good you are doing for yourself coz normally when we get tested we have to wait a couple of weeks for results and we don't know what we can improve on in that time*

In q20, two students gave a higher ranking to assessing their own progress in Q2, which meant they thought it was less important for their self-efficacy, one kept the same ranking, and three gave it a lower ranking to indicate they thought it was more important (see Figure 4.5 and also Figure 4.2).

Overall, students perceived self-assessment to be important for their sense of can do it in maths. Although the rating question revealed no clear pattern, most students gave it a higher rating following the interventions.

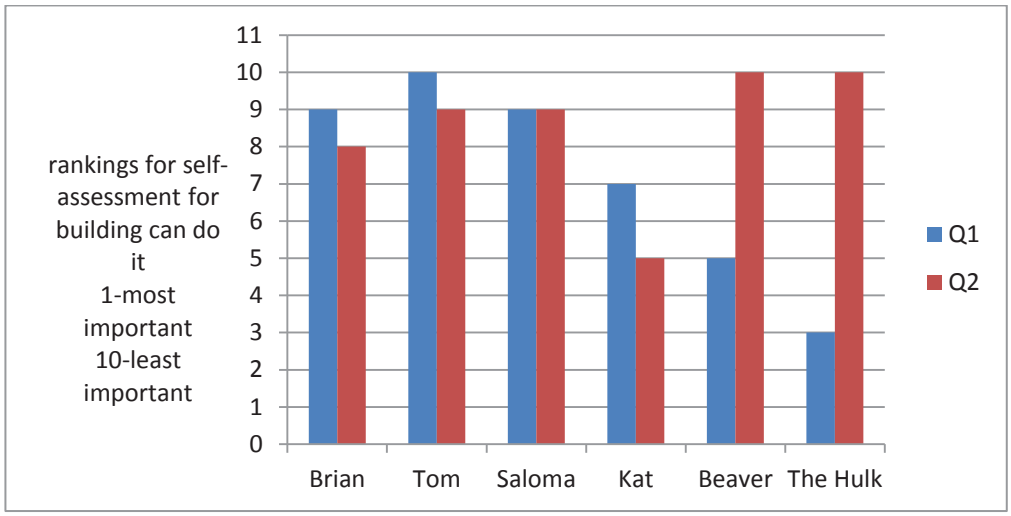


Figure 4.5 Student rankings for self-assessment for building can do it in maths from responses to q20 (1-most important 10-least important)

4.3.2 Student perceptions of self-efficacy

The way students see their capabilities influences their attitude, behaviour, and performance. Students' beliefs about what contributes to the development of those capabilities will influence learning behaviour. Questions 10 to 15 of the questionnaires, along with some of the interview questions (iq9, iq12), provided specific information on self-efficacy.

Responses to q10 thinking of one thing that you do that you know you are good at, what is it that makes you feel that you can do it and be successful at it? in Q1 included

> Brian: *recalling past success and experience…*
>
> Bob: *because I am good at it and it gives me confidence*
>
> Beaver: *because it's fun and I'm confident in it*
>
> Ana: *…I feel I can be successful at it because I spend a lot of time on it*

Tom replied *courage* in Q1 and changed this to *getting the correct answer* in Q2. Two students referred to being able to do something *with ease* as the can do it feel good factor in Q2. Two others referred to interest and enjoyment.

In response to how do you think people get good at something? (q11) in Q1, all students referred to *practice.* Bob added *confidence* and The Hulk included *motivation… willpower…* This emphasis recurred in Q2. The more specific question do you think you are good at maths?

Yes, no, or not sure? (q12) in Q1 received five *yes* replies, three *no* replies, and five *not sure*. The emphasis shifted slightly with one *no* and an equal number *yes* and *not sure* responses in Q2. The next question asked what helps/makes students feel good/not good at maths? (q13).

> Sonny: *my grades, just thinking I am good*
>
> Tom: *getting correct answers and understanding the problem*
>
> Ana: *I am able to work out other strategies I can use other than the ones provided*
>
> Kat: *… it all depends on what area of maths it is*

This final comment, indicating that self-efficacy is not only domain-specific but also topic specific, is echoed in Nike's answer to q12; *I have my strengths in different areas.*

Questions 14 and 15 relate specifically to students sense of can do it in maths.

> How strong is your sense of "can do it" when learning new things in maths?
>
> How strong is your sense of "can do it" with regard to learning what you need to in maths this year?

The average rating rose on both of these questions between Q1 and Q2, with an increase in q14 from 56.3 to 65[20] and a slightly larger increase for q15 from 56.3 to 66.9 (see Figure 4.6).

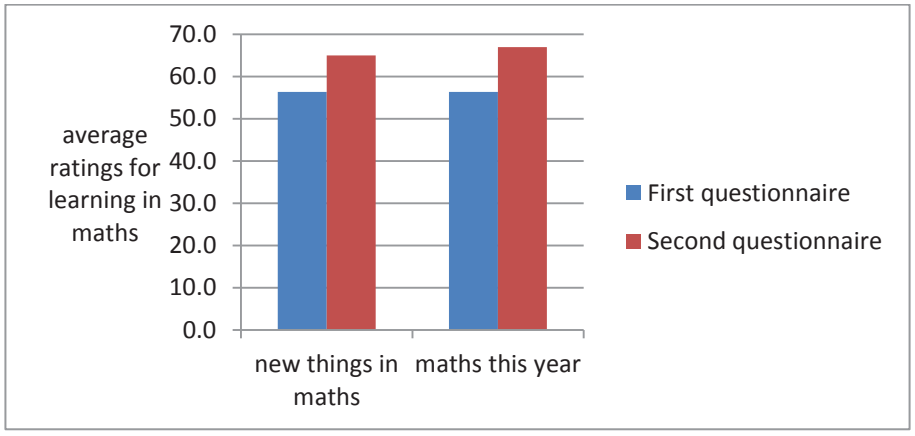


Figure 4.6 Average self-efficacy ratings for learning new things in maths and learning maths this year from responses to questions 14 and 15 on the questionnaires

[20] This is using only the 8 students who completed both questionnaires. If all 13 who completed Q1 are included this number for Q1 reduces to 54.2. The ratings of the four absent for Q2 were 30, 40, 45 and 50.

Individual changes for q14 and q15 are given in Table 4.1. Of note is the 200% increase in Saloma's rating from 20 to 60 in q15 and the decrease in rating by 10 for Tom and Kat. These changes in self-efficacy resulted in self-efficacy beliefs that were more accurate in terms of past performances and performances on practice assessments.

Table 4.1 Student self-efficacy ratings for learning new things in maths and learning maths this year

Student	New things Q1 q14	New things Q2 q14	This year Q1 q15	This year Q2 q15	Attendance[21]
Beaver	50	60	50	70	5/7
Saloma	30	40	20	60	7/7
Brian	70	70	60	70	5/7
Tom	60	70	80	70	5/7
Reynor	30	40	40	40	5/7
Nike	90	90	70	90	6/7
Kat	50	50	60	50	6/7
The Hulk	70	85	70	85	4/7

Interviewees were selected from the information provided in the first questionnaire in response to q15 and q14. The two highest responses of 90 on Q1 were from a student who attended only two of seven classes during research and from Sonny who had joined class late in the topic, so the next two highest responses, ratings of 80 and 70 from Tom and Nike respectively, were chosen as high self-efficacy. 70 and above was classified as high, below 70 and above 39 was classified medium, and 39 and below was classified as low self-efficacy. All students were given a self-efficacy level on the basis of their responses to q15. Responses to q14 were used to support this placement. For example, Tom's ratings for the two questions were 80 and 60 putting him in the high-medium (H-M) category and Nike's were 70 and 90 putting her in the high-high (H-H) category (see Table 4.2 for the self-efficacy ratings of the interviewees).

[21] This fraction refers to attendance during 7 lessons of interventions and data collection. Average attendance for all 14 students on the roll was 4.8 lessons out of 7 with one student attending once and another twice. Data from these two students was not used in the research.

Table 4.2 Self-efficacy levels for interviewees learning in maths

Student	This year	New things	Self-efficacy category
Nike	70	90	H-H
Tom	80	60	H-M
Brian	60	70	M-H
Ana	62	45	M-M
Beaver	50	45	M-M
Bob	30	30	L-L
Saloma	20	30	L-L

The first three interview questions addressed students' feelings about maths, how good they thought they were, and what contributed to them feeling this way.

> Nike (H-H): *um I feel like it's a must/need for my future… like physics, if I want to carry on with physics then I really need mathematics for future jobs and stuff…there is always room for improvement but I think I'm not too shabby. I'm not where I want to be… I'm understanding the maths that I'm being given… like um getting answers right and stuff*
>
> Tom (H-M): *pretty good I guess… alright… 65*

This compares to Tom's ratings for q15 of 80 in Q1 and 70 in Q2.

> Brian (M-H): *confident enough learning new things but unless they're repeated I forget them nearly straight away… if I do manage to remember things I'm pretty confident… 75*

This rating of 75 compares with 60 in Q1 and 70 in Q2. Q2 was completed the same day as the interview.

> Brian (M-H): *if I know a topic is coming up I will go back and revise because I will have completely forgotten it by then and just that revision keeps me confident about whether or not I can do it*

The interviews were near the end of the research and both Ana (M-M) and Saloma (L-L) rated themselves more highly in the interview, 74 and 50 respectively, than in Q1 (62 and 20). Saloma rated herself 60 in Q2, which was completed the same day as her interview. Ana based her rating of 74 (the same rating for the interview and for Q2) on the effort she put into study.

Saloma (L-L): *some of the work I know and some of the work I don't know…some of the work I can do and some of the work I can't… I can't work it out*

Beaver (M-M): *I feel confident sometimes… I feel like I could do better…. You know if I listened …um like 70…could be more like 90… if I listen more*

Beaver had rated self-efficacy at 50 on q15 in Q1 and, the day following her interview, rated 70 (the same as the interview rating) on the same question in Q2.

Bob (L-L): *not very confident at it… but I can do some of the things that I need to do…ah… half decent at it… there's still things I need to grasp*

Iq9 asked students <u>how would you rate your sense of can do it for this topic</u>? They were not asked to use a numerical scale to do this, but most of them did. This probably stems from the rating questions in Q1 in which they were asked to use a numerical scale to rate themselves. This is interesting because, although the interview was several weeks after Q1, students were thinking in terms of rating themselves in this way. Students are listed here in descending order of self-efficacy.

Nike: *not being too cocky but it's probably like 90 if I put the effort in*

Tom: *alright… quite high…it's got up higher*

Brian: *around 60 or 70 coz I have missed quite a few lessons. If I hadn't missed lessons I believe that I would be 80%*

Beaver: *um 60* (Interviewer: what would you have rated it before, say two weeks ago, before we stared doing what we are doing?) *10 coz I didn't get how they get it*

Bob: *for this topic… probably 5 out of 10*

Saloma: *60* (Interviewer: is that higher than you would normally put?) *yeah yeah* (what would you normally put?) *40*

The final question on the interview (iq12) gave students an opportunity to identify any other things that <u>helped you feel better at maths</u>**.** Beaver and Ana referred to the level of engagement:

Beaver: *um when I um start asking questions. Sometimes I just sit there and can't be bothered. In maths coz I like maths coz calculus is interesting and I just want to ask questions so I can get it*

Ana: *like how we all participate in answering the questions and helping each other to understand and like it's not just a one on conversation it's more like a group it like helps everyone understand not just the one person… It's a different person teaching us… like the period seems longer and I am getting through more and more each day*

Two students referred to the process of marking their practice tests using assessment schedules in terms of helping them to see what they could achieve.

Brian: *coming up to the normal test in the past I would have thought ok this is a topic I need to know everything for it whereas now I can look and see exactly what I need for it and your technique of working one problem at a time until you've got it before moving on and improving slowly that helps*

Nike: *like doing the tests and achieving them or getting merit in them… it shows you can do it*

4.3.3 The effect of self-assessment on self-efficacy

Strategy training is a form of guided mastery that has the potential to increase students' self-efficacy (Eisenberger et al., 2005; Jackson 2002). Equipping students with self-assessment skills is a form of strategy training and thus has the potential to increase self-efficacy.

q18 asked students to rank, on a scale from 0 (*lowest*) to 100 (*highest*), <u>how much do you think marking your own practice test papers from assessments schedules would help/helps your confidence to succeed in maths?</u> Kat decreased from 80 to 50 from Q1 to Q2. Most increased their rating. The ratings, between 50 and 100, were at the higher end of the scale for both questionnaires with the average rating of 65 the same for Q1 and Q2. Nike did not complete this question in Q2 (see Figure 4.7).

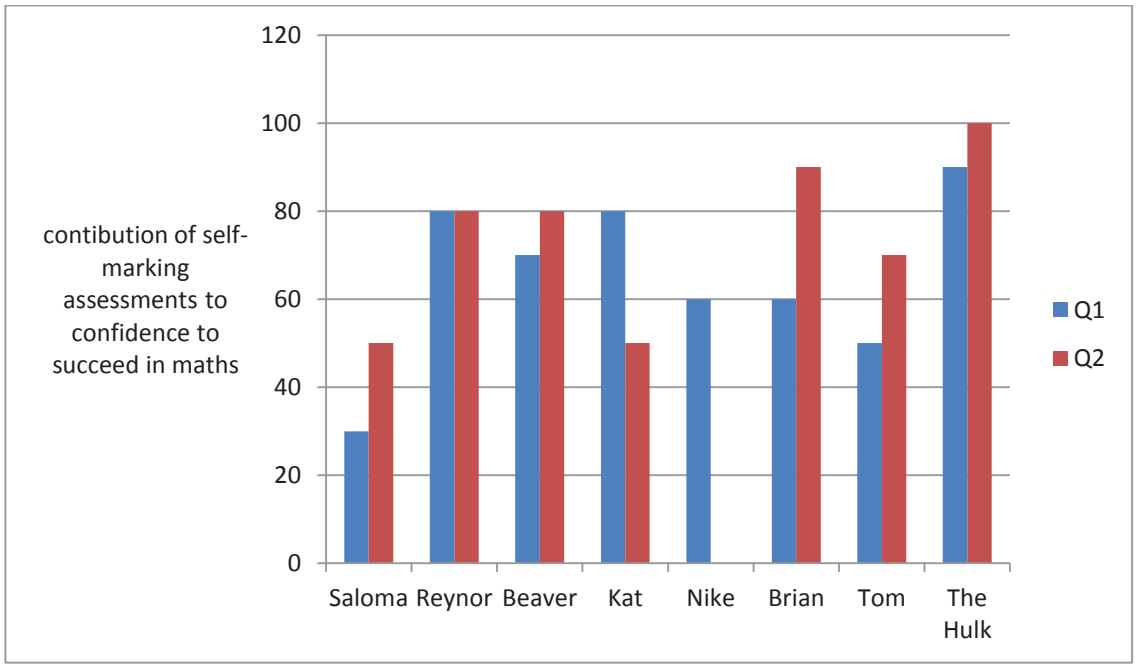


Figure 4.7 Contribution of self-marking assessments to confidence to succeed in maths from student responses to rating question 18 (rating from 0-100, 100 being highest)

The same question was asked in the interviews but with reference to the specific topic rather than maths as a whole subject. How much do you think assessing your own practice assessments using assessment schedules helps this (their sense of can do it for this topic)? (iq10). All students thought that it helped. Saloma was the least enthusiastic saying *helped a bit*. However, others felt it played a more significant role:

> Beaver: *played a big part coz like how in class we focus on the question then when I go home I try to do some of the ones I know then go on to the ones I don't know then when I come to school its cool coz then I go back on to the assessments and try to do it*
>
> Nike: *90%... a big help*
>
> Bob: *helps quite a lot coz you compare what I did before doing the self-assessment I struggled… then with the self-assessment I know what to work on to get to achieved, merit or excellence*
>
> Brian: *it does help coz I can see whether or not I'm making the same mistakes and if I'm improving and also points out what I need to work on so I'm not sort of… what is… what is… floating around in the darkness …* (interviewer: floundering around in the darkness?) *Yes*

These positive responses were supported by answers to iq8, how does marking your own practice assessments using assessment schedules help you, if at all?

Nike: *oh um… it helps me heaps um it's letting me know what I'm doing wrong and I'm doing well in… areas… yeah… I think it's… it's a great way for me to learn*

Nike, who had given a rating of 60 in Q1 and had not given a rating for q18 in Q2, was not the only student to respond enthusiastically to iq8.

Beaver: *um helped me to be more confident in myself coz I know what I can gain and work out what I need to learn*

Ana: *um its good coz then you can go through it by yourself and like see where you went wrong or see that you did what it asked you to do properly coz instead of the teacher trying to tell you how you went wrong [and you're] kinda blank*

Saloma and Bob made similar comments to Tom's, which was *pretty good, quite helpful*. In q20 students had to rank options in terms of their importance for building their sense of can do it in maths. Responses to you mark your own tests using assessment schedules showed no clear pattern. Two of the six students who completed this question both times improved the ranking, two lowered it and two remained the same (see Figure 4.8).

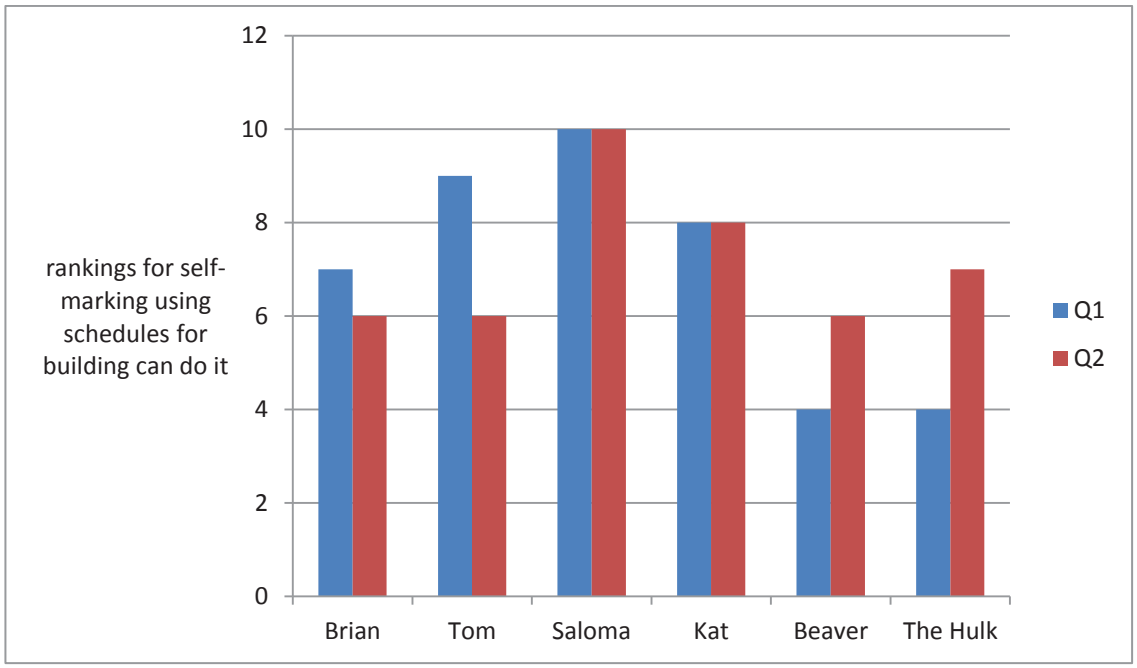


Figure 4.8 Student rankings for self-marking using schedules for building can do it in maths from responses to q20 (1-most important 10-least important)

Responses to how does marking your own practice assessments using assessment schedules help you, if at all? (iq8) included

> Brian: *it does help coz you can see how they are marked and what the markers are looking for*
>
> Tom: *pretty good… quite helpful*

Students written comments on assessments helped focus on the skills requiring improvement. Students kept copies of practice tests and referred to these in class when working on specific achievement criteria in preparation for the next assessment. Also of note is that, on the final day of the practice assessments, which was also the final day of the in-class research, all students accepted an offer of another test and assessment schedule to do and mark at home.

Students selected for the interviews on the basis on their levels of self-efficacy showed little difference in their ideas about what contributed to self-efficacy. Students with high and medium self-efficacy expressed strong opinions that practice assessments and self-assessment contributed to their self-efficacy. Although low self-efficacy students were less forthcoming in expressing the same belief, a low self-efficacy student was the only one to rank being able to assess yourself as the most important contributor to sense of can do it in maths. Another low self-efficacy student was the most proactive in participating in and utilising self-comments on the practice tests. In this study any variations seemed to be independent of the self-efficacy level of students.

4.4 Summary

The three subquestions provided a framework for developing the data gathering instruments and for considering the information collected through questionnaires, interviews, observations and assessment schedules. This chapter has presented the findings in terms of

- What role does feedback play in students' ability to self-assess?
- What role does understanding problems in terms of achievement criteria play in students' ability to self-assess?
- What is the effect of self-assessment on self-efficacy?

All students wanted to get good feedback in some form. They felt that feedback helped them to learn by showing them what they were doing right and what they needed to improve on. As

they learned how to do one type of question they were better equipped to judge their performance on a similar question, which supported them in increasing their ability to self-assess. In the ranking question, students placed relatively low importance on generating feedback from test and classroom work for their sense of mathematical can do it. During self-assessment however, they found that the marking schedules and writing self-comments on their tests generated good feedback.

Students perceived that understanding problems in terms of achievement criteria contributed positively to their ability to self-assess. During class observations there was a high level of engagement in this process. This was most notable immediately prior to and following practice assessments. Some students were very positive in verbalising that relating achievement criteria to problems gave clarity and provided focus for their learning.

Self-assessment made a significant contribution to self-efficacy. As their self-assessment skills increased they felt more capable. This may be because they felt more empowered by their skills and knowledge to change outcomes. From the students' perspective practice was the vital feature for building self-efficacy, with past experience and confidence as contributing factors. Overall, students thought it very important to be able to self-assess as a means of enhancing self-efficacy, although they were less sure of their ability to do so. In other words, in spite of their sense of can do it for self-assessment being low, self-assessment still enhanced their self-efficacy for their maths. They placed most importance on self-marked practice tests as a means of boosting self-efficacy.

The next chapter looks at the implications of these findings and seeks to answer the question, for these students at this time,

- What effect does students' self-assessment have on their self-efficacy?

CHAPTER FIVE

Discussion

Whether you think you can or you can't, you're usually right

Henry Ford

5.0 Introduction

Most readers will affirm from personal experience that having a strong sense of can do it makes a big difference when undertaking a particular task. Research supports that this feeling of self-efficacy is one of the best predictors of achievement (Hattie, 2009; Pajares, 1996; Wigfield & Eccles, 2000). With such a vital role to play in achievement enhancing self-efficacy is of interest to teachers and learners. Bandura (1997) puts self-efficacy within social cognitive theory. He argues that self-efficacy affects the way people function cognitively, affectively, motivationally, and in terms of choices they make. He advocates guided mastery as the most effective means of enhancing self-efficacy, and thereby improving human functioning (see also Pajares, 2008).

Guided mastery has four basic aspects. These are acquisition, generality, durability, and resilience. Acquisition is the development of knowledge, skills, and self-belief that govern human thought, affect, and action, and is particularly relevant to self-efficacy. Generality is how widely applicable acquired capabilities are, durability is how well changes are sustained over time, and resilience is the ability to recover quickly from set-backs. The current study focused on acquisition in the form of self-assessment strategy training to equip students to take more control of their learning, increase their mastery experiences, and in so doing increase their self-efficacy (Eisenberger e al., 2005; Ross & Starling, 2008). As a form of self-directed mastery self-assessment also contributes to durability and generality, and to a lesser extent resilience (Bandura, 1997).

The interventions in this study, which are described in detail in chapter three, focus on developing students' self-assessment skills. This enables them to cope better with learning as they have more understanding of the process and it reinforces for them that they can control outcomes. The interventions involve using feedback and achievement criteria to break learning tasks down into small incremental steps with the support of the teacher. Relating

achievement criteria to assessment problems, combined with the process of repeated opportunities to improve, made it easier to meet all of the achievement criteria of the standard one criterion at a time. This meant that what is normally a formidable and seemingly unachievable task for some students became manageable and achievable.

This study set out to answer the question

- What effect does students' self-assessment have on their self-efficacy?

It did this by examining three subquestions

- What role does feedback play in students' ability to self-assess?
- What role does understanding problems in terms of achievement criteria play in students' ability to self-assess?
- What is the effect of self-assessment on self-efficacy?

This chapter is organised around these three subquestions and discusses the research findings with reference to the literature. Data collected using questionnaires, interviews, observations, and student practice assessments, is considered under the headings of feedback and achievement criteria, in relation to self-assessment, and self-assessment in relation to self-efficacy.

5.1 The role of feedback in students' self-assessment

There is a significant amount of research internationally and nationally to support the importance of feedback in student learning (Black & Wiliam, 1998; Crooks, 1988; Hattie, 2009). Feedback is one of the most powerful components of learning and assessment and involves strategic thinking and metacognitive strategies, which are critical for developing self-assessment capabilities (Harris et al., 2008; Hattie, 2009). This study found that students valued and wanted feedback in their learning and not only saw the teacher as having a key role in providing that feedback, but also valued and utilised skills to generate feedback for themselves. Students generated feedback by comparing their work with worked examples, relating achievement criteria to past NZQA and commercial assessment papers, and self-marking practice tests using assessment schedules.

Feedback encourages effort and persistence as students respond to gaps in their learning by focusing on assessment problems linked to specific achievement criteria to increase their

mastery (Harlen & Deakin Crick, 2003). In this study students often made comments such as *you know what you need to work on, you can fix what's wrong* and *the feedback can help me for next time,* which suggests they were motivated by the feedback to put in effort to improve. The knowledge of another opportunity to complete a similar assessment the next day seemed to make the feedback more powerful in its impact on students' self-efficacy as they were motivated to engage with it to improve their performance.

> Beaver: *when I go home I try to do some of the ones I know then go on to the ones I don't know then when I come to school its cool coz then I can go back onto the assessments and try to do it*

Another comment from the same student supports the important role of self-generated feedback in self-assessment.

> Beaver: *Um yeah I think it's important coz then you can understand how good you are doing for yourself coz normally when we get tested we have to wait for a couple of weeks to get the results and we don't know what we can improve on in that time*

This comment is valuable for several reasons. It indicates the importance of students understanding how they are progressing in their learning, the contribution that this makes to enabling students to improve their learning, and the value of this knowledge being put in students' hands as soon as possible after assessment. Self-marking practice tests using assessment schedules does all of these.

5.1.1 Sources of feedback

Students valued feedback from a variety of sources. Students generated feedback by writing comments on their test papers and by referring to the marking schedules, which provided a model for them to compare their work against. Students thought however, that the teacher was the best source of feedback to provide them with information on whether they were doing it right and getting it right and how to improve. Watching the teacher work through examples ranked consistently highly as a source of building their sense of can do it in maths and hence enhancing their self-efficacy. Although this is not feedback, it does highlight the importance of an expert model, which is consistent with opinion and research that vicarious experience provided by models is one of the chief sources of self-efficacy (Margalit, 2010; Pajares, 2008). Some students broadened the scope for a suitable model to people who already know the work, or a professional, as a source of feedback. One student also referred

to the importance of the teacher's belief in students' ability to help their sense of can do it in maths.

> Nike: *the teacher believes you can do it…*

All of this emphasises the important role of the teacher as a model, to provide verbal persuasion in the process of guided mastery, and as a source of feedback (Bandura's, 1997).

Students also modelled good learning behaviour when they worked together to master the gaps in learning. In so doing, they acted as a source of feedback for other students, and in relation to self-efficacy, acted as a vicarious experience for each other. This occurred mostly after one practice test and in preparation for the next one. These formative practice tests marked immediately by students are reported in the literature as an excellent source of feedback to help establish current learning, reveal gaps, and give information for the next step in mastering achievement criteria (Crooks, 1988; Sadler, 1989).

In summary, students in this study saw the teacher as the best source of feedback. They also utilised marking schedules, self-comments, and each other to generate good feedback to enhance their learning and self-assessment capabilities.

5.1.2 Student perceptions of feedback

Feedback is an essential learning tool that enables students to generate information to help them identify what they have already learned, what they have yet to learn, and how to close gaps in their learning (Black & Wiliam, 1998; Crooks, 1988; Hattie, 2009; Sadler, 1989). However, students' perceptions influence the value of potential learning experiences. If they do not perceive that feedback is of value to them this will affect any potential gains that can be made in their learning.

Following the interventions students' ideas on ways in which they could get feedback changed from an emphasis on double-checking and looking over their work to include *self-assessment* and *comparing answers and working to the marking schedule*. Students valued self-comments on assessment papers. These comments, written as instructions to themselves in words after they had completed marking a test, focused on the next step or next achievement criteria that they needed to master on their way to meeting all the requirements of the standard. The

value students got from writing comments is supported in research done by Harlen & Deakin Crick (2003) and Retnowati (2010).

Self-comments by students support the focus on and assimilation of feedback. Taras (2008) found the use of comments, instead of grades, effective in teacher feedback. I had planned to check students marking on the first practice test, but having read Tan, Teo and Ng's (2011) research changed this plan. These researchers found that teacher remarking of students' self-marked work undermined students' judgements and affected their confidence levels. In the current research project instead of check marking after students I worked with students, contributing verbal comments and suggestions, as they self-marked in class. One of the advantages of doing practice tests and teaching students how to self-mark from schedules is to minimise the need for teacher corrections and maximise students' ability to take control of their learning and assessment. Self-assessment with emphasis on schedules enabled students to refer directly to the same authority that the teacher is subject to, in this case the NCEA standard.

The current study found that students valued feedback and wanted to get feedback when they were learning because they perceived that it helped them learn. Feedback gave students information about their success on completing the learning task and their management of learning in terms of cognitive and emotional strategy use. This seemed to equip them to accurately assess learning evidence, as their comments on practice assessment papers indicate (see Appendix G), and increase their control and positive attributions to move forward in their learning. All of this is supported by earlier research that shows the value of feedback for increasing learning (Black & Wiliam, 1998; Boud, 2000; Crooks, 1988; Hattie & Timperley, 2007; Sadler, 1989).

Students generated feedback by comparing their work with worked examples and by relating achievement criteria to past NZQA and commercial assessment papers. This is consistent with other research (Retnowati, 2010; Schmidt-Weigand, Hanze & Wodzinski, 2009).

> Brian: *[self-generated feedback] helps reinforce to me what I am doing right and what I need to work on to correct mistakes*
>
> Reynor: *[self-generated feedback] helps you understand where and what you got right and wrong*

Another student identified the advantage of self-marking of *not* having to wait for results, thus recognising the importance of immediate, corrective feedback in the context of incremental process goals and clear criteria.

> Beaver: *… normally when we get tested we have to wait… to get the results and we don't know what we can improve on in that time*

Other research has also found value in immediate student-generated feedback (Eisenberger et al., 2005; Hattie & Timperley, 2007).

In summary, this study found that these students perceived feedback as valuable. They appreciated feedback that they generated without the direct input of the teacher. They also valued feedback from the teacher on their process and in the form of verbal persuasion and belief in their ability to succeed. Most students generated feedback for themselves. Some students, who thought they did not generate feedback or *rarely* did so, thought they lacked the ability do so. This uncertainty regarding their ability to generate feedback is interesting and suggests that in a further cycle of action research students would benefit from help to identify and be aware of when they are generating feedback. In spite of this uncertainty, they readily took on new skills for generating feedback and had definite ideas on potential sources of feedback.

5.2 The role of achievement criteria in student self-assessment

When students have access to information about their learning in terms of clearly expressed achievement criteria they learn more (Black & Wiliam, 1998; Brookhart, 2008; Brown et al., 2008; Hattie & Timperley, 2007; Hipkins et al., 2004; Meyer et al., 2009). Achievement criteria and feedback work together as task oriented feedback linked to assessment criteria tells students what achievement criteria they can do, what they still have to master, and how to close the gap between the two.

This study found that students valued relating achievement criteria to specific assessment problems because it helped their learning and supported them in self-assessment. Understanding the achievement criteria in terms of assessment problems empowered students by contributing to clarity and transparency. Students' beliefs that assessment was primarily about standards or criteria supported them in learning more at a deeper level. When

they could relate the criteria to problems, and vice versa, they were more able to generate feedback, had greater confidence and belief in their ability, and learned more.

5.2.1 Student perceptions of achievement criteria

Although research supports the value of achievement criteria for learning students' perceptions will influence the actual value gained from understanding those criteria. If students perceive them to be of little value then achievement criteria will add little to their learning. If students believe that achievement criteria add value to their learning then they will engage with those criteria and use them in learning.

In this study two factors contributed to students' perceptions that relating achievement criteria to specific assessment problems helped them learn. Firstly they believed it enabled them to *know what to focus on* and pointed out to them *what you have to do*. One student thought it was a *lot easier* using this process of checking what they knew against criteria. Secondly students thought that translation of the English used in the standard's description of the achievement criteria made it easier to understand. Students perceived that specific achievement criteria related to assessment problems contributed to their learning.

Students valued the emphasis on mastering one achievement criteria at a time. Earlier research has found that achievement criteria support a mastery-task-effort incremental approach, which encourages students to learn in achievable steps (Dweck, 2000; Good & Brophy, 2010). Research supports the findings of this study that the focus on achievement criteria linked to assessment problems, along with an emphasis on mastering one criterion at a time, kept the feedback manageable (Clarke et al., 2003; Harlen, 2005; Walsh & Sattes, 2005). Put another way, students felt able to learn knowledge associated with one criterion, as opposed to being confronted with the whole standard, and in this way established closing the gaps goals according to their current level of achievement. Even students with high self-efficacy found this beneficial.

> Brian: *… working one problem at a time until you've got it before moving on, and improving slowly… that helps*

Another student commented on the benefit of assessing against criteria using self-assessment

> Ana: *we've been going through it slowly and if we don't know we can ask….it's like we are all at our different stages… but you push us to do that extra…*

5.2.2 Achievement criteria and self-assessment

Achievement criteria help students to self-assess (Bourke, 2000; Casas, 2011). To self-assess successfully, students need a clear understanding of what is required of them, feedback, and skills on how to improve to meet the standard required (Black & Wiliam, 1998; Boud, 1995b; Sadler, 1898). Tan, Teo and Ng (2011) found that it was important for students to be presented with clear and unambiguous standards to self-assess successfully.

Knowledge of criteria helped familiarise students with assessment processes. Students developed ability to critically and dispassionately self-assess as they used criteria and standards to make, justify, and explain judgements of their work. This seemed to help wean them away from the teacher-as-sole-authority and showed them where else to find learning support. Students had more control, more opportunity to develop metacognitive skills, and were motivated to engage with the self-generated feedback to improve.

Research confirms that assessment is optimised when it promotes progress for all and is built on evidence based assessment using achievement criteria (Absolum et al., 2008; Crooks et al., 2009). This process also helped students to focus on self-improvement in relation to the standard rather than in comparison with their peers.

> Beaver: *I like the way we can check it ourselves to see if we do get achieved and that… coz sometimes I don't like people knowing what I get and like if I know what I get then it's… like better …*

This comment also confirms other research that has found that an emphasis on meeting criteria for success reduces the normative performance-ego-ability orientation that is counterproductive to maximum learning, which in turn reduces negative effects of testing (Brophy, 2010; Harlen, 2005; Harlen & Deakin Crick, 2003). Achievement criteria as goals have been found to put the focus on the individual and individual vocational goals and pathways, which adds context, relevance, and motivation (Alison, 2008; Rawlins et al., 2005).

In summary, students benefitted from relating achievement criteria to assessment problems. It helped their understanding of what was required of them, made learning easier, motivated them, and made them feel more able to succeed. It reduced the normative aspect of assessment and placed the focus on individual improvement against the criteria. It appears from this study that enabling students to understand achievement criteria in terms of problems they have to master to succeed supported their learning and the development of self-assessment skills.

5.3 Self-assessment and self-efficacy

Self-assessment enhances learning (Andrade & Valtcheva, 2009; Black & Wiliam, 1998; Boud, 2000; Bourke, 2000). Students who are trained in self-regulatory strategies of self-assessment learn more and have higher self-efficacy (Crooks, 1988; Taras, 2008; Zimmerman et al., 1996). Other research that relates self-assessment and self-efficacy found that a level of self-efficacy just beyond actual ability seems to be the optimum for achievement (Ng & Earl, 2008). Self-assessment based on feedback generated from standards based criteria against which students judge their performance builds students' confidence and belief in their ability to improve (Black & Wiliam, 1998; Bourke, 2000; Crooks, 1988; Tan, 2009; Wilson, 2007). When students believe the purpose of assessment is their learning progress, measured against standards or criteria, they do better (Brown, 2008). This was the experience of students in this study. Their assessment capabilities developed and they grew in confidence and self-belief to advance their learning as they repeated practice tests and self-marked these using assessment schedules.

> Bob: *[achievement criteria] helped me a lot… coz I know what to focus on… what to work on*

Students reported that it made the criteria understandable and the work easier.

> Bob: *…we check what we know against criteria and I find that a lot easier*

Research supports the understanding that assessment is most effective when; purposes are clear and stated in terms of criteria aligned to the curriculum, standards, and instruction; assessment is frequent; and assessment is used to effectively monitor progress (Absolum et al., 2009; Cromey, 2000; Ministry of Education, 2007). Student involvement in identifying criteria with specific problems enhanced feedback, achievement, and self-efficacy. Although the current standards at year 12 and 13 are detailed and specific, the standards being introduced at year 11 are less explicit and provide opportunity for criteria to be developed with students. Research suggests that involving students in writing criteria is advantageous for feedback, achievement, and self-efficacy (Clarke, 2009).

In the current study students' sense of can do it was enhanced by self-marking practice tests using assessment schedules. Students learned more when given regular opportunity to perform and to self-assess performances. As the students in this study increased mastery throughout this process their self-efficacy was enhanced. Students appreciated that self-

assessment shifted the focus to them and their learning improvement and away from a comparison with other students and involvement of the teacher in assessment.

> Beaver*: I like the way we can check it ourselves to see if we do get achieved and that… coz sometimes I don't like people knowing what I get and like if I know what I get then it's… like better…*

5.3.1 Student perceptions of self-assessment and self-efficacy

Research has established the value of self-assessment and a link between self-assessment and self-efficacy (Black & Wiliam, 1998; Crooks, 1988). However, students' perceptions and beliefs will ultimately influence the actual value derived from learning activities. Students in the current study expressed a firm belief that it is important to be able to self-assess. The relatively low ranking they gave it in the questionnaire appeared to be offset by interview responses, the level of student engagement in the process of self-marking from assessment schedules, and responses to other questions related to the process.[22] Students clearly perceived self-marked practice tests, a form of self-assessment, as the most significant means of enhancing their sense of can do it. Taras (2008) draws attention to the fact that in many higher education institutions in the United Kingdom mock assignments, arguably the equivalent of practice tests, have proven to be better than drafts for providing feedback and opportunities for improvement on work that will eventually be assigned a summative grade.

5.3.2 The effect of self-assessment on self-efficacy

Interventions based on strategy instruction can change students' approaches to learning and result in significant increases in self-efficacy. One strategy, self-assessment, has been found to increase self-worth and strengthen positive beliefs and relationships to increase learning and further decrease the normative tendencies of students (Bishop, 2008; Brophy, 2010; Meyer et al., 2009; Harlen, 2006). In this study student self-efficacy was enhanced by student self-assessment. Self-assessment increased self-efficacy in part because as students mastered more criteria they improved causal attributions attributing success to their efforts and strategies. Students repeatedly reported that self-assessment was a *big help.*

[22] This low ranking may also have been related to the difficulty students seemed to have ranking 10 different options. Some students did not complete this question in the second questionnaire.

Bob: *helps quite a lot coz you compare what I did before doing the self-assessment I struggled… then with the self-assessment I know what to work on to get achieved or merit or excellence*

This comment points to the role of assessment in giving students control and generating feedback, which combined with self-assessment using assessment schedules to give students an enhanced sense of competence. Students often made comments similar to *now I know*...or *now I can see what I have done right and what I have done wrong*. This is consistent with other research that indicates that regular self- assessment increases students' assessment capabilities by enhancing self-determination, ability to self-regulate, and understanding of the next step in their learning (Hattie & Timperley, 2007; Ministry of Education, 1994; Sadler, 2009). It seems from this study that the more students self-assessed, and the more access they had to their personal assessment information, the greater their sense of can do it.

As well as the importance of feeling a sense of control and empowerment through the information provided through this process, students also placed significant importance on feedback from the teacher. They valued teacher feedback in terms of their process, their progress, verbal encouragement, and belief in their ability to succeed. Thus it seems to be vital that teacher and students work together to build students' effort toward mastery and self-efficacy.

Students feel more self-efficacious toward mastering criteria when they know how to access specific, relevant, descriptive feedback (Black & Wiliam, 1998, Crooks, 1988, Harlen, 2006). Students in this study felt their sense of can do it was increased by the opportunities to self-assess against the criteria clearly expressed in the standard and assessment schedules. This also increased their self-regulation and their ability to generate feedback. This enhanced their self-efficacy, especially in the context of the repeated opportunities to increase their mastery. This effect of feedback in increasing motivation and engagement is supported by other research findings (Black & Wiliam, 1998; Bourke, 2000; Caccioppoli & Cullen, 2006; Sadler, 1989).

Self-assessment skills enabled students to identify evidence that attested to their learning in terms of criteria, to interpret that evidence, and use it to improve their learning. Emotional and cognitive self-regulation strategies enabled students to manage their motivational and cognitive states, which supports the development of self-efficacy.

Beaver: *it helps me to be confident in myself coz I know what I can gain and work out what I need to learn*

> Nike: *oh um it helps me heaps… it's letting me know what I'm doing wrong and what I'm doing well… it's a great way for me to learn… I like doing the tests and achieving them or getting merit in them… it shows you can do it*

Extensive research supports these findings that student motivation and learning benefit from repeated opportunities to perform and achieve (Aitken & Sinnema, 2008; Caccioppoli & Cullen, 2006; Crooks, 1988; Davies & Hill, 2009; Dweck, 2002; Kahu, 2008; Sadler, 1989).

The current study found that self-assessment was an excellent source of feedback, established current learning, revealed gaps, and gave information for the next step in mastering criteria. Resultant raised self-efficacy increased motivation and ability to use different strategies. Frequent tests also added to validity and reliability of judgements as students experienced repeated achievement at improving levels. Knowledge of on-going opportunities to improve mastery significantly motivated students to persist toward goals and reinforced to students that the main purpose of self-assessment was learning.

Students were positive about marking their papers and gave considerable time and thought to the process. This helped reduce errors primarily associated with teacher bias in marking assessments and students' tendency to look at their marked paper hoping to find errors in marking rather than looking to improve their learning. This also has the potential to increase consistency, validity, and reliability; however this was not investigated in this study. Students placed significant value on self-marking practice tests. A major part of this was the important role that such self-assessment played in helping students to "get it right". Confidence and getting it right were closely associated, which is not surprising as the latter implies mastery. Not only did self-assessment enable students to identify what they did correctly their perception was that it made learning easier. It provided information on what they had done wrong so that they could focus on these gaps in their learning and prepare to get it right in the next practice test. Built into getting it right is the relatively immediate knowledge that they have got it right, which self-assessment provided, enabling students to personally connect with their success and increase self-efficacy.

The use of past summative and commercial assessments seemed to help demystify the testing process, particularly as students became more familiar with assessment schedules. These assessments were not prepared by the teacher and some of them were backed by the process of national assessment design. Both of these features seemed to strengthen student confidence that the results they achieved were a reliable indicator of their learning and of their likely performance in the summative assessment. The repeated practice tests also acted

as multiple sources of evidence over time to increase validity and strengthen students' beliefs in their ability to succeed. In this study, there was an increase in students' sense of can do it for the topic being studied. Self-marked practice tests contributed to task accomplishment or mastery experiences, especially immediate past performance, and were the main contributors to self-efficacy.

As discussed earlier, Bandura (1997) advocates guided mastery as the best means of enhancing self-efficacy. Guided mastery builds mastery experiences, which are the main source of self-efficacy and involves several features that were present in the intervention process in this action research study. Two of these features are that learning must be structured to develop coping skills and it must reinforce for students that they can control outcomes and minimise risk. The process of self-marking practice tests from schedules meets these two conditions. One particular student comment encapsulates both of these aspects of guided mastery.

> Beaver: *It helps me to be more confident in myself coz I know what I can gain and work out what I need to learn…I like the way we can check it ourselves to see if we do get achieved and that…coz sometimes I don't like people knowing what I get and like I know what I get then its better…*

Self-marking and putting the schedules in the hands of students, along with linking achievement criteria to assessment problems, increased their understanding of what was required. It also gave them access to the same resources that the teacher used to assess them. This empowered students to give them a sense of control over outcomes. Access to the marking schedules also supported students in developing coping skills, such as generating feedback to find a way forward, and perseverance, as they used the models provided to improve their learning.

The third feature of guided mastery is that difficult tasks need to be broken down into subtasks within students' capability. The skill of relating achievement criteria to assessment problems combined with the process of repeated opportunities to improve through practice tests facilitated approaching the task of meeting all of the achievement criteria of the standard one criterion at a time. This meant that what is normally, for some students, a formidable and seemingly unachievable task became achievable.

> Brian: *Coming up to the normal test I would have thought ok this is a topic I need to know everything for it whereas now I can look and see exactly what I need for it and your technique*

of working one problem at a time until you've got it before moving on and improving slowly that helps

The fourth feature of Bandura's guided mastery that is needed to boost self-efficacy is that students need to be able to gain support from the teacher. This was apparent in several ways during the current study. It was enacted in the worked examples intervention lesson as I worked through problems and the students copied these to use as models for their problem solving and feedback generation. Casas (2011) refers to this as "using the instructional strategy of modelling" (p. 117). Students themselves prioritised observing the teacher work through examples as the second most important contributor to their self-efficacy. Five of the 11 responses to what helps their self-efficacy in maths included reference to the teacher. The role of the teacher in offering support was also a feature of the repeated self-assessed practice tests, as one student confirms when describing what we had been doing differently in class during the research;

> Ana: *We've been going through it slowly and if we don't know it we can ask you for … um and it's like we are all at our different stages but you have time for each and every one of us…* (Interviewer: like whatever stage you are at?) *Yeah and you push us to do more…to do that extra*

This comment indicates that self-assessment reinforced belief in ability as incremental, not fixed, which contributes significantly to student success in a way that enables them to "appreciate their developing expertise" (Brophy, 2010, p. 111). In other words, it enhances their self-efficacy.

There was some evidence to suggest that self-efficacy is domain specific and also topic specific within domains. Students felt differently about their can do it with regard to maths in general, learning new things in maths, different areas of maths, and the particular topic involved in the study. There was little evidence to suggest that there was any difference in gains to be made for students with different levels of self-efficacy, with high, medium and low self-efficacy students all finding benefit in the process.

In this study self-assessment seemed to have a moderating effect on inaccurate self-efficacy. Two students lowered their ratings as a result of the interventions, which gave them a sense of can do it that was more in accord with their past achievements. Others increased theirs to be more in accord with their ability, a benefit which Ross & Starling (2008) also found in their research. Moreover, it seems from this study that repeated opportunities to self-assess practice tests in exam conditions are an important factor in self-assessment as a means to

enhance academic self-efficacy. Another interesting finding is the way students responded to rating their self-efficacy. Their readiness to describe their self-efficacy in terms of rating scales after only one exposure to this, which was in the first questionnaire, is perhaps indicative that supporting students in the use of such scales may have significant potential for making them mindful of their self-efficacy.

In summary, the results of this study indicate that self-assessment is a means for enhancing self-efficacy. Self-assessment not only boosted the self-efficacy of those who had inaccurate low self-efficacy, it also modified the self-efficacy of one student who had overly high self-efficacy. Self-assessment as a form of guided mastery in this study involved students in generating feedback, evaluating their previous performance, goal setting for their next practice test in terms of achievement criteria, and monitoring their progress. These learnable behaviours not only contribute to self-efficacy directly, but in the current study, also formed part of the strategy training of self-assessment advocated by researchers as a form of guided mastery to increase self-efficacy. As students learned to self-assess using schedules to mark tests they employed metacognitive processes of forethought, performance, and reflection. This enhanced learning, as other researchers have found (Bandura, 1997; Eisenberger et al, 2005) and as indicated by the following student comment.

> Brian: *I've never used this self-assessment that we've been doing lately… it's been really quite helpful…I've done a lot in a short space of time*

5.4 Summary

The discussion has suggested that academic self-efficacy can be enhanced by guided mastery based on self-assessment. The evidence included the importance of feedback for closing gaps in learning, relating achievement criteria to problems, and self-assessment. The evidence supports that a focus on feedback, achievement criteria linked to assessment problems, and self-assessment that recognises achievement in previous practice tests enabled students to increase mastery experiences and associated causal attributions, and thereby build self-efficacy.

To complete this thesis I will now look at some closing points including some implications for practice, limitations to the research, and possibilities for future research.

CHAPTER SIX

Conclusion

If I have the belief that I can do it, I shall surely acquire the capacity to do it even if I may not have it at the beginning

Mahatma Ghandi

6.0 Introduction

This study was designed to look into the effects of self-assessment on academic self-efficacy. The particular form and focus of self-assessment involved using assessment schedules and criteria over several intervention lessons with one year 12 achievement standards mathematics class in a decile two urban secondary school. Training students in self-assessment involved specific attention to worked examples or models of what good work looks like, how to generate feedback, and how to relate problems to and understand achievement criteria. The research suggests that when students are equipped to self-assess there is a positive impact on self-efficacy.

This chapter revisits the purpose and design of the study and looks at its limitations. It summarises the most significant findings and looks at implications this has for practice and for future research.

6.1 Research purpose and design

This action research investigation set out to gain insights into whether training students in self-assessment skills would increase their self-efficacy. Self-efficacy is concerned with students' perceptions of their capabilities. This emphasis on perceptions determined the underlying epistemology, theoretical perspective, and methodology. Constructivism, symbolic interactionism, and action research were best suited to determine data gathering techniques and analysis to answer the research question and subquestions. This was outlined in chapter three.

Research has established the significant influence of self-efficacy and self-assessment on learning and achievement, and that self-efficacy is one of the best predictors of achievement. If self-efficacy is reshaped in a positive direction then learning and achievement will improve. This study uses self-assessment strategy training, which is a form of guided mastery, to enhance self-efficacy. There is some research on self-assessment and self-efficacy at tertiary level and in work settings and a limited amount on the effects of training students in strategies on self-efficacy. However, very little research has been done into the effect of self-assessment on raising self-efficacy in secondary school students. If self-assessment is found to raise self-efficacy, and students respond to training in self-assessment, then the relationships between self-efficacy, self-assessment, and achievement means there are significant implications for educational practice and policy.

The research set out to investigate the question

- What effect does students' self-assessment have on their self-efficacy?

It did this by investigating the subquestions

- What role does feedback play in students' ability to self-assess?
- What role does understanding problems in terms of achievement criteria play in students' ability to self-assess?
- What is the effect of self-assessment on self-efficacy?

Questionnaires, interviews, observations, and students' annotated practice assessments were analysed to identify themes and patterns.

6.2 Summary of findings

The research effectively demonstrated the value of strategy instruction in self-assessment as a form of guided mastery for enhancing self-efficacy for the participants in this class studying this topic. The research has enabled some conclusions to be made regarding the roles of feedback, relating achievement criteria to assessment problems, and self-assessment in enhancing students' sense of can do for these students.

All students valued and used feedback to increase their learning capability. Though some were unsure of their ability to generate feedback without the help of the teacher, all responded to and valued feedback, both self-generated and provided by teacher and peers, as a tool in self-

assessment. Marking schedules and writing comments on practice assessments were good sources of feedback that students could access and use with limited help from the teacher after they had gained the necessary skills.

The role of the teacher is one that students valued highly to support them in gaining mastery. Students saw the teacher as providing good vicarious experience through modelling and worked examples, and as the chief source of feedback in terms of the accuracy of their process, belief in their ability to succeed, and verbal persuasion. Students also relied on peers, especially as role models, helping them to generate feedback and master criteria, which supported self-assessment.

For this group there seemed to be little difference between low, medium, and high self-efficacy students in their perceptions of what helped their sense of can do it. Students' self-efficacy was enhanced by the process of repeated opportunities to master and accurately self-assess their performance. From this research it seems that students believe practice does indeed "make perfect". It seems to be important that the opportunities for mastery replicate the criteria that they will be judged *on* and *in* as closely as possible. It seems significant that self-assessed practice assessments were in exam conditions as this provided the same experience that students were preparing for in terms of both what they would be judged on and the conditions they would be judged in for summative purposes. Further research needs to be done into this.

The research has shown the importance of repeated opportunities to master skills and of students self-assessing the level of mastery they achieve at each attempt. In effect self-assessed practice tests provided opportunity for and enabled students to accumulate mastery experiences, the chief source of self-efficacy, and seemed to build self-efficacy in a way that other activities did not.

6.3 Limitations of the research

There are limitations to any research in terms of both the topic of the investigation and the methodology employed. Contextualisation within the everyday practice of the classroom limits the application of all action research undertaken in schools. Although the results were very positive for students involved, and encouraging for future classroom practice, such findings can only suggest rather than conclude definite links between self-assessment and

self-efficacy. The small size of the class and the restriction to working within one subject domain, and on one topic within that domain, are further limitations to the research. Any generalisability is therefore restricted to similar mathematics classes in this and similar schools, and perhaps to other subject areas within this school and similar schools.

Another limitation in this particular study was my role as researcher conducting the research from outside of the role of classroom teacher. Although this had advantages in some areas, such as minimising role conflict and freeing up time to concentrate on the research, it limited the extent to which I could work within the class on a daily basis. Acting as researcher and teacher for the interventions had the advantage of keeping my observation focused on and in context of the interventions and student engagement with these and the disadvantage of limiting detailed notes.

The short time frame meant that repeated cycles could not be enacted and observed. This limitation was mitigated by the earlier research I had done on the same topic at the end of 2010 making this investigation, to some extent, the second cycle of research. However, it was with a different class and with a six month gap in between, thus limiting the research.

The historical problem of absenteeism within the school combined with sports-week[23] during the early part of the research and exam week at the end to limit the research.[24] Although 13 of the 14 students on the roll were present for the first questionnaire absences on the last day of the research and exam leave the following day meant only seven completed the second questionnaire. One of the students who did not complete a second questionnaire was Bob as he was absent from class the day it was done, which was the last day of school before exam week, making follow up difficult. As a low self-efficacy student who was interviewed, and who saw being able to assess oneself as the most important contributor to self-efficacy, his second questionnaire may have provided useful insights.

The balance between interpreting data gathered through the filter of my own perspective and allowing the data to speak for itself via patterns and themes is a crucial one. Data gathered from questionnaires, observations, and interviews was interpreted through my researcher gaze, which was strengthened by my past involvement with the school and students and my

[23] This is a nationwide annual sports event in which all codes participate in a week of competition, meaning students are out of class for the entire week. Approximately one third of students from this class were involved.
[24] The teacher also noted that absences had increased in the time prior to the research.

qualifications in terms of experience and study. I was aware of the need to establish and maintain balance and sought to use my qualified status to read out of the data, interpreting it, rather than reading into it my own beliefs. The extent to which I achieved this balance is for the reader to judge using the detailed descriptions of data collection techniques, interventions, findings, and discussions.

6.4 Implications for practice

The implications for practice as a result of action research apply primarily to the researcher. These will be considered before looking at any implications beyond the researcher's classroom.

6.4.1 The next cycle of action research

My focus in teaching will include greater emphasis on equipping students to self-assess. The next cycle of investigation for me as researcher-teacher will involve working with the same students at year thirteen calculus or statistics in 2012, and other students who may join the school. I will be more mindful of the role I have in providing an effective model for students through my worked examples, in advising them on their process, offering verbal encouragement, and believing in them and their ability to succeed. I will repeat the three interventions in a modified form. I will put more emphasis on helping students to build confidence in their ability to generate feedback, getting them to identify when they do this, particularly with regard to using worked examples, their peers, and assessment schedules. I will regularly use the beginning and end of each lesson for students to identify what they already know, what they need to work on next, and how they will improve in relation to achievement criteria. I will have repeated self-marked practice tests in exam conditions prior to assessments that are used for summative purposes (see Table 6.1 for the plan for the next cycle of action research). Another advantage that I will take from using exam conditions is that if students do not meet certain criterion in an internal summative assessment then practice tests can be used as evidence that students have met the required standard.[25]

[25] This is according to the Principal's Nominee in the research school on advice received from NZQA.

Table 6.1 Action research plan for 2012

Research Questions	Recommended action targeted to findings	Who is responsible for action?	Who needs to be informed?	Who will monitor or collect data?	Timeline	Resources
		S students T teacher	Principal	S students T teacher	Start time but all actions on-going after start	
1. What effect does student self-assessment have on self-efficacy? 1.1 feedback generation and awareness to support self-assessment 1.2 involves understanding achievement criteria to support self-assessment 1.3 promotes assessment *is* learning to support self-assessment 1.4 increases students self-assessment skill to enhance self-efficacy	1.1 support students to generate feedback from self-assessment of classroom work and practice tests including self-comments 1.1 increase students awareness of their ability to generate feedback 1.2 support students in relating achievement criteria to assessment problems and vice versa 1.2 support students to work towards success one achievement criterion at a time and to appreciate their increasing mastery 1.3 -1.4 train students in self-assessing using schedules 1.3-1.4 provide repeated opportunities for students to gain mastery through self-marked practice tests	1.1 T S 1.2 T S 1.3 T S 1.4 T S	1.1-1.4	Observations T Surveys T S Interviews T S Assessments T S	1.1 early term 1 1.2 near end of each topic prior to first practice assessment 1.3 from first lesson 1.4practice tests prior to end of all topic tests	1.1-1.2 smartboard & online assessments 1.3-1.4 class sets of assessments and assessment schedules

6.4.2 Further implications for practice

Self-efficacy has a significant impact on achievement. Mastery experiences are the main source of self-efficacy and, for the students in this study, repeated opportunities to achieve mastery in assessment conditions combined with self-assessment to boost students' self-efficacy. The results of the study indicate students had higher self-efficacy with regard to the particular topic in which the interventions were applied. The results are sufficient to suggest that it would be worthwhile for teachers in other mathematics classes within the school, in other domains within the school, and in similar schools to apply the same or comparable interventions in an effort to improve students' self-efficacy. Those interventions are

- Providing specific worked examples for students and teaching them how to do their working in such a way that they can check in with the models given to generate feedback

- Breaking down achievement criteria by relating them specifically to problems from past assessments[26]
- Giving students a series of practice assessments in exam conditions[27] and teaching them how to self-mark using assessment schedules, and writing themselves instructions on what they have to work on to improve on the next practice assessment

The results also have implications for future research.

6.5 Implications for future research

This research provides some insights into the value of self-assessment and suggests further possibilities for investigation. Although it would be naive to make generalisations from a small action research project, the study does raise interesting questions that warrant consideration. How would self-efficacy be affected if students are trained in self-assessment in other topics in mathematics? What kind of impact would these interventions, or ones like them, have on the self-efficacy of students in mathematics classes at other levels and in other schools? How would students in other domain areas respond to training in self-assessment? It is interesting to note that although the limited time frame available for training students in self-assessment resulted in them having low self-efficacy for self-assessment, there was still a notable increase in self-efficacy for the topic being studied. How big an impact on self-efficacy would result from more comprehensive training in self-assessment? Thus future research could include training of students in generating feedback for themselves and making them aware of this process, teaching them to identify achievement criteria in terms of specific assessment problems and vice versa, and thorough training in self-assessment to increase self-efficacy. All of these approaches could be used in other topics in mathematics, at different levels, and in other subjects. These could all be investigated in terms of their effect on enhancing self-efficacy.

[26] The new curriculum changes introduced at year 11 in 2011 and higher levels thereafter have less prescriptive criteria and provide opportunity for more involvement of students in developing the achievement criteria. This research suggests time spent on this would enhance students' self-efficacy.
[27] One outcome of the research was the high value students placed on practice tests for their self-efficacy. One area of research may be the difference in effect on self-efficacy of practice "tests" (in exam conditions) and test-like activities that are not in exam conditions.

The nature of the link between self-assessment, self-efficacy, and achievement suggests more extensive research into the effect of training students in self-assessment skills on self-efficacy is not only warranted but urgent and essential. The positive response of low, medium, and high self-efficacy students to the interventions and the on-going concerns with low Māori achievement reinforce the importance of this topic for its potential future impact on achievement within New Zealand secondary schools.

6.6 Closing thoughts

Both self-assessment and self-efficacy are positively linked with achievement. The NZC is committed to producing "young people who will be confident, connected, actively involved, lifelong learners" (Ministry of Education, 2007, p. 7). It identifies the need to develop students' self-assessment capabilities as an important aspect of this. The results of this investigation suggest there is a direct link between self-assessment and self-efficacy. An increase in self-assessment skills, in the context of repeated opportunities to achieve mastery, seems to result in an increase in self-efficacy. The study also indicates that students of all self-efficacy levels can be effectively trained to self-assess and as a consequence of this training their self-efficacy is enhanced.

In today's and tomorrow's world of rapid change students need to be equipped to adapt to a variety of life circumstances and career requirements. They need skills that are transportable across circumstances and careers. These skills become more vital when they also enhance self-efficacy. Self-assessment in the context of repeated opportunities for mastery appears to meet these two strategic criteria for life-long learning and life-time success.

References

Absolum, M. (2006). *Clarity in the classroom*. New Zealand: Hodder.

Absolum, M., Flockton, L., Hattie, J., Hipkins, R., & Reid, I. (2009). *Directions for assessment in New Zealand: Developing students' assessment capabilities.* Wellington, New Zealand: Ministry of Education.

Airasian, M. (2008). *Classroom assessment: Concepts and application*. Boston, MA: McGraw-Hill Higher Education.

Aitken, G., & Sinnema, C. (2008). *Effective pedagogy in social sciences/tikanga a iwi: Best evidence synthesis.* Wellington, New Zealand: Ministry of Education.

Alderman, M. (2004). *Motivation for achievement: Possibilities for teaching and learning*. NJ: Erlbaum.

Alderman, M. (2008). *Motivation for achievement: Possibilities for teaching and learning*. New York, NY: Routledge.

Aleksiuk, M. (1996). *Power therapy: Maximizing health through self-efficacy*. Seattle, WA: H & H.

Alexander, P. (2006). *Psychology in learning and instruction*. New York, NY: Pearson.

Alison, J. (2008). The NCEA and how we got there: The role of PPTA in school qualification reform 1980-2002. *New Zealand Journal of Teachers' Work, 5*(2), 119-138. Retreived from Education Research Complete database.

Alton-Lee, A. (2003). *Quality teaching for diverse students in schooling: Best evidence synthesis*. Wellington, New Zealand: Ministry of Education.

Andrade, H., & Valtcheva, A. (2009). Promoting learning and achievement through self-assessment. *Theory Into Practice, 48*, 12-19. doi: 10.1080/00405840802577544

Andrade, H., Wang, X., Du, Y., & Akawi, R. (2009). Rubric-Referenced Self-Assessment and Self-Efficacy for Writing. *Journal of Educational Research, 102*(4), 287-301. doi: 10.3200/JOER.102.4.287-302

APA Work Group. (1997). *Learner-centred psychological principles: A framework for school reform and design.* WA: Board of Educational Affairs.

Artzt, A., Armour-Thomas, E., & Curcio, F. (Eds.). (2008). *Becoming a reflective mathematics teacher: A guide for observations and self-assessment*. London, England: Erlbaum.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. NJ: Prentice-Hall.

Bandura, A. (1992). Exercise of personal agency through the self-efficacy mechanism. In R. Schwarzer (Ed.), *Self-efficacy: Thought control of action* (pp 3-38). WA: Hemisphere.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. USA: W. H. Freeman.

Bangert-Drowns, R., Kulik, C., Kulik, J., & Morgan, M. (1991). Instructional effect of feedback in test-like events. *Review of Educational Research, 61*(2), 213-238. doi: 10.3102/00346543061002213

Bassey, M. (1999). *Case study research in educational settings*. Buckingham, England: Open University Press.

Berg, B. (2009). *Qualitative research methods for the social sciences* (7th ed.). Boston, MA.: Pearson.

Berman, M. (n.d.). Two archetypes from http://quotes.dictionary.com/search/epistemology?rh=www.google.co.nz&__utma=1.213122836.1307465461.1307465461.1308003400.2&__utmb=1.2.9.1308003399798&__utmc=1&__utmx=-&__utmz=1.1308003400.2.2.utmcsr=google|utmccn=(organic)|utmcmd=organic|utmctr=epistemology%20definition&__utmv=-&__utmk=140053171

Bishop, R. (2008). A culturally responsive pedagogy of relations. In C. McGee & D. Fraser (Eds.), *The professional practice of teaching* (pp. 154-171). North Shore, New Zealand: Cengage Learning.

Black, P., Harrison, C., Lee, C., Marshall, B., & Wiliam, D. (2003). *Assessment for learning: Putting it into practice*. PA: Open University.

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education, 5*(1), 7-75. Retrieved from Academic Search Planner database.

Black, P., & Wiliam, D. (2003). 'In praise of educational research': Formative assessment. *British Educational Research Journal, 29*(5), 623-637. Retrieved from Psychology and Behavioural Sciences Collection database.

Black, P., & Wiliam, D. (2006). Developing a theory of formative assessment. In J. Gardner (Ed.), *Assessment and learning* (pp. 81-100). London, England: Sage.

Blumer, H. (1969). *Symbolic interactionism: Perspective and method.* NJ: Prentice-Hall.

Boud, D. (1995a). *Enhancing learning through self-assessment*. London, England: Kogan Page.

Boud, D. (1995b). *Implementing student self-assessment*. Australia: Higher Education Research and Development Society of Australasia Inc.

Boud, D. (2000). Sustainable assessment: Rethinking assessment for the learning society. *Studies in Continuing Education, 22*(2), 151-167. doi: 10.1080/01580379950177314

Bourke, R. (2000). *Students' conceptions of learning and self-assessment in context* (Unpublished doctoral dissertation). Massey University, Palmerston North, New Zealand.

Bourke, R. (2008). What students can teach us about learning. In A. St. George & R. Bourke (Eds.), *Facing the big questions in education: Purpose, power and learning* (pp. 155-164). Australia: Cengage.

Brookhart, S. (2008). *How to give effective feedback*. Alexandria, VA: Association for Supervision and Curriculum Development.

Brophy, J. (2010). *Motivating students to learn* (3rd ed.). New York, NY: Routledge.

Brown, G. (2008). *Conceptions of assessment: Understanding what assessment means to teachers and students.* New Zealand: Nova Science.

Brown, G., Irving, E., & Keegan, P. (2008). *An introduction to educational assessment, measurement, and evaluation* (2nd ed.). North Shore, New Zealand: Pearson Education.

Butler, R. (1988). Enhancing and undermining intrinsic motivation: The effects of task involving and ego-involving evaluation on interest and involvement, *British Journal of Educational Psychology,* 58, 1-14.

Caccioppoli, P., & Cullen, R. (2006). *Māori education.* New Zealand: Kotahi.

Carr, M., & Kemmis, S. (2005). Staying critical: Becoming critical in retrospect. *Educational Action Research Journal, 13*(3), 347-358.

Casas, M. (2011). *Enhancing student learning in middle school*. New York, NY: Routledge.

Cassidy, D. (2007). Assessing "inexperienced" students' ability to self-assess: Exploring links with learning styles and academic personal control. *Assessment and Evaluation in Higher Education, 32*(3), 313-330. doi: 10.1080/02602930600896704

Chemers, M., Li-tze, H., & Garcia, B. (2001). Academic self-efficacy and first-year college student performance and adjustment. *Journal of Educational Psychology, 93*(1), 55-64.

Clarke, S. (2009). *Formative assessment in the secondary classroom*. Great Britain: Hodder Murray.

Clarke, S., Timperley, H., & Hattie, J. (2003). *Unlocking formative assessment*. New Zealand: Hodder Moa Beckett.

Corno, L. (2008). Work habits and self-regulated learning. In D. Schunk & B. Zimmerman (Eds.), *Motivation and self-regulated learning: Theory, research, and applications* (pp. 197-217). New York, NY: Erlbaum.

Covington, M. (1992). *Making the grade: A self-worth perspective on motivation and school reform*. USA: Cambridge University.

Cresswell, J., Hanson, W., Clark Plano, V., & Morales, A. (2007). Qualitative designs: Selection and implementation. *The Counseling Psychologist, 58*(4), 438-481.

Cromey, A. (2000). Using student assessment data: What can we learn from schools? *Policy Issues, 6,* 2-13.

Crooks, T. (1988). The impact of classroom evaluation practices on students. *Review of Educational Research, 4*, 438-481. Retrieved from http://www.jstor.org.ezproxy.massey.ac.nz/stable/1170281

Crooks, T., Darr, C., Gilmore, A., Hall, C., Hattie, J., Smith, J., & Smith, L. (2009). *Toward defining, assessing, and reporting against national standards for literacy and numeracy in New Zealand.* The New Zealand Assessment Academy.

Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process.* Australia: Allen & Unwin.

Davies, A., & Hill, M. (2009). *Making assessment work*. Wellington: NZCER.

Deemer, S. (2010). Using action research methodology to unite theory and practice. In G. Goodman (Ed.), *Educational psychology reader: The art and science of how people learn* (pp. 517-521). New York, NY: Peter Lang. Retrieved from ERIC database.

Denscombe, M. (1998). *The Good Research Guide*. PA: Open University Press.

Denzin, N., & Lincoln, Y. (Eds). (1994). *Handbook of qualitative research.* London, England: Sage.

Dweck, C. (1986). Motivational processes affecting learning. *American Psychologist, 41*(10), 1040-1048. doi: 10.1037/003-066x.41.10.1040

Dweck, C. (2000). *Self theories: Their role in motivation, personality and development.* PA: Psychology Press.

Dweck, C. (2002). Messages that motivate: How praise molds students' beliefs, motivation, and performance (in surprising ways). In J. Anderson (Ed.), *Improving academic achievement* (pp. 37-60). San Diego, CA: Academic Press.

Education Review Office. (2009). *Supplementary review: Tokoroa High School.*

Eisenberger, J., Conti-D'Antonio, M., & Bertrando, R. (2005). *Self-efficacy: Raising the bar for all students* (2nd ed.). Larchmont, NY: Eye on Education.

Elliot, J. (1994). Research on teachers' knowledge and action research. *Educational Action Research, 2*(1), 133-137.

Elliot, J. (2005). Becoming critical: The failure to connect. *Educational Action Research, 13*(3), 359-374

Ezzy, D. (2002). *Qualitative analysis: Practice and innovation*. Australia: Allen & Unwin.

Foulger, T. (2010). External conversations: An unexpected discovery about the critical friend in action research inquiries. *Educational Action Research, 8*(2), 135-152.

Gage, N., & Berliner, D. (1998). *Educational psychology* (6th ed.). New York, NY: Houghton Mifflin.

Gardner, J. (2006). *Assessment and learning*. London, England: Sage.

Gillham, B. (2000). *Case study research methods.* London, England: Continuum.

Ginsberg, M. (2005). Cultural diversity, motivation and differentiation. *Theory into practice, 44*(3), 218-225. doi: 10.1207/s15430421tip4403_6

Good, T., & Brophy, J. (2010). *Looking into classrooms*. USA: Addison-Wesley.

Guilfoyle, A. (2008). Embedding indigenous content into qualitative research in psychology in reflective case studies. In J. Cross, L. McCormack, & J. Renner, *Sustainability in higher education: Directions for change.* EDU - COM conference proceedings 19-21 November, 2008 (pp. 201-211). Perth: Edith Cowan University.

Hall, K., & Burke, W. (2003). *Making formative assessment work.* Berkshire, England: Open University Press.

Hansen, S. (2000). *Gender differences and writing: Self-efficacy beliefs, attitudes, preferences and perceptions* (Unpublished master's thesis). Massey University, Palmerston North, New Zealand.

Harding, S. (1987). *Feminism and methodology.* IN: Indiana University Press.

Hareli, S., & Hess, U. (2008). When does feedback about success at school hurt? The role of causal attributions. *Social Psychology of Education, 11*, 259-272. doi: 10.1007/s11218-008-9059-x

Harlen, W. (2005). Teachers' summative practices and assessment for learning - tensions and synergies. *The Curriculum Journal, 16*(2), 207-223. doi: 10.1080/09585170500136093

Harlen, W. (2006). The role of assessment in developing motivation for learning. In J. Gardner (Ed.), *Assessment and learning* (pp. 61-80). London, England: Sage.

Harlen, W., & Deakin Crick, R. (2002). *A systematic review of the evidence of the impact on students, teachers and the curriculum of the process of using assessment by teachers for summative purposes.* London, England: University of London.

Harlen, W., & Deakin Crick, R. (2003). Testing and motivation for learning. *Assessment in Education, 10*(2), 169-206. doi: 10.1080/0969594032000121270

Harris, L., Irving, S., & Peterson, E. (2008). *Secondary teachers' conceptions of the purpose of assessment and feedback.* Paper presented at the Australian Association for Research in Education, Brisbane, Australia.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London, England: Routledge.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*, 81-112. doi: 10.3102/003465430298487

Hill, M. (2008). Using classroom assessment for effective learning and teaching. In C. McGee & D. Fraser (Eds.), *The professional practice of teaching* (pp. 136-153). North Shore, New Zealand: Cengage.

Hipkins, R. (2006). *What it might take to implement the key competencies: Some issues to consider.* NZCER. Retrieved from http://nzcurriculum.tki.org.nz/Digital-stories/Case-studies/Key-competencies-exploratory-studies-2006

Hipkins, R., Vaughan, K., Beals, F., & Ferral, H. (2004). *Learning curves: Meeting student learning needs in an evolving qualifications regime.* Wellington, New Zealand: NZCER. Retrieved from http://www.nzcer.org.nz/pdfs/12798.pdf

Huang, H. (2010). What is good action research?: Why the resurgent interest? *Action Research, 8*(1), 93-109.

Jackson, J. (2002). Enhancing self-efficacy and learning performance. *Journal of Experimental Education, 70*(3), 243-254. Retrieved from Psychology and Behavioural Sciences Collection database.

Kabernick, S., & Newman, R. (Eds.). (2006). *Help seeking in academic settings: Goals, groups, and contexts*. NJ: Erlbaum.

Kahu, E. (2008). Feedback: The heart of good pedagogy. *New Zealand Annual Review of Education 17*, 187-197.

Kearney, A., Bevan-Brown, J., Haworth, P., & Riley, T. (2008). Inclusive education: Looking through the kaleidoscope of diversity. In A. St. George, S. Brown & J. O'Neill (Eds.), *Facing the big questions in teaching: Purpose, power and learning* (pp. 110-120). Australia: Cengage.

Kemmis, S. (2006). Participatory action research and the public sector. *Educational Action Research, 14*(4), 459-476.

Kemmis, S., & McTaggart, R. (1988). *The Action Research Planner* (2nd ed). Geelong, Australia: Deakin University Press.

Kobus, T., Maxwell, L., & Provo, J. (2008). *Increasing motivation of elementary and secondary school students through positive reinforcement, student self-assessment, and creative engagement.* (Master's thesis, Saint Xavier University, Chicago, Illinois). Retrieved from http://www.eric.ed.gov.ezproxy.massey.ac.nz/PDFS/ED498971.pdf

Latu, V. (2010). *There is more to learning mathematics than mathematics: Attributional beliefs and motivation of Maori and Pacific Island students.* Retrieved from http://www.merga.net.au/documents/RP402004.pdf

Leach, L., Neutze, G., & Zepke, N. (2001). Assessment & empowerment: Some critical questions. *Assessment and Evaluation in Higher Education, 26*(4), 293-305. doi: 10.1080/02602930120063457

Lebler, D. (2007). Student-as-master? Reflections on a learning innovation in popular music pedagogy. *International Journal of Music Education, 25*(3), 205-221. doi: 10.1177/0255761407083575

Lopez, M. (2008). Complexity and participation: The path of strategic intervention. *Interdisiciplinary Science Review, 33*(2), 153-177.

Lord, P. (2005). *Learner motivation: An international perspective*. Retrieved from www.inca.org.nz

Maddux, J. (1995). Self-efficacy theory: An introduction. In J. Maddux (Ed.), *Self-efficacy , adaptation, and adjustment: Theory, research, and application* (pp. 3-36). New York, NY: Plenum.

Maddux, J., & Lewis, J. (1995). Self-efficacy and adjustment: Basic principles and issues. In J. Maddux (Ed.), *Self-efficacy, adaptation, and adjustment: Theory, research, and application* (pp. 37-68). New York, NY: Plenum.

Maddux, J., & Meier, J. (1995). Self-efficacy and depression. In J. Maddux (Ed.), *Self-efficacy, adaptation and adjustment* (pp. 143-169). New York, NY: Plenum.

Mangels, J., Butterfield, B., Lamb, J., Good, C., & Dweck, C. (2006). Why do beliefs about intelligence influence success? A social cognitive neuroscience model. *Social Cognitive and Affective Neuroscience, 1*, 75-86. doi: 10.1093/scan/ns1013

Margalit, M. (2010). *Lonely children and adolescents: Self-perceptions, social exclusion, and hope.* New York, NY: Springer.

McCarthy, P., Meier, S., & Rinderer, R. (1985). Self-efficacy and writing: A different view of self-evaluation. *College composition and communication, 36*(4), 465-471. Retrieved from http://www.jstor.org.ezproxy.massey.ac.nz/stable/357865

McMillan, J., & Wergin, J. (Eds.). (2010). *Understanding and evaluating educational research* (4th ed.). Boston, MA: Pearson.

McNiff, J., & Whitehead, J. (2006). *All You Need to Know About Action Research. London: Sage.*

Meyer, L., Weir, K., McClure, J., Wakley, F., & McKenzie, L. (2009). *Motivation and achievement in secondary school - The relationship between NCEA and student motivation and achievement: A three-year follow-up.* Wellington, NZ: Victoria University of Wellington.

Mills, G. (2007). *Action research: A guide for the teacher researcher* (3rd ed.). NJ: Pearson.

Ministry of Education. (1994). *Assessment: Policy and Practice.* Wellington: Learning Media.

Ministry of Education. (2007). *The New Zealand curriculum.* Wellington: Learning Media.

New Zealand Ministry of Education. (2010). *Position paper: Assessment [schooling sector].* Retrieved from http://www.minedu.govt.nz/theMinistry/PublicationsAndResources/AssessmentPositionPaper.aspx

Nbina, J., & Viko, B. (2010). Effect Of Instruction In Metacognitive Self-assessment Strategy On Chemistry Self-efficacy AndAchievement Of Senior Secondary School Students In Rivers State, Nigeria. *Academic Leadership Journal, 8*(4). Retrieved from http://www.academicleadership.org/issue/Fall-2010

Ng, J., & Earl, J. (2008). Accuracy in self-assessment: The role of ability, self-efficacy, feedback and goal orientations. *Australian Journal of Career Development, 17*(3), 39-50.

Noffke, S. (1992). The work and workplace of teachers in action research. *Teaching & Teacher Education, 8*(1), 15-29.

Nuthall, G. (2007). *The hidden lives of learners.* Wellington, New Zealand: NZCER.

Organisation for Economic Cooperation and Development (OECD). (2005). *Formative assessment: Improving learning in secondary classrooms.* Retrieved June 19, 2010 from http://www.oecd.org/dataoecd/32/0/34221065.pdf

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research, 66*(4), 543-578. Retrieved from http://www.jstor.org.ezproxy.massey.ac.nz/stable/1170653

Pajares, F. (2008). Motivational role of self-efficacy beliefs in self-regulated learning. In D. Schunk & B. Zimmerman (Eds.), *Motivation and self-regulated learning: Theory, research, and applications* (pp. 111-139). New York, NY: Erlbaum.

PISA (2009). Retrieved 19 February, 2010 from www.oecd.org

Poskitt, J. (1994). *Research as learning: The realities of action research in a New Zealand individualised learning programme* (Unpublished doctoral dissertation). Massey, Palmerston North, New Zealand.

Pyrch, T. (2007). Participatory action research and the culture of fear: Resistance, community, hope and courage. *Action Research, 5*(2), 199-216.

Rawlins, P. (2008). Unlocking the formative potential of NCEA. *New Zealand Journal of Teachers' Work, 5*(2), 105-118. Retreived from Education Research Complete database.

Rawlins, P., Brandon, J., Chapman, J., Leach, L., Neutze, G., Scott, A., & Zepke, N. (2005). Standards-based assessment in the senior secondary school: A review of the literature. *New Zealand Journal of Teachers' Work, 2*(2), 107-115. Retrieved from http://www.teacherswork.ac.nz/journal/volume2_issue2/rawlins.pdf

Rawlins, P., & Poskitt, J. (2008). Assessment for learning and teaching. In A. St. George, S. Brown & J. O'Neill (Eds.), *Facing big questions in teaching: Purpose, power and learning* (pp. 42-50). Victoria, Australia: Cengage.

Retnowati, E. (2010). Worked example effects in individual and group work settings. *Educational Psychology, 30*(3), 349-367.

Roeser, R., Peck, S., & Nasir, N. (2006). Self and identity processes in school motivation, learning and achievement. In P. Alexander & P. Winne (Eds.), *Handbook of educational psychology* (pp. 391-419). NJ: Erlbaum.

Ross, J., & Starling, M. (2008). Self-assessment in a technology-supported environment: The case of grade 9 geography. *Assessment in Education: Principles, Policy & Practice 15* (2), 183-199. doi: 10.1080/09695940802164218

Ryan, R., & Deci, E. (2000). Intrinsic motivation and extrinsic motivation: Classic definitions and new directions. *Contemporary Educational Psychology, 25*, 54-67. doi: 10.1006/ceps.1999.1020

Sadler, P., & Good, E. (2006). The impact of self and peer grading on student learning. *Educational Assessment, 11*(1), 1-31. doi: 10.1207/s15326977ea1101_1

Sadler, R. (1989). Formative assessment and the design of instructional systems. *Instructional Science, 18*, 119-144. doi: 10.1007/BF00117714

Sadler, R. (2009). Indeterminacy in the use of preset criteria for assessment and grading. *Assessment and Evaluation in Higher Education, 34*(2), 159-179. doi: 10.1080/02602930801956059

Schmidt-Weigand, F., Hanze, M., & Wodzinski, R. (2009). Complex problem solving and worked examples: The role of prompting strategic behaviour and fading-in solution steps. *Zeitschrift fur Padagogische Psychologie, 23*(2), 129-138.

Schmuck, R. (2006). *Practical action research for change.* CA: Corwin Press.

Schunk, D. (1995). Self-efficacy and education and instruction. In J. Maddux (Ed.), *Self-efficacy, adaptation, and adjustment: Theory, research and application* (pp. 281-304). New York, NY: Plenum.

Schunk, D. (2000). *Learning theories: An educational perspective* (3rd ed.). NJ: Pearson.

Schunk, D. (2004). *Learning theories: An educational perspective* (4th ed.). NJ: Pearson.

Schunk, D., Pintrich, P., & Meece, J. (2008). *Motivation in education: Theory, research and application.* NJ: Pearson.

Sebba, J. (2006). Policy and practice in assessment for learning: The experience of selected OECD countries. In J. Gardner (Ed.), *Assessment for learning* (pp. 185-196). London, England: Sage.

Seifert, T. (2004). Understanding student motivation. *Educational Review, 46*(2), 137-149.

Serra, M., & Metcalfe, J. (2009). Effective implementation of metacognition. In D. Hacker, J. Dunloskey & A. Graesser (Eds.), *Handbook of metacognition in education* (pp. 278-298). New York, NY: Routledge.

Sewell, A., & St. George, A. (2008). The classroom as a community of learners. In C. McGee & D. Fraser (Eds.), *The professional practice of teaching (3rd ed.)* (pp. 204-220). Melbourne: Cengage Learning.

Silverman, D. (1993). *Interpreting qualitative data: Methods for analysing talk, text and interaction.* London, England: Sage.

Smith, R. (1989). Effects of coping skills training on generalized self-efficacy and locus of control. *Journal of Psychology and Social Psychology, 56*, 228-233. doi: 10.1037/0022-3514.56.2.228

Sobral, D. (1997). Improving learning skills: A self-help group approach. *Higher Education, 33*(1), 39-50. Retrieved from http://www.jstor.org/stable/3448311

Somekh, B., & Zeichner, K. (2009). Action research for educational reform: Remodelling action research theories and practices in local contexts. *Educational Action Research, 17*(1), 5-21.

St. George, A., & Bourke, R. (2008). Understanding learning to inform teaching. In A. St. George, S. Brown & J. O'Neill (Eds.), *Facing the big questions in teaching: purpose, power and learning* (pp. 123-133). Australia: Cengage.

St. George, A., & Riley, T. (2008). Motivation and learning: Can I do it? Do I want to? In A. St. George, S. Brown & J. O'Neill (Eds.), *Facing the big questions in education: Purpose, power and learning* (pp. 144-154). Australia: Cengage.

Stanton, R. (1999). *The effects of attributional feedback on perceived self-efficacy and achievement* (Unpublished master's thesis). Palmerston North, New Zealand: Massey University.

Stipek, D. (2002). *Motivation to learn: Integrating theory & practice.* (4th ed.). MA: Pearson.

Strategy & System Performance Group, (2009). *Indicators live: Education at a glance 2009, results for New Zealand.* Ministry of Education. Retrieved 12 April, 2010 from http://www.educationcounts.govt.nz/publications/schooling/56219/5

Tan, K. (2004). Does student self-assessment empower or discipline students? *Assessment & Evaluation in Higher Education 29*(6), 651-662. doi: 10.1080/0260293042000227209

Tan, K. (2009). Meanings and practices of power in academics' conceptions of student self-assessment. *Teaching in Higher Education 14*(4), 361-373. doi: 10.1080/13562510903050111

Tan, K., Teo, C., & Ng, C. (2011). Varition in students' conceptions of self-assessment and standards. *Education Research International 2011,* 1-8. doi: 10.1155/2011/487130

Taras, M. (2008). Issues of power and equity in two models of self-assessment. *Teaching in Higher Education 13*(1), 81-92. doi: 10.10801356251070179407 6

Tobias, S., & Everson, H. (2009). The importance of knowing what you know: A knowledge monitoring framework for studying metacognition in education. In D. Hacker, J. Dunloskey & A. Graesser (Eds.), *Handbook of metacognition in education* (pp. 107-128). New York: Routledge.

Walsh, J., & Sattes, B. (2005). *Quality questioning: Research-based practice to engage every learner.* Thousand Oaks, CA.: Corwin Press/AEL.

Webb, N., Ing, M., Dersting, N., & Neme, K. (2006). Help-seeking in cooperative learning groups. In S. Kabernick & R. Newman (Eds.), *Help seeking in academic settings* (pp. 45-88). Mahwah, NJ: Erlbaum.

Weiner, B. (2000). Intrapersonal and interpersonal theories of motivation from an attributional perspective. *Educational Psychology Review, 12*(1). Retrieved from Psychology and Behavioural Sciences Collection database.

Welcome to the NZQA website. Retrieved from http://www.nzqa.govt.nz/

Wigfield, A., & Eccles, J. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology, 25*, 68-81. doi: 10.1006/ceps.1999.1015

Williams, L. (1995). Self-efficacy, anxiety, and phobic disorders. In J. Maddux (Ed.), *Self-efficacy, adaptation and adjustment: Theory, research and application* (pp. 69-108). New York Plenum.

Wilson, D. (2007). *Peer and Self- Assessment in Written Language: Strategies for Motivation and Achievement.* (Unpublished master's thesis). Massey University, Palmerston North, New Zealand.

Winne, P., & Hadwin, A. (2008). The weave of motivation and self-regulated learning. In D. Schunk & B. Zimmerman (Eds.), *Motivation and self-regulated learning: Theory, research, and applications* (pp. 297-314). New York, NY: Erlbaum.

Zimmerman, B. (1996). Enhancing student academic and health functioning: A self-regulatory perspective. *School Psychology Quarterly, 11*(1), 47-66.

Zimmerman, B. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology Reader, 25*, 82-91. doi: 10.1006/ceps.1999.1016

Zimmerman, B., Bonner, S., & Kovach, R. (1996). *Developing self-regulated learners: Beyond achievement to self-efficacy.* WA: American Psychological Association.

Zimmerman, B., & Moylan, A. (2009). When metacogniton and motivation intersect. In D. Hacker, J. Dunloskey & A. Graesser (Eds.), *Handbook of metacognition in education* (pp. 299-315). New York, NY: Routledge.

Appendix A

Intervention One

Lesson topic: Find and simulate derivatives and integrals

Learning Objectives:

1. Recognise the importance of working through problems in a systematic way
2. Work through problems on normal distribution according to a modelled example
3. Use own worked problems to purposefully seek out feedback on learning progress

Lesson Outline

Introduction: Do Now

1. What is something that you are good at?
2. Write down at least three things that you did or do to be good at it
3. For each of these three things what could you do in learning maths that would make you good?

Body:

1. Discuss students' answers and draw out principles of practice, modelling, encouragement
2. Focus on following a model/good example… in maths context need a good worked example to compare our work with
3. Formal notes on differentiation (see other page) which students copy
4. Give problems on the board for students to work through using the worked example notes as a model. Students check their problems against the pattern of the worked example, checking that they have the same components in their working out. Then go through together on the board using the same pattern as the formal notes
5. Discuss how to purposefully see out feedback on their work
    - Look for what they have done **R**ight/the same as the worked example
    - Look for what they have done **W**rong
    - **R**edo the problem the correct way
    - Write in **W**ords a message to self re what you have to practice and focus on in the next problem to eliminate the error
6. Repeat this process for each kind of differentiation problem

Conclusion:

1. Identify the four steps that are involved in purposefully seeking out feedback (RWRW)
2. Think up four other words that could be used instead of Right Wrong Redo and Words that mean the same but may give something that is easier to remember

Appendix B

Intervention Two

Lesson topic: Find and use straightforward derivatives and integrals

Learning Objectives:

1. Identify achievement objectives for AS 90286 2.3
2. Understand achievement objectives for AS 90286 2.3
3. Select problems that match these achievement objectives
4. Work through problems

Lesson Outline

Introduction:

1. Students locate AOs using course outline (or Nulake workbook) - Hint: use "I can do" lists to help
2. Select those that relate to "achieve" AOs write it out in your own words
3. Find a problem in Nulake or in your workbook or another text that you think matches the AO you have chosen
4. Share/ discuss what you have done with one or two others

Body:

1. Using an AO chosen by one of the students, discuss what it means in 'student language'
2. Find problems together that match this AO
3. Using past assessments identify problems that relate to this AO, students work through it prior to:
    a. checking the answer together against marking schedule
    b. me going through it in worked example style on the board
4. Students then identify what they did right, what they did wrong and write down in words next to the problem what they need to learn, ideally in terms of the AO
5. Select a similar problem from another past NZQA assessment and repeat 3. For this problem
6. Repeat the process from 1 to 5 for each "achieve" AO
7. Check your mastery by getting another student to test you on all "achieve" AOs
8. Work through "achieve" section and once mastered go on to "merit' and "excellence"
9. Summarise what AOs they have covered during the lesson

Conclusion:

1. What AOs can you now identify in the form of a problem/s
2. What AOs can you now do in the form of a problem/s
3. Write down one thing that you need to work on to master one more AO

Appendix C

Intervention Three

Lesson Topic: Find and use straightforward derivatives and integrals

Lesson Objective:

1. Use assessment schedules to mark own work
2. Identify what you know in terms of AO and using schedule
3. Identify what you don't know in terms of AO and using schedule
4. Work out and write in words what you need to do to do better on the next practice test

Lesson format:

1. Describe purpose of the lesson and recap on 4 achievement criteria
2. Allow 30 minutes to complete assessment in test conditions
3. Put assessment schedule on screen and go through together discussing each problem and how to use the schedule, including judgement column and last column
4. Hand out assessment schedules and students go through their own paper again and mark using the schedule using tick and crosses
5. Determine where they are at re what problem did I need to get correct to get A M or E (depending where they are at) RWRW… right wrong redo words
6. Write comments with correct working next to the problem identified in 5
7. Find some of these problems and do at least 3 for homework

Conclusion:

1. Tomorrow you will be doing another part of a practice test
2. Write down your goal
3. Write down what you have to do in terms of learning to achieve that goal

Appendix D

Observation

2011-08-29 period 2 @ 10 am

During second day of third intervention… assessment in exam conditions followed by marking from schedules and putting feedback comments on their own papers

***absences from sports week (last week) now back to “normal” (context of notable absences over last few weeks according to teacher…and historical problem of absenteeism in the school).

Prior to practice test students given opportunity to work on problems they are targeting from yesterday’s practice assessment.

Students focused and engaged in process of identifying what they are working on/can do with specific achievement criteria at the start of the lesson prior to doing the test.

Students are working well together to help each other identify achievement criteria with specific problems and mastering how to do those problems.

Responded well to writing words on their assessments (most have written comments to self on papers) and to concept of feedback in incremental stages to target next step in learning - again in terms of achievement criteria.

After marking from schedules, students once again focused on and very engaged in identifying what they can do in terms of achievement criteria and also what achievement criteria they will work on for tomorrows test. A lot of peer tutoring is taking place at this stage as students work on filling the gaps in their learning. Students also using previous practice tests to revisit and work on same types of problems they are currently working on to cover learning gaps.

Once again students asked to keep tests to work on to revise for next practice test (unusual in this school to even contemplate preparation for a practice test).

Appendix E

Questionnaire

Name ……..

This survey is designed to get information on your understanding of feedback and to help me understand what makes you feel that you "can do" what is required for you to succeed in your learning. All responses will be kept in a secure place and information regarding your identity will be confidential.

1. How do you know if you are learning or not?

2. How do you find out what you already know and what you still need to learn?

3. Once you realise what you still don't know, what do you do to help make sure you can learn what you need to?

The following questions are about feedback. Feedback is information that tells you what you have already learned, what you still need to learn and how you can improve.

4. Do you think that feedback helps you to learn? Why or why not?

5. Do you want to get feedback when you are learning? Why or why not?

6. Do you get feedback when you are learning?

7. If you answered yes to question 6, where do you get feedback from?

8. Do you think you can get feedback for yourself from your own work?

9. If you answered yes to questions 8, what are some ways you might be able to get feedback for yourself from your own work?

10. Thinking of one thing that you do that you know you are good at, what is it that makes you feel that you can do it and be successful at it?

11. How do you think people get good at something?

12. Do you think you are good at maths? Yes, no or not sure?

13. If you answered yes to question 12, what helps you to feel that you are good at maths?

If you answered no to question 12, what makes you feel you are not good at maths?

In the following questions rate your degree of confidence by recording a number from 0 to 100 using the scale given below:

0 10 20 30 40 50 60 70 80 90 100

Cannot do at all *Moderately can do* *Highly certain can do*

14. How strong is your sense of "can do it" when learning new things in maths?

0 10 20 30 40 50 60 70 80 90 100

15. How strong is your sense of "can do it" with regard to learning what you need to in maths this year?

0 10 20 30 40 50 60 70 80 90 100

16. How good are you at seeking out and getting feedback on your learning?

0 10 20 30 40 50 60 70 80 90 100

17. How confident are you that you can accurately assess your own progress in maths?

0 10 20 30 40 50 60 70 80 90 100

18. How much do you think marking your own practice test papers from assessment schedules would help/helps your confidence to succeed in maths?

0 10 20 30 40 50 60 70 80 90 100

Not at all moderately a lot

19. What things help your sense of "can do it" in maths?

Use the numbers 1 – 10 to rank the following in order of importance (1 – most important, 2- second most important etc. to 10- least important). Use each number 1,2,3,4,5,6,7,8,9,10 only once.

20. What helps you to strengthen your sense of "can do it" in maths?

_____ You assess your own progress

_____ You work through problems

_____ You purposefully seek out feedback from practice tests

_____ You purposefully seek out feedback from normal classroom work

_____ You watch the teacher work through problems

_____ You mark your own tests using assessment schedules

_____ You do practice tests

_____ You do revision by practising problems on your own

_____ You work with a peer or peers on problems

_____ You work through problems and relate them to achievement criteria

Appendix F

Interview Schedule

This interview is designed to provide information on the value of relating achievement criteria to assessment problems, self-assessment using assessment schedules and how these relate to student sense of "can do it" (self-efficacy). The interview will be recorded and you will receive a copy of the transcript that you can add to or delete from. You may choose not to answer any of the questions. All responses will be kept in a secure place and information regarding your identity will be confidential.

1. **How do you feel about doing mathematics?**

2. **How do you feel about how good you are at mathematics?**

3. **What is it that makes you feel this way?**

4. **Describe what you have been doing differently in this particular topic?**

5. **Did the lesson/s on relating achievement criteria to assessment problems help you to learn?**

6. **If you answered yes to questions 5, how did it help you to learn?**

7. **Which is most helpful for giving yourself feedback on practice assessments?... ticks and crosses only, grades only (A.M E), comments on what to do to improve…other?**

8. **How does marking your own practice assessments using assessment schedules help you, if at all?**

9. **How would you rate your sense of "can do it" for this topic?**

10. **How much do you think assessing your own practice assessments using assessment schedules helps this?**

11. **How important do you think it is to be able to self-assess on order to learn what you need to learn to reach your learning goals?**

12. **What else have you found has helped you feel better at maths from any of the things we have done in class for this topic…or any other topic?**

Appendix G

Practice Assessment

You are advised to spend 35 minutes answering the questions in this booklet.

Assessor's use only

2.3 CALCULUS AND ROBERT'S GARDEN

Show any **derivatives** and **integrals** that you need to find when solving the problems.

QUESTION ONE

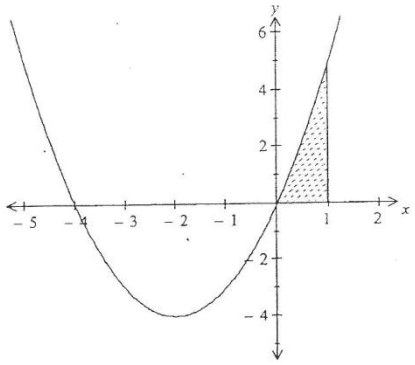
Find the gradient of the curve $y = 3x^2 + 5x - 7$ at the point where $x = 3$.

what I did wrong is that I forgot the $\frac{dy}{dx}$ but I got the right answer

QUESTION TWO

The graph shown below has the equation $y = x^2 + 4x$.

Calculate the shaded area.



$\int_0^1 (x^2+4x)\,dx$

$\left[\frac{x^3}{3} + \frac{4x^2}{2}\right]_0^1$

$\left[\frac{x^3}{3} + 2x^2\right]_0^1$

$\left(\frac{1}{3}^3 + 2(1)^3\right) - 0$

$= 2\frac{1}{3}$

I need to know how to do this problem

QUESTION THREE

Assessor's use only

The gradient function of a curve is $f'(x) = 4x^3 + 6x - 5$.
The curve passes through the point (1, 3).

- already differentiate
» integrate

Find the equation of the curve.

$\frac{4x^4}{4} + \frac{6x^2}{2} - 5x$

$1 + 9 - 5 + c$

$3 - 5 + c$

$c = -2$

-2

QUESTION FOUR

Find the x-coordinates of the two points on the graph $y = \frac{1}{3}x^3 - 2x^2$

where the gradient is 12.

Find x values, gradient is 12

$y = \frac{1}{3}x^3 - 2x^2$

$\frac{dy}{dx} = 3 \times \frac{1}{3}x^2 - 2 \times 2x^1$

$= x^2 - 4x$

$x^2 - 4x = 12$

$x^2 - 4x - 12 = 0$ equate poly

$(x - 6)(x + 2) = 0$

$x = 6 \quad x = -2$

x = -2		x = 6
-6	2	+

I need to learn or study over this problem on the weekend for testen Monday

Appendix H

Assessment Schedule

ASSESSMENT SCHEDULE: MATHS 2.3 ROBERT'S GARDEN

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT	Find and use derivatives and integrals	1	$\frac{dy}{dx} = 6x + 5$ At $x = 3$ the gradient is 23.	A	No alternative. Statement is not needed. Or equivalent.	**Achievement:** **Three** of Code **A**
		2	$\left[\frac{x^3}{3} + 2x^2\right]_0^1 = 2\frac{1}{3}$	A		
		3	$f(x) = x^4 + 3x^2 - 5x + c$ (1, 3): $-1 + c = 3$ $c = 4$ $f(x) = x^4 + 3x^2 - 5x + 4$	A	No alternative.	
		4	$\frac{dy}{dx} = x^2 - 4x$ $x^2 - 4x - 12 = 0$ $x = 6$ or -2	A	No alternative.	
MERIT	Apply calculus techniques to solve problems	5	$\frac{dy}{dx} = 2x - 5$ At (1, -7), $\frac{dy}{dx} = -3$ Equation: $3x + y + 4 = 0$	A M	Or equivalent.	**Merit:** Achievement **plus** **Two** of Code **M** **OR** **Three** of Code M
		6	$s = \int 0.3t.dt$ $= 0.15t^2 + c$ When $t = 0$, $s = 0$ so $c = 0$ $s = 0.15t^2$ When $t = 6$, $s = 5.4$ metres	A M	Or equivalent.	
		7	$\int_0^3 (9 - x^2)\,dx = 18$ $\int_3^4 (9 - x^2)\,dx = -3\frac{1}{3}$ Area of garden $= (4 \times 9 - 18) + 3\frac{1}{3} = 21\frac{1}{3}$	A A M	Accept alternative approaches. Or equivalent.	
EXCELLENCE	Apply differentiation techniques to solve optimisation problems	8	$V = 0.5x(40 - x)(60 - 2x)$ $\frac{dV}{dx} = 3x^2 - 140x + 1200 = 0$ $x = 11.315$ Maximum = 6065 cm^3	A M E	Students need to form the equation and use diff to solve the problem.	**Excellence:** Merit **plus** Code **E**

Appendix I

Massey University Human Ethics Approval Letter

MASSEY UNIVERSITY

31 May 2011

Taryn Johnson
11 Maunganui Road
MOUNT MAUNGANUI 3116

Dear Taryn

Re: HEC: Southern B Application – 11/29
Self-assessment: A means to enhance academic self-efficacy in Year 12 mathematics

Thank you for your letter dated 25 May 2011.

On behalf of the Massey University Human Ethics Committee: Southern B I am pleased to advise you that the ethics of your application are now approved. Approval is for three years. If this project has not been completed within three years from the date of this letter, reapproval must be requested.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely

Dr Nathan Matthews, Acting Chair
Massey University Human Ethics Committee: Southern B

cc Dr Peter Rawlins
School of Curriculum & Pedagogy
PN900

Dr Alison Kearney, HoS
School of Curriculum & Pedagogy
PN900

Mrs Roseanne MacGillivray
Graduate School of Education
PN900

Massey University Human Ethics Committee
Accredited by the Health Research Council
Te Kunenga ki Pūrehuroa
Research Ethics Office, Massey University, Private Bag 11222, Palmerston North 4442, New Zealand
T +64 6 350 5573 +64 6 350 5575 F +64 6 350 5622
E humanethics@massey.ac.nz animalethics@massey.ac.nz gtc@massey.ac.nz
www.massey.ac.nz

Appendix J

Request Letter to Board of Trustee for Research Approval

And Consent Form

Dear Board of Trustees members,

I am writing to request your permission to conduct research in one of the senior mathematics classes at Tokoroa High School. I am doing research into the effects of students' self-assessment on their sense of self-efficacy (i.e. their sense of feeling that they "can do" what is required to succeed in a particular area). I believe the more students know how to assess their own learning the more confident they are in their ability to succeed, and, as a result of this, they are more successful.

The research involves teaching students how to assess their own learning by marking their own practice tests using the assessment schedules that are normally used by teachers to mark student work. I want to look at the effect this has on their sense of feeling that they "can do" what is necessary to achieve their goals for the official assessments.

The project will be completed in phases. (See attached appendix for detail of interventions and phases/data collection.)

Project Recruitment and Invitation
I would like all students in the class to benefit from learning how to self-assess and so I would like to invite all students in the year 12 MAT class to participate in the research. This will enable me to look into the effects of learning how to self-assess on students who are achieving at different levels, and on students with different levels of self-efficacy.

Confidentiality
While confidentiality cannot be guaranteed, to help maintain confidentiality neither the names of individual students nor the school will be used in the thesis. There is also a clear expectation that all participants, including the researcher, will respect any information shared through the research process and will treat it with confidentiality. Neither the school nor any individuals will be identified either directly or indirectly in verbal or written form.

Participant's Rights
Students and parents are under no obligation to accept this invitation. Detailed information sheets will be given to parents and students clearly outlining their rights. Neither participation, nor non-participation will have an effect on grades.

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 11/29. If you have any concerns about the conduct of this research, please contact Dr Nathan Matthews, Acting Chair, Massey University Human Ethics Committee: Southern B, telephone 06 350 5799 x 8729, email humanethicsouthb@massey.ac.

I have asked Mr Ford to act as advisor for ethnic and cultural matters, which he has agreed to do. I will submit all documents that relate to the research to him before they are issued to participants.

If you are willing to give approval for the research as outlined above please sign the attached consent form and return it to me in the enclosed reply post-paid envelope.

Kind regards

Taryn Johnson
11 Maunganui Road
Mount Maunganui 3116 Email;tarynj22@gmail.com Phone; 0273023440

Appendix

Methodology for research project:

Self-assessment: A means to enhance academic self-efficacy in year 12 mathematics

Project Procedures and Data Collection

The project is an extension of the normal teaching and learning in the classroom and will take place over a 5 week period during June and July. The specific interventions will help students identify what they already know, what they need to learn and how to close any gaps in their learning. As the purpose of the project is to teach students how to self-assess the students themselves will receive the greatest benefit from the study. The data gathered will also be used to form the basis of my M.Ed thesis through Massey University.

Phase 1 - Questionnaire

Students will be invited to complete a questionnaire that will provide information on their understanding of what is involved in self-assessment, and to what extent they feel they can pass their mathematics assessments. This will take between 10 and 15 minutes.

Phase 2 – Interventions (see below for details)

The specific interventions will help students identify what they already know, what they need to learn and how to close any gaps in their learning. These will be in the form of lessons taught by me.

Phase 3 – Observations

Informal observations will be done of the class as a whole during their normal learning time. These observations will be done by me for the purpose of looking at the effects of the specific interventions. The interventions will involve me teaching three lessons. The first lesson teaches students how to set out and complete work in a way that makes it easier for them to identify what they are doing right, what they are doing wrong and how to improve where they need to. The second and third lessons help students to understand what is required of them in assessments and how to judge their own progress toward meeting assessment requirements.

Phase 4- Interviews

Students will also be invited to take part in the interview phase of the project. From those who indicate an interest, I will select six students with different levels of feelings of "can do it' according to the information provided in the questionnaires. Students who are to be interviewed will receive another consent form prior to the interviews. Interviews will take place at a time that is convenient for the student that does not disrupt their normal learning. Interviews will be recorded to help ensure accuracy. They will also receive a copy of the

transcribed interview to check that it is accurate. They can change or withdraw any information that is given.

Phase 5 – Questionnaire

This questionnaire is the same as the one in phase 1 and will be repeated at the end of the research to see if there has been a change in their feeling of confidence to pass as a result of the training in self-assessment.

Students practice assessments (photocopies) will also be collected to enable me to monitor any change that may result from the interventions. Not all students will have copies of their assessments collected. This will be done for a selection of students, depending on the information collected in the questionnaire.

Any student who chooses not to participate in the research will not be disadvantaged as they will receive the same lessons as the participants but their data will not be used for anything other than regular classroom learning. Students who choose non-participation do not have to give a reason for their choice. Participants can withdraw at any time and can choose to not answer particular questions in both the questionnaire and the interviews. Neither participation nor non-participation will affect grades.

Data that is collected will be stored in a secure place with Peter Rawlins, my supervisor, and will be destroyed after 5 years. On completion of the research a summary of the research findings will be available. Contact me by email or phone if you would like to receive a copy.

Intervention 1- Worked examples

This lesson teaches content with emphasis on working out problems using specific steps and specific setting out. The worked examples act as a template for students to use when doing their own problems. Students use the worked example/s to monitor their own progress as they work through each problem

Intervention 2 –Achievement criteria

This lesson focuses on teaching students how to understand and recognize the achievement criteria as they relate to individual problems. They will learn how to identify which skills they need to use to solve individual problems.

Intervention 3 – Self-assessment using assessment schedules.

This lesson involves students doing a practice assessment in exam conditions. Following the test they will be taught how to mark their own assessments using official assessment schedules.

CONSENT FORM – BOARD OF TRUSTEES

We have read the information pertaining to the study.

We agree to allow the researcher to conduct the research as described in the letter.

We understand that we can ask any questions at any time regarding the research.

We understand that the researcher will liaise with Mr Ford throughout the research process and that he will also act as advisor on ethnic and cultural matters.

Name: ……..

On behalf of the Tokoroa High School Board of Trustees I give permission for Taryn Johnson to conduct the research as described in the information letter.

Signature: ……..

Date: …….

Appendix K

Student Information Sheet[28]

Self-assessment: A means to enhance academic self-efficacy

INFORMATION SHEET FOR STUDENTS

Researcher Introduction

Hi, my name is Taryn Johnson. I have a Postgraduate Diploma in Education (teaching and learning) with distinction. I am HOD Mathematics at Tokoroa High School and am currently on study leave to complete my Master of Education.

I am doing research to see if when you can assess your own learning, you feel more confident that you can do well and pass. I believe the more you know how to assess your own learning the more confident you will be that you can succeed.

The research involves teaching you how to assess your learning by marking your own practice tests using the assessment schedules that are normally used by teachers.

The Principal, Mr. Willie Ford, and the Board of Trustees fully support this research project.

Project Recruitment and Invitation

I would like all students in this class to benefit from learning how to self-assess and so all students in this year 12 MAT class are invited to participate in the research. This will help me to look at the effect of being able to self-assess on students at different levels.

Project Procedures and Data Collection

The project will be part of the normal teaching and learning in the classroom and will take place over a 5 week period during June and July. The lessons will help you identify what you already know, what you need to learn and how to fix any gaps in your learning. You will receive the greatest benefit from the study because you will learn how to self-assess, which will benefit you throughout life. The data gathered will also be used to form the basis of my M.Ed thesis through Massey University.

The project will be completed in phases:

Phase 1 - Questionnaire

[28] This and all information sheets and consent forms were supplied on Massey University letterhead.

You will be invited to complete a questionnaire that will show me what you know about self-assessment and how confident you are about succeeding. This will take between 10 and 15 minutes

Phase 2 – Interventions

Specific lessons will help you identify what you know, what you need to learn and how to close any gaps in your learning.

Intervention 1- Worked examples

This lesson teaches content with emphasis on working out problems using specific steps and specific setting out. The worked examples act as a template for you to use when doing your own problems. You use the worked example/s to monitor your progress as you work through each problem

Intervention 2 –Achievement criteria

This lesson focuses on teaching you how to understand and recognize the achievement criteria as they relate to individual problems. Researcher and students look at past assessments on the smartboard and individual problems are identified with specific criteria. You then use the skills learned from intervention 1 to work through problems. The researcher works through each problem on the board/smartboard immediately after students.

Intervention 3 – Self-assessment using assessment schedules.

This lesson involves you doing a practice assessment in exam conditions. The researcher then puts the assessment on the screen. The researcher works through one problem. Following this the marking schedule is put on the screen. The entire paper is worked through one problem at time so you can ask about your own answers. Assessment schedules are then passed out one per student. You will work in pairs or individually if you prefer, marking your own paper using the schedule. The researcher moves around the class discussing what students are doing and giving guidance as needed. Papers are handed in at the end for the researcher to check mark. These are returned at the start of the next lesson prior to another practice assessment with students marking in pairs of individually. If you mark on your own you get a peer to check mark.

Phase 3 – Observations

Informal observations will be done of the class as a whole during your normal learning time. These observations will be done by me for the purpose of looking at the effects of the specific interventions. The interventions will involve me teaching three lessons. The first lesson teaches you how to set out and complete work in a way that makes it easier for you to identify what you are doing right, what you are doing wrong and how to improve where you need to. The second and third lessons help you to understand what is required of you in assessments and how to judge your own progress toward meeting assessment requirements.

Phase 4- Interviews

You will also be invited to take part in the interview phase of the project. From those who indicate an interest, I will select six students with different levels of feelings of “can do it’ according to the information provided in the questionnaires. Students who are to be interviewed will receive another consent form prior to the interviews. Interviews will take place at a time that is convenient for the student that does not disrupt your normal learning. Interviews will be recorded to help ensure accuracy. If you are interviewed, I will write out the interview from the

recording and give you a copy so that you can check that it is accurate. You can change or withdraw any information that is given.

Phase 5 – Questionnaire

This questionnaire is the same as the one in phase 1 and will be repeated at the end of the research to see if there has been a change in your feelings of confidence to pass as a result of the training in self-assessment.

Practice assessments (photocopies) will also be collected to enable me to monitor any change that may result from the interventions. Not all students will have copies of their assessments collected. This will be done for a selection of students, depending on the information collected in the questionnaire.

If you choose not to participate in the research you will not be disadvantaged. You will receive the same lessons as the participants but your data will not be used for anything other than regular classroom learning. If you choose non-participation, you do not have to give a reason for your choice. If you choose to participate, you can withdraw at any time and can choose to not answer particular questions in both the questionnaire and the interview. Neither participation nor non-participation will have an effect on grades.

Data that is collected will be stored in a secure place with Peter Rawlins, my supervisor, and will be destroyed after 5 years. On completion of the research a summary of the research findings will be available. Contact me by email or phone if you would like to receive a copy.

Confidentiality

While confidentiality cannot be guaranteed, to help maintain confidentiality neither the names of individual students nor the school will be used in the thesis. There is always a risk of a breach of confidentiality. I can give an assurance of confidentiality and anonymity to the extent allowed by law. There is a clear expectation that all participants, including the researcher, will respect any information shared through the research process and will treat it with confidentiality. Neither the school nor any individuals will be identified either directly or indirectly in verbal or written form. Any direct quotes that are used will have a pseudonym.. You will be using their own self-assessment information, with the support of the teacher, to improve their own learning.

Participant's Rights

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- be given access to a summary of the project findings when it is concluded;
- ask for the recorder to be turned off at any time during the interview;

completion and return of the questionnaire implies consent. You have the right to decline to answer any particular question.

Neither participation, nor non-participation will have an effect on grades.

Project Contacts

If you have any questions now or at any stage of the research you are invited to contact me or either of my supervisors.

Researcher: Taryn Johnson

phone: 027 548 2259

email: tarynj2011@live.com

Supervisors: Peter Rawlins

phone: 06 3569099 ext. 8855

email: P.Rawlins@massey.ac.nz

Alison Kearney

phone: 06 3569099 ext. 8704

email: A.C.Kearney@massey.ac.nz

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 11/29. If you have any concerns about the conduct of this research, please contact Dr Nathan Matthews, Acting Chair, Massey University Human Ethics Committee: Southern B, telephone 06 350 5799 x 8729, email humanethicsouthb@massey.ac.

Appendix L
Parent Information Sheet

Self-assessment: A means to enhance academic self-efficacy

INFORMATION SHEET FOR PARENTS AND CAREGIVERS

Researcher Introduction

Hi, my name is Taryn Johnson. I have a Postgraduate Diploma in Education (teaching and learning) with distinction. I am HOD Mathematics at Tokoroa High School and am currently on study leave to complete my Master of Education.

I am doing research into the effects of students' self-assessment on their sense of self-efficacy (i.e. their sense of feeling that they "can do" what is required to succeed in a particular area). I believe the when students know how to assess their own learning the more confidence they have. This leads to more success.

The research involves teaching students how to assess their own learning by marking their own practice tests in the same way the teacher would mark. I want to look at the effect this has on their sense of feeling that they "can do" what is necessary to achieve their goals for the official assessments.

The Principal, Mr. Willie Ford, and the Board of Trustees fully support this research project.

Project Recruitment and Invitation

I would like all students in the class to benefit from learning how to self-assess and so all students in the year 12 MAT class are invited to participate in the research. This will help to look at what happens to students feelings about being able to do the work when they know how to assess their own work..

Project Procedures and Data Collection

The project is an extension of the normal teaching and learning in the classroom and will take place over a 5 week period during June and July. What I plan to do with the students will help them identify what they already know, what they need to learn and how to fix any problems. As the purpose of the project is to teach students how to self-assess, the students themselves will

receive the greatest benefit from the study. The data gathered will also be used to form the basis of my M.Ed thesis through Massey University.

The project will be completed in phases:

Phase 1 - Questionnaire

Students will be invited to complete a questionnaire that will provide information on their understanding of what is involved in self-assessment, and to what extent they feel they can pass their mathematics assessments. This will take between 10 and 15 minutes.

Phase 2 – Interventions

The specific interventions will help students identify what they already know, what they need to learn and how to close any gaps in their learning. These will be in the form of lessons taught by me.

Intervention 1- Worked examples

This lesson teaches students how to work out problems using specific steps and specific setting out. The researcher works through examples on the board showing students how to do each step and how to set out the problem. Students copy the worked examples. Students use the worked example/s to monitor their own progress as they work through each problem. If their working fits the pattern of the worked example they know they are on track. If their working does not fit the pattern of the worked example they know they need to adjust what they are doing. Constant reference back to the worked example/s helps students to know if they are doing things right – and if they are not, it shows them what they need to do to fix the problem..

Intervention 2 –Achievement criteria

This lesson teaches students how to understand and recognize the achievement criteria as they relate to individual problems. Researcher and students look at past assessments on the smartboard and individual problems are identified with specific criteria. Students then use the skills learned from intervention 1 to work through problems. The researcher works through each problem on the board/smartboard immediately after students.

Intervention 3 – Self-assessment using assessment schedules.

This lesson involves students doing a practice assessment in exam conditions. The researcher then puts the assessment on the screen. The researcher works through one problem. Following this the marking schedule is put on the screen. The researcher and students then discuss the answer in terms of the assessment schedule. The entire paper is worked through in this manner one problem at time with students asking about their own answers. Assessment schedules are then passed out one per student. Students work in pairs or individually if they prefer, marking their own paper. Papers are handed in at the end for the researcher to check mark. These are returned at the start of the next lesson before the next practice assessment with students marking in pairs of individually. If they mark on their own they get a peer to check mark.

Phase 3 – Observations

Informal observations will be done of the class as a whole during their normal learning time. These observations will be done by me for the purpose of looking at the effects of the specific interventions described above.

Phase 4- Interviews

Students will also be invited to take part in the interview phase of the project. From those who indicate an interest, I will choose six students with different levels of feelings of “can do it’ according to the information provided in the questionnaires. These students will receive another consent form prior to the interviews. Interviews will take place during interval, lunchtime or after school. Interviews will be recorded to help ensure accuracy. I will write out the interview and give each student a copy for them to check. They can change or withdraw any information that is given.

Phase 5 – Questionnaire

This questionnaire is the same as the one in phase 1 and will be repeated at the end of the research to see if there has been a change in their feeling of confidence to pass as a result of the training in self-assessment.

Students practice assessments (photocopies) will also be collected to help me monitor any change that may result from the interventions. Not all students will have copies of their assessments collected. I will choose students based on the information collected in the questionnaire.

Any student who chooses not to participate in the research will not be disadvantaged as they will receive the same lessons as the participants but their data will not be used for anything other than regular classroom learning. Students who choose non-participation do not have to give a reason for their choice. Participants can withdraw at any time and can choose to not answer particular questions in both the questionnaire and the interviews. Neither participation nor non-participation will have an effect on grades.

Data that is collected will be stored in a secure place with Peter Rawlins, my supervisor, and will be destroyed after 5 years. On completion of the research a summary of the research findings will be available. Contact me by email or phone if you would like to receive a copy.

Confidentiality

While confidentiality cannot be guaranteed, to help maintain confidentiality neither the names of individual students nor the school will be used in the thesis. When any research is conducted there is always a risk of a breach of confidentiality. I can only give an assurance of confidentiality and anonymity to the extent allowed by law. However, there is a clear

expectation that all participants, including the researcher, will respect any information shared through the research process and will treat it with confidentiality. Neither the school nor any individuals will be identified either directly or indirectly in verbal or written form.

Participant's Rights

You and your student are under no obligation to accept this invitation. If you and your student decide to participate, you and your student have the right to:

- decline to answer any particular question;
- withdraw from the study;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- be given access to a summary of the project findings when it is concluded;
- ask for the recorder to be turned off at any time during the interview;
- completion and return of the questionnaire implies consent. Your student has the right to decline to answer any particular question.

Project Contacts

If you have any questions now or at any stage of the research you are invited to contact me or either of my supervisors.

Researcher: Taryn Johnson

phone: 027 548 2259

email: tarynj2011@live.com

Supervisors: Peter Rawlins

phone: 06 3569099 ext. 8855

email: P.Rawlins@massey.ac.nz

Alison Kearney

phone: 06 3569099 ext. 8704

email: A.C.Kearney@massey.ac.nz

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 11/29. If you have any concerns about the conduct of this research, please contact Dr Nathan Matthews, Acting Chair, Massey University Human Ethics Committee: Southern B, telephone 06 350 5799 x 8729, email humanethicsouthb@massey.ac

Appendix M

Teacher Information Sheet

Self-assessment: A means to enhance academic self-efficacy

INFORMATION SHEET FOR TEACHER

Researcher Introduction
Hi, my name is Taryn Johnson. I have a Postgraduate Diploma in Education (teaching and learning) with distinction. I am HOD Mathematics at Tokoroa High School and am currently on study leave to complete my Master of Education.

I am doing research into the effects of students' self-assessment on their sense of self-efficacy (i.e. their sense of feeling that they "can do" what is required to succeed in a particular area). I believe the more students know how to assess their own learning the more confident they are in their ability to succeed, and, as a result of this, they are more successful.

The research involves teaching students how to assess their own learning by marking their own practice tests using the assessment schedules that are normally used by teachers to mark student work. I want to look at the effect this has on their sense of feeling that they "can do" what is necessary to achieve their goals for the official assessments.

The Principal, Mr. Willie Ford, and the Board of Trustees fully support this research project.

Project Recruitment and Invitation
I would like all students in the class to benefit from learning how to self-assess and so I would like to invite all students in the year 12 MAT class to participate in the research. This will enable me to look into the effects of learning how to self-assess on students who are achieving at different levels, and on students with different levels of self-efficacy.

Project Procedures and Data Collection
The project is an extension of the normal teaching and learning in the classroom and will take place over a 5 week period during June and July. The specific interventions will help students identify what they already know, what they need to learn and how to close any gaps in their learning. As the purpose of the project is to teach students how to self-assess the students themselves will receive the greatest benefit from the study. The data gathered will also be used to form the basis of my M.Ed thesis through Massey University.

The project will be completed in phases:

Phase 1 - Questionnaire

Students will be invited to complete a questionnaire that will provide information on their understanding of what is involved in self-assessment, and to what extent they feel they can pass their mathematics assessments. This will take between 10 and 15 minutes.

Phase 2 – Interventions
The specific interventions will help students identify what they already know, what they need to learn and how to close any gaps in their learning. These will be in the form of lessons taught by me.

Intervention 1- Worked examples

This lesson teaches content with emphasis on working out problems using specific steps and specific setting out. The researcher works through examples on the board/smartboard showing students how to do each step and how to set out the problem. Students copy the worked examples. The worked examples act as a template for students to use when doing their own problems. Students use the worked example/s to monitor their own progress as they work through each problem. If their working fits the pattern of the worked example they know they are on track. If their working digresses from the worked example they know they need to adjust what they are doing. Constant reference back to the worked example/s enables students to get meaningful feedback on their own learning. This meaningful feedback enables them to recognize what they have done right, what they have done wrong and what they need to do to correct their mistake. This in turn enables them to move forward in their learning.

This researcher will teach this during the same lesson as and immediately after she administers the initial questionnaire.

Intervention 2 –Achievement criteria

This lesson focuses on teaching students how to understand and recognize the achievement criteria as they relate to individual problems. The lesson takes place after students have learned the content. Each achievement criterion is related to individual problems. Researcher and students then look at past assessments on the smartboard and individual problems are identified with specific criteria. Students then use the skills learned from intervention 1 to work through problems The researcher works through each problem on the board/smartboard immediately after students.

The researcher will teach this lesson after students have a reasonable grasp of content and toward the end of the topic.

Intervention 3 – Self-assessment using assessment schedules.

This lesson involves students doing a practice assessment in exam conditions. The researcher then puts the assessment on the screen. The researcher works through one problem. Following this the marking schedule is put on the screen. The researcher and students then discuss the answer in terms of the assessment schedule. Each aspect of the schedule that relates to that problem is discussed i.e. evidence, judgement, code and sufficiency. The entire paper is worked through in this manner one problem at time with students asking about variations/ their own answers. Assessment schedules are then passed out one per student. Students work in pairs or individually if they prefer, marking their own paper using the schedule. The researcher moves around the class discussing what students are doing and giving guidance as needed. Papers are handed in at the end for the researcher to check mark. These are returned at the start of the next lesson prior to another practice assessment with students marking in pairs of individually. If they mark on their own they get a peer to check mark.

This lesson/s takes place at the end of the topic and prior to the summative assessment.

Phase 3 – Observations

Informal observations will be done of the class as a whole during their normal learning time. These observations will be done by me for the purpose of looking at the effects of the specific interventions. The interventions will involve me teaching three lessons. The first lesson teaches students how to set out and complete work in a way that makes it easier for them to identify what they are doing right, what they are doing wrong and how to improve where they need to. The second and third lessons help students to understand what is required of them in assessments and how to judge their own progress toward meeting assessment requirements.

Phase 4- Interviews

Students will also be invited to take part in the interview phase of the project. From those who indicate an interest, I will select six students with different levels of feelings of “can do it’ according to the information provided in the questionnaires. Students who are to be interviewed will receive another consent form prior to the interviews. Interviews will take place at a time that is convenient for the student that does not disrupt their normal learning. Interviews will be recorded to help ensure accuracy. They will also receive a copy of the transcribed interview to check that it is accurate. They can change or withdraw any information that is given.

Phase 5 – Questionnaire
This questionnaire is the same as the one in phase 1 and will be repeated at the end of the research to see if there has been a change in their feeling of confidence to pass as a result of the training in self-assessment.

Students practice assessments (photocopies) will also be collected to enable me to monitor any change that may result from the interventions. Not all students will have copies of their assessments collected. This will be done for a selection of students, depending on the information collected in the questionnaire.

Any student who chooses not to participate in the research will not be disadvantaged as they will receive the same lessons as the participants but their data will not be used for anything other than regular classroom learning. Students who choose non-participation do not have to give a reason for their choice. Participants can withdraw at any time and can choose to not answer particular questions in both the questionnaire and the interviews. Neither participation, nor non-participation will have an effect on grades.

Data that is collected will be stored in a secure place with Peter Rawlins, my supervisor, and will be destroyed after 5 years. On completion of the research a summary of the research findings will be available. Contact me by email or phone if you would like to receive a copy.

Confidentiality
While confidentiality cannot be guaranteed, to help maintain confidentiality neither the names of individual students nor the school will be used in the thesis. When any research is conducted it must be recognized that there is always a risk of a breach of confidentiality and that I can only give an assurance of confidentiality and anonymity to the extent allowed by law. It should be noted, however, that there is a clear expectation that all participants, including the researcher, will respect any information shared through the research process and will treat it with confidentiality. Neither the school nor any individuals will be identified either directly or indirectly in verbal or written form. Where direct quotes from the interview tapes or written correspondence are used in subsequent publications pseudonyms will be assigned to maintain anonymity. Students will be using their own self-assessment information, with the support of the teacher, to improve their own learning.

Participant's Rights
You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- be given access to a summary of the project findings when it is concluded.

Project Contacts
If you have any questions now or at any stage of the research you are invited to contact me or either of my supervisors.

Researcher: Taryn Johnson
phone: 027 548 2259
email: tarynj2011@live.com

Supervisors: Peter Rawlins
phone: 06 3569099 ext. 8855
email: P.Rawlins@massey.ac.nz

Alison Kearney
phone: 06 3569099 ext. 8704
email: A.C.Kearney@massey.ac.nz

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 11/29. If you have any concerns about the conduct of this research, please contact Dr Nathan Matthews, Acting Chair, Massey University Human Ethics Committee: Southern B, telephone 06 350 5799 x 8729, email humanethicsouthb@massey.ac

Appendix N

Student consent form

Self-assessment: A means to enhance academic self-efficacy

STUDENT CONSENT FORM

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree to participate in this study under the conditions set out in the Information Sheet.

Signed: _____

Full Name (printed): _____

Date: _____

Appendix O

Parent Consent form

Self-assessment: A means to enhance academic self-efficacy

PARENT/CAREGIVER CONSENT FORM

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree to allow my student to participate in this study under the conditions set out in the Information Sheet.

Student's Name ……

Relationship to student ……..

Signature ..... **Date** .....

Full Name - printed .....

Appendix P

Teacher Consent Form

Self-assessment: A means to enhance academic self-efficacy

CONSENT FORM - TEACHER

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree to participate in this study under the conditions set out in the Information Sheet.

Name …….

Signature …….

Date ……..

Appendix Q

Interview Consent Form

Self-assessment: A means to enhance academic self-efficacy

PARTICIPANT CONSENT FORM - INDIVIDUAL

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree/do not agree to the interview being sound recorded.

I wish/do not wish to have a transcript of the interview.

I agree to participate in this study under the conditions set out in the Information Sheet.

Full Name - printed ……..

Signature ……

Date ……