Assessing self-efficacy and agency of secondary school students in a multi-cultural context: Implications for academic achievement

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Abstract The concept of self-efficacy is based on the triadic reciprocity model symbolising a three way reciprocal relationship between: (a) personal factors i.e. cognition, emotion, and biological events (b) behaviour and (c) environmental factors (Maddux, 1995). Cognition, emotion and behaviour are the domains of personality which form the basis of research in self-efficacy. Research has been extensive on the relationship between self-efficacy and performance attainment in academic settings. Self-report scales are common in the assessment of self-efficacy. Guidelines to construct scales to assess self-efficacy have been specified by Bandura (2001). These guidelines highlight the importance of developing self-report measures which are task specific, and take into consideration all three domains of self-efficacy and three levels within each domain. Suggestions to develop measures which are reliable and have content validity have been provided. The major aims of this present research were to assess students’ self-efficacy in mathematics, and explore agency. Participants were from multi-cultural secondary schools in Auckland. A scale was developed incorporating New Zealand curriculum specific items in mathematics for Years 11, 12 & 13, and items on related constructs which impact on self-efficacy such as: (a) motivation strategies, (b) cognitive and metacognitive strategies, (c) resource management, (d) self-regulated learning, (e) meeting others’ expectations, and (f) self-assertiveness. A qualitative self-report measure was designed to explore self-efficacy and agency in students. This paper reports the findings from this research in progress, and discusses the implications for student achievement.

Introduction

Self-efficacy is the judgment of capabilities to organise and effect courses of action to attain goals. Introduced by Bandura, the concept of self-efficacy has been researched extensively in the field of psychology and education. A multi-dimensional construct, it influences human functioning directly and indirectly through its effects on other determinants (Bandura, 1997) such as motivation, self-regulation, attribution and emotion. Research in the field of education, and in particular in its role in academic achievement has shown positive correlation with performance attainment (Bandura, 1986; Bempechat & Drago-Severson, 1999; Covington, 2000; Pajares, 1996; Pajares & Miller, 1997; Pajares & Valiante, 1997; Patrick, Hayes & Ryan, 1997; Schunk, 1995; Zimmerman, Bandura & Martinez-Pons, 1992).

Cross cultural research reveals culture specific determinants on efficacy and performance attainment (Gibson, 1999; Bempechat & Drago-Severson, 1999; O’Brien, Martinez-Pons, & Kopala, 1999). “Cultural embeddedness shapes the ways efficacy beliefs are developed, the purposes to which they are put, and the sociostructural arrangements through which they are exercised” (Bandura, 2001). However, Bandura states that cultures are not insular any longer. Globalisation and advances in telecommunications are disseminating ideas, values, and behaviour rapidly, and with increasing ethnic diversity due to mass migration, ethnicity becomes a

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subculture of a larger society, and bicultural efficacy becomes crucial to human functioning. In New Zealand, there has been a demographic shift in population over the years, with increase in the proportion of Maori, Pacific and Asian people (Education Review Office ERO, 2000). Acknowledging this trend, and in the light of the evidence of wide disparities in academic achievement across schools and ethnic groups in New Zealand (Government, 2001b), many initiatives have been furthered. Raising academic achievement of students has been a major goal of the initiatives aimed to reduce disparities and close the gaps in education achievement among diverse groups (Government, 2001a).

An area where students lag behind is mathematics, and their “past experiences, often times failures in mathematics, usually dictate student opinions concerning their perception of their ability in mathematics as well as their optimism about career choices where mathematics is a basis of the curriculum…ultimately their futures are limited to areas where mathematics is rarely used” (Hall & Ponton, 2002, p.10). In the context of the critical role of self-efficacy in educational achievement, this present research aimed to assess self-efficacy, and explore agency in students from multicultural secondary schools in Auckland. Self-efficacy in mathematics was the major focus.

**Self-efficacy - A social cognitive theory of personality**

Self-efficacy is a social cognitive theory of personality which postulates a triadic reciprocal interaction between an individual’s personal factors, environmental events and behaviour (Maddux, 1995). Introduced by Bandura, perceived self-efficacy has been defined as “a generative capability in which cognitive, social, emotional, and behavioral subskills must be organised and effectively orchestrated to serve innumerable purposes” (Bandura, 1997, p. 37). Self-efficacy mediates between an individual’s ability and their purposive action. Perceived self-efficacy influences the course of action adopted, effort invested, endurance and resilience in the face of obstacles and failures, coping, and the level of accomplishments. Bandura states that people with high self-efficacy tend to be future orientated, take effective course of action, and in turn self-efficacy is enhanced. In its role as a mediator between task capability and action, self-efficacy is dependent on one’s belief in control capability. “Perceived self-efficacy is concerned with people’s beliefs in their capabilities to perform in ways that give them some control over events that affect their lives”(Bandura, 1997, p.181).

**Self-efficacy and agency**

In its agentic role, Bandura (2001) considers self-efficacy as the most crucial mechanism of agency. He defines agency as an intentional act, with its key feature being the power to originate actions for given purposes. “Whatever other factors may operate as guides and motivators, they are rooted in the core belief that one has the power to produce effects by one’s actions” (p.10). There is a functional relation between intention and action, separated in time. Crucial to exercising agency are: (a) planning, (b) forethought which includes outcome expectations (c) self-evaluation, (d) motivation and (e) self-regulation. These components are also inherent in self-efficacy. Personal agency also works in tandem with proxy agency and collective agency. Proxy agency is the way an individual tries to get a person or people to be agents to achieve desired goals. Collective agency refers to “ people’s shared beliefs in their collective power to produce desired results”(Bandura, 2000, p.75). Thus both the belief in one’s capability (i.e. self-efficacy) to accomplish a goal (task capability), and the belief in one’s power to attain the goal through action (i.e. personal agency) are important. It is arguable that an individual can have high self-efficacy without feeling highly agentic. Figure 1 depicts the role of self-efficacy and agency in human functioning.
Domains of self-efficacy
Self-efficacy regulates functioning through four processes: (a) cognitive (b) motivational, (c) choice and (d) emotional processes (Bandura, 1999). This regulatory role of self-efficacy in the domains of cognition, behavior and emotion is measured by assessing cognitive self-efficacy, motivational self-efficacy, behavioural self-efficacy, and emotional self-efficacy.

Cognitive processes
These impact on choice of strategies, development of rules for predicting and influencing events, and efficiency and effectiveness in problem solving and decision-making (Maddux, 1995). Cognitive processes include one's ability to exercise control over one's thoughts and mental processes.

Motivation
Perceived efficacy is crucial for the development and regulation of motivation. “Cognitive motivation based on goal intentions is mediated by three types of self influences: self-evaluation, perceived self-efficacy for goal attainment, and ongoing adjustment of personal standards”(Bandura, 1990, p. 81). Among these three mediators of motivation, self-efficacy has a causal influence on motivation.

Choice behavior
Perceived self-efficacy influences choice of goals, activities directed to attaining the goal, the amount of effort expended, and perseverance in the face of obstacles. High self-efficacy leads to setting higher goals and greater commitment to attaining them (Maddux, 1995).
Emotion
Self-efficacy beliefs impact on both the type and intensity of emotion, with low self-efficacy to attain a goal leading to despondency. Lack of self-belief in controlling disturbing thoughts results in negative affect states leading to poor self-efficacy, lowered performance, and further despondency. Positive affect states lead to enhanced self-efficacy. Emotional efficacy can be measured through measurement of cognitive and behavioural self-efficacy for controlling emotions, cognitive self-regulation and for performing pleasant or mastery-related behaviours.

Structure of self-efficacy
Bandura (1997) has given a three-fold classification of the structure of self-efficacy which includes: (a) level/magnitude, (b) generality, and (c) strength. Level/magnitude refers to self-efficacy on tasks ranging from simple to most difficult performances. Generality of self-efficacy refers to its pervasiveness across behaviours and contexts. People may perceive themselves to be generally efficacious in a range of activities or only within a domain of functioning. Strength of self-efficacy refers to the resoluteness of one’s conviction to perform a task, and the stronger the self-efficacy expectancy the greater the likelihood of selecting challenging tasks, striving despite obstacles, and successfully attaining their goal. The dimensions of self-efficacy suggest that an individual can have self-efficacy on a task which is limited in its specificity to a particular level, cannot be generalised across domains, and is of limited strength. Conversely, an individual can have a high level of self-efficacy within a task, with wide generality in applicability across domains and strength of conviction to accomplish the goal despite any obstacles. Determining perceived self-efficacy involves measuring the three domains, and the dimensions within each domain.

Assessing self-efficacy
In assessing self-efficacy Bandura recommends a microanalytic research strategy. “To achieve explanatory and predictive power, measures of personal efficacy must be tailored to domains of functioning and must represent gradations of task demands within those domains” (Bandura, 1997, p.42). Maurer and Andrews (2000) compared the reliability and validity of three formats of self-efficacy scale (traditional, Likert and general categorical). The results revealed that for assessing task specific level and strength of self-efficacy, traditional and Likert measures are useful, while the simplified measure is suitable to assess general confidence of belief.

Measurement of academic self-efficacy involves students being administered self-efficacy scales, with ratings of confidence to perform specific tasks in the selected curriculum. “Capabilities assessed and capabilities tested should be the same or similar capabilities” (Pajares, 1996, p.2). This will help ensure correspondence between beliefs and outcomes and increase the predictive power of self-efficacy assessment. Further, Pajares states that the skills required to accomplish the outcomes in the criterial tasks should be understood by the participants. Thus when assessing self-efficacy it is important to develop scales which are comprehensive, ensuring that all domains of self-efficacy, the three levels within each domain, the related personality constructs, and the knowledge and skills which are required to accomplish criterial tasks are included.

Self-efficacy in the educational context
Performance attainments, enactive attainments, vicarious experiences, verbal persuasion, physiological states are the major sources of self-efficacy information (Maddux, 1995). Self-efficacy research in academic settings has focused primarily in the areas of its link with college major, career choices, and with related psychological constructs of academic motivation and achievement (Pajares, 1996). Students with low confidence in mathematics abilities, despite the
realisation that strong math skills are essential for high GRE scores and thereby eligibility for graduate school, may keep away from certain courses and not apply to graduate school. While perception of self-efficacy enables participation in activities, leading to further acquisition of competencies, self-inefficacies can lead to avoidance behaviour, giving up easily deterring the development of one’s true potential. Pajares and Valiante (1997) report the predictive role of self-efficacy in elementary students’ writing. Student self-efficacy in writing capability influenced writing apprehension and essay writing performance.

“Compared with students who doubt their learning capabilities, those who feel efficacious for learning or performing a task participate more readily, persist longer when they encounter difficulties, and achieve at a higher level” (Schunk, 1994, p.75 ). Schunk highlights factors which impact on academic self-efficacy. These include:
1. Goal setting: This is an important cognitive process, and goal proximity, specificity, difficulty, self-setting of the goals, the nature of the goal i.e. process goal or product goal, and feedback affect self-efficacy.
2. Information processing: Self-efficacy correlates positively with competence in information processing.
4. Feedback: Self-efficacy is impacted by the nature and timing of feedback, the ability levels of children, and perception of credibility of the source of feedback.
5. Rewards: Rewards which are linked to student accomplishments enhances self-efficacy.

Self-efficacy and self-regulation share a reciprocal relationship. Self-efficacy contributes to the self-regulation of cognitive functioning through the use and monitoring of learning strategies, structuring the environment, regulating motivational, affective and socio cognitive skills to attain a person’s goal (Bandura, 1997). Self-efficacy operates during all phases of self-regulation i.e. forethought, performance and self-evaluation based on reflection (Schunk & Etmer, 1994). “Self-regulation is important because a major function of education is the development of life-long learning skills” (Zimmerman, 2002, p.66). Skills include: (a) setting specific proximal goals, (b) adopting strategies to attain the goals, (c) monitoring progress, (d) restructuring context to suit the goal, (e) efficient use of time, (f) self-evaluation of methods, and (g) attribution.

Attribution and self-efficacy have a bi-directional causal relationship. Attributions affect appraisal of self-efficacy and perceived self-efficacy biases causal attributions (Bandura, 1990). Bandura concludes that when intelligence is viewed as an incremental skill, effort, perseverance in the face of obstacles and task-orientation are the patterns of behaviour in attaining a goal. Similarly Ames (1990) contends that self-efficacy is determined as one develops by: (a) self-evaluation of one’s ability vs effort at a task, and (b) attribution of success/failure to ability or effort. She points out that “older children also develop a more differentiated view of effort and ability. While effort can increase the chance of success, ability sets the boundaries of what one’s effort can achieve. Effort now becomes the ‘double edged sword’. Trying hard and failing threatens one’s self-concept of ability” (p.412-413).

Feedback is another variable which has been researched in the context of self-efficacy. Undertaking tasks for which one has high perceived self-efficacy and received informed feedback are factors crucial to enduring motivation on tasks (Bandura & Cervone, 1986). Their study found that goals enhanced effort when self-evaluation against standards was combined with performance feedback.

Cross-cultural research in self-efficacy shows cultural variations in source of self-efficacy information and processing of the information (Oettingen, 1995). Some sources may be more
prevalent, different forms of information sources may be used, and different value judgment of
the sources may be applied. The type of information attended to, and the combination rules
employed in processing the information also might vary among cultures. For example in
Collectivist cultures, feedback on performance might be in a within group setting, individual
attainments might not be very highly valued. In the context of the socialcognitive theory,
individualism, collectivism and communality become modes of exercising agency based on self-
efficacy (Bandura, 2002). Bandura states that individual agency, proxy agency, and collective
agency might show cross-cultural variations. However irrespective of cultural differences, all
three agentic modes are required for successful functioning. Further he contends that with high
global mobility, greater international embeddedness and interdependence of societies, collective
efficacies are becoming critical.

Cross-cultural research in students’ self-efficacy also reveals ethnicity as an important variable in
determining self-efficacy (Gibson, 1999; Bempechat & Drago-Sevenson, 1999; O'Brien,
Martinez-Pons, Kopala, 1999). Gibson (1999) researching on group efficacy and group
effectiveness across tasks and cultures, had as independent variables level of task certainty, level
of task interdependence and level of collectivism. The participants in the study were U.S. (ethnic
mix of Asian, Caucasian, Latino, Pacific Island and African American) and Hong Kong
University students (comprising mainly Asian and a few Caucasian). Results showed collectivism
and interdependence to be significantly related to group efficacy and group effectiveness, with
group efficacy and group effectiveness positively correlated with groups high on
interdependence, and not significantly correlated with groups low on interdependence. In a cross-
cultural study on self-regulation strategies, self-efficacy and achievement, Chye, Walker and
Smith (1997) report differences in students’ choice of learning strategies based on the country
they were located in. Singaporean students in Singapore were found to make greater use of effort
regulation strategies than Singaporean students who studied in Australia. However the former
scored less in use of organisational strategies than their counterparts in Australia. The authors
reported strategies used as a better predictor of academic grade than self-efficacy.

Cultural variations in power differentials also impact on school functioning. Where there are large
power differentials, the teacher is perceived as a powerful influence agent (Oettingen, 1995).
Teacher evaluation becomes influential in children’s appraisal of self-capabilities. In cultures
with low power differentials, children become creators of their own performance
accomplishments, the verbal evaluations of teachers are not as valued. In cultures where there is
low uncertainty avoidance, with highly individualised instruction and performance attainments,
vicarious experiences become significant source of personal appraisal and development of self-
efficacy.

Reviewing research on self-efficacy in the academic context, it appears that when assessing self-
efficacy it is imperative that the construct be considered in terms of the dynamic interplay it
shares with variables such as motivation, self-regulation, attribution, choice of strategies for
attaining goals, and the teaching-learning and cultural context.

**Assessing self-efficacy and agency in the New Zealand educational context**
In this present research, the measures were tailored to assess self-efficacy for mathematics in the
context of the general aims of mathematics education and achievement aims of the mathematics
The seven aims have been subgrouped into three categories (Ferguson, 2002). These include: (a)
personal aspects related to students’ confidence in ability to undertake mathematics tasks, belief
in the value of mathematics, (b) developing knowledge and skills in content and thinking
processes, and (c) the relevance of mathematics to higher studies and work. These three indices
emphasise the different domains of self-efficacy cognitive, behavioural, and emotional. The curriculum framework also enumerates the eight essential skills: (a) communication, (b) numeracy; (c) information; (d) problem-solving; (f) self-management and competitive skills; (g) social and co-operative skills; (i) physical skills; and (j) work and study skills. These eight skills have been interwoven in the six major strands into which the achievement aims of mathematics education have been grouped. These include: (a) mathematical processes, (b) number, (c) measurement, (d) Geometry, (e) Algebra, and (f) Statistics. To the last three strands, a few changes have been made to the Framework related to Level 8 (Ministry of Education, 1995).

These six strands were used as the main framework in designing the mathematics self-efficacy scale. Secondly, using multi-faceted predictors of self-efficacy, subscales of the following related constructs were incorporated. These included self-efficacy in: (a) motivation, (b) cognitive learning strategies, (c) self-regulation, (d) resource management, (e) leisure-time skills and extracurricular activities, (f) enlisting support, and (g) self-assertiveness. Emotional self-efficacy was measured through items in subscales on cognitive strategies, cognitive self-regulation, leisure time and extracurricular activities. The items within subscales were designed to assess the three dimensions of level, generality and strength of self-efficacy.

A semi-structured survey was designed to obtain data on agency. Participants’ views on agency in their social and cultural context were the focus. Researching an integral aspect of personality, i.e. self-efficacy in a postmodern terrain, calls for investigation into participant perceptions of the cultural constitution of personality.

...The model of most social sciences, including psychology, sociology, and economics and biology...the person has been objectified....personal agency is anchored in the fundamental assumption that the self is autonomous and separate from others and situations...one’s wishes, desires, interests and abilities are the chief constituents of self-hood...Western theories of agency and motivation have tended to view personal choice as the ultimate good ... in the Asian context the self is understood as socially constructed and interdependent with others... (Cross & Markus, 1999, p.383-384)

However Smith (2001) contends that with globalisation Western cultural values are being relativised as one of the local brought in contact with others through globalisation. There is ‘hybridisation’, that is, the mixing of cultures and lifestyles leading to people sharing qualities of their core culture and periphery. Adopting a cultural approach permits focus on situations and contexts that generate and maintain or support particular personality processes (Cross & Markus, 1999). The postmodern acknowledgment of the need for research on culturally-contextualised notions of personality has been a major factor in determining the aims of this research.

The guiding principles in constructing the measures for this research
The research process was led by the guiding principles from (a) Guidelines stipulated by Bandura (2001), (b) The Code of Fair Testing practices (1988, 1994), and (c) Pacific consultation guidelines (2001). The phraseology of the items was in terms of “can do” (measuring belief in capability) rather than “will do” (belief in intention), single judgment format was used, and all three domains viz: cognitive, behavioral and emotional were considered. Items were also included to assess strength and generality. Prior to beginning the research consultation with school principals and Ministry of Education officials was undertaken which informed the pre-pilot stage and revision of the pilot instrument. Interactions were based on valuing respect, reciprocity, communalism, humility, service and spirituality of different cultures.
Aims

1. To assess mathematics self-efficacy of students from multicultural schools;
2. To assess the relationship between self-efficacy and mathematics achievement;
3. To explore agency of students from multicultural schools.

Research hypotheses

1. Perceived self-efficacy in mathematics will be correlated with efficacy in related constructs;
2. Perceived self-efficacy in motivation strategies, cognitive strategies, self-regulated learning, resource management, leisure time skills and extracurricular activities, meeting others expectations and self-assertiveness will be correlated with achievement in mathematics;
3. Perceived self-efficacy in mathematics will be correlated with achievement in mathematics;
4. Different domains of self-efficacy will have different relationships with achievement in mathematics.

Methodology

The Participants
All student participants came from multi-cultural schools in Auckland. Multicultural schools in New Zealand have been defined by the Education Review Office (ERO) as: “a school in which students from at least two other ethnic groups together comprise at least 20 percent of the school’s population” (ERO, 2000, ¶.3). Based on this definition, two out of five New Zealand schools are multi-cultural. Rural schools constitute one-third of all New Zealand schools. Less than 10% of these schools are multicultural. 90.5 percent of multicultural schools are in urban areas. In New Zealand, the Ministry of Education ranks state schools into decile groupings. Decile 1 schools are in areas of greatest socio-economic disadvantage. Areas of least socio-economic disadvantage fall in decile 10 category. About 60 percent of multi-cultural schools are in the lowest four decile, 6 percent are in the highest decile. Most of the multicultural schools are in the North Island, particularly in Auckland.

Eleven schools were approached to seek research participants. Three schools gave permission to proceed. Participation was voluntary. Students who volunteered were requested to: (a) complete the scale-based questionnaire, and (b) give written consent to the researcher to obtain information from their schools about grades in mathematics in the mid-semester examinations.

Pilot group participants
Participants comprised students aged 16+ from a decile 7 school in Auckland. The ethnic composition of the school comprised: (a) Pakeha 45%, (b) Maori 5%, (c) Indian 16%, (d) Chinese 13%, (e) Middle Eastern 4%, (f) Samoan 3%, (g) African 2%, (h) Tongan 1%, (i) Cook Island 1%, (j) other 10%. The school was described in its evaluation report by ERO (ERO, 2003) as “…a high performing school where students are provided with a sound educational environment for learning” (¶. 3). Participants were from Form VII, who had opted for mathematics either as Math-Statistics, or Math-Calculus or both.

Participants for the final study
Students from two schools from West Auckland participated in the study. (n=137).

Group 1.
School A
School A was decile 3, and the participants were aged 16 years and over. The ERO evaluation report of 2003 states that the school has made significant progress since the 2000 evaluation by ERO which recommended raising the quality of teaching and learning as being a key priority. “Significant progress had been made by the principal and staff to develop a robust curriculum management system to help achieve this goal” (¶ 15). The ethnic composition of the school was: (a) Pakeha 55%, (b) Maori 22%, (c) Samoan 6%, (d) Other Pacific 5%, (e) Chinese 2%, (f) Indian 2%, (g) Tongan 1%, (h) Niuean 1%, (i) Cook Island 1%, and (j) other 5%. The participant group comprised Form VII students. (n=52)

Group 2.
School B
This school was decile 4, with an ethnic composition of: (a) Pakeha 54%, (b) Maori 18%, (c) Samoan 9%, (d) Asian 7%, (e) other Pacific 8%, (f) Chinese 3%, and (g) other 1%. The participant group comprised students from Form VI. (n= 85) The ERO (2000) evaluation describes the school as one where the “Senior managers work closely with staff to promote a school wide culture of ‘achievement for all’. …Barriers to learning, particularly in literacy are being identified and addressed in innovative ways” (¶ 5).

Procedure
The questionnaires were handed over to the principal/ deputy principal/ Heads of Department. The schools opted to have the questionnaires administered during class time.

The measures
Assessing self-efficacy
A scale-based self-report questionnaire was designed comprising two parts, Part I and Part II.

Part I included six sections, each assessing self-efficacy in mathematics on a range of specified dimensions.
Section I – Numerical problems – 4 items;
Section II – Measurement – 3 items;
Section III – Geometry – 3 items;
Section IV – Algebra – 4 items;
Section V - statistics – 3 item;
Section VI – mathematical processes – 6 items..
Section VII – Some items in the subscales in section VII were self-designed, and others adapted from published measures (Bandura, 2001; Pintrinch, 1986). Subscales included:
- Motivation strategies (5 items);
- Cognitive strategies (16 items);
- Resource management strategies (13 items);
- Self-regulated learning (16 items);
- Leisure time skills and extracurricular activities (6 items);
- Self-belief to meet others’ expectations (6 items);
- Self-assertiveness (4 items); and
- Self-belief in enlisting community support (3 items).

All items required participants to respond to a Likert 5 point scale ranging from ‘not well at all’ to ‘very well’. The midpoint was ‘satisfactorily’.
Part II sought demographic data. Participants were requested to provide information on gender, ethnicity, age-group, family structure, languages spoken, choice of subjects, favourite subject(s), and likelihood of taking up tertiary education following bursary examinations.

Results
This present paper reports the results on assessment of self-efficacy. Data on agency will be reported in a subsequent paper.
Developing a measure to assess self-efficacy

Procedure for data analyses
Data were analysed using both descriptive and inferential measures. Reliability analysis of the pilot questionnaire was used to refine the scale items. A series of factor analyses of the data from the final questionnaire were performed to ascertain the main factors. Correlations of the factor scores, and between subscales within each factor, and with academic achievement scores were computed to explore relationships.

Piloting results
There were 92 items in the pilot questionnaire. Reliability analyses, and feedback from participants were used to refine the questionnaire. All items which had item-total correlations less than 0.30 were dropped. Subscales which had alpha less than .70 were also removed. See Table 1.

<table>
<thead>
<tr>
<th>Item subscales</th>
<th>alpha</th>
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<tbody>
<tr>
<td>Numerical problems</td>
<td>.79</td>
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<tr>
<td>Measurement</td>
<td>.49</td>
</tr>
<tr>
<td>Geometry</td>
<td>.73</td>
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<tr>
<td>Algebra</td>
<td>.74</td>
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<tr>
<td>Statistics</td>
<td>.74</td>
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<tr>
<td>Mathematical processes</td>
<td>.74</td>
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<tr>
<td>Motivation</td>
<td>.82</td>
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<tr>
<td>Cognitive strategies</td>
<td>.92</td>
</tr>
<tr>
<td>Resource Management</td>
<td>.84</td>
</tr>
<tr>
<td>Self-regulated learning</td>
<td>.91</td>
</tr>
<tr>
<td>Leisure time skills</td>
<td>.77</td>
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<tr>
<td>Meeting others expectations</td>
<td>.80</td>
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<td>Self assertiveness</td>
<td>.84</td>
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<td>Enlisting parental and</td>
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<td>community support</td>
<td>.69</td>
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Summary of demographic data for the pilot group is as follows:
The gender breakdown shows 20 (54.1%) females and 17 (49.9%) males.
Twenty participants (48.6%) were bilingual and some multilingual.
Seven (19%) of the 37 participants reported mathematics as their favourite subject, although all had opted for mathematics.

The refined Self-efficacy scale
Participation rate was 63.72%. Out of 215 questionnaires distributed, there were 137 returns.*
The refined scale comprised 85 items. Cronbach’s alpha was calculated to assess the reliability of the refined scale. See Table 2.

* A set of 45 questionnaires were distributed to a second group of participants in the beginning of Term IV. The data from these questionnaires have not been used in this analyses since the completed questionnaires are to be collected from the school.
The means and standard deviation of responses of participants are shown in Table 3. Participants rated their self-efficacy as ‘satisfactory’ to ‘pretty well’ on all the different subscales which indicates moderately high levels of self-efficacy.

<table>
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<tr>
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<th>alpha</th>
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<tbody>
<tr>
<td>Numerical problems and measurement</td>
<td>.83</td>
</tr>
<tr>
<td>Geometry</td>
<td>.77</td>
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<tr>
<td>Algebra</td>
<td>.81</td>
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<tr>
<td>Statistics</td>
<td>.81</td>
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<tr>
<td>Mathematical processes</td>
<td>.82</td>
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<tr>
<td>Motivation</td>
<td>.94</td>
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<tr>
<td>Cognitive strategies</td>
<td>.96</td>
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<td>Resource Management</td>
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<td>Self-regulated learning</td>
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<td>Leisure time skills</td>
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<td>Meeting others expectations</td>
<td>.95</td>
</tr>
<tr>
<td>Self assertiveness</td>
<td>.94</td>
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</table>

The means and standard deviation of responses of participants are shown in Table 3. Participants rated their self-efficacy as ‘satisfactory’ to ‘pretty well’ on all the different subscales which indicates moderately high levels of self-efficacy.

Correlations were computed between subscales based on Pearson’s Product Moment correlation. All correlations between subscales in the mathematics self-efficacy subsection were significant and positive. The range was between .58 to .68 (p<.01). Correlations were significant and positive between subscales on related constructs, with a few exceptions. Positive, and significant correlations ranged between .29 and .87 (p<.01). Correlations between subscales in self-efficacy for mathematics and the other subscales showed positive and mostly significant correlations ranging between a low .11 to .56.
Following correlation, factor analyses (Varimax rotated, based on principal component analysis) were computed. The aim was to explore the possibility of categorising the subscales based on emerging factors. Table 4 shows the 3 factors which accounted for 67% of the variance.

Table 4. Factors (Varimax rotation) from the ratings on different self-efficacy subscales

<table>
<thead>
<tr>
<th>Subscales</th>
<th>Factors 1</th>
<th>Factors 2</th>
<th>Factors 3</th>
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<tbody>
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<td>Self assertiveness</td>
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<td>.307</td>
<td></td>
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<tr>
<td>Meet others expectations</td>
<td>.836</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leisure time skills</td>
<td>.815</td>
<td>.471</td>
<td></td>
</tr>
<tr>
<td>Self regulated learning</td>
<td>.750</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numerical problems</td>
<td></td>
<td>.750</td>
<td>.326</td>
</tr>
<tr>
<td>Geometry</td>
<td></td>
<td></td>
<td>.747</td>
</tr>
<tr>
<td>Math processes</td>
<td></td>
<td></td>
<td>.616</td>
</tr>
<tr>
<td>Algebra</td>
<td></td>
<td></td>
<td>.607</td>
</tr>
<tr>
<td>Statistics</td>
<td></td>
<td></td>
<td>.606</td>
</tr>
<tr>
<td>Cognitive strategies</td>
<td>.329</td>
<td></td>
<td>.841</td>
</tr>
<tr>
<td>Motivation strategies</td>
<td>303</td>
<td></td>
<td>.731</td>
</tr>
<tr>
<td>Resource Management</td>
<td>.539</td>
<td></td>
<td>.572</td>
</tr>
<tr>
<td>Eigenvvalue</td>
<td>3.28</td>
<td>2.50</td>
<td>2.3</td>
</tr>
<tr>
<td>Variance</td>
<td>27.34</td>
<td>20.84</td>
<td>19.35</td>
</tr>
</tbody>
</table>

In the final stage of data analyses, achievement scores were analysed using both descriptive and inferential procedures. Pearson’s Product Moment Correlations were computed between factor scores and academic achievement scores. See Table 5.

Table 5. Correlation between the factor scores and academic achievement

<table>
<thead>
<tr>
<th>Factors</th>
<th>Achievement</th>
<th>Factor1</th>
<th>Factor2</th>
<th>Factor3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement</td>
<td>1</td>
<td>.14</td>
<td>.045</td>
<td>.138</td>
</tr>
<tr>
<td>Factor 1</td>
<td>.14</td>
<td>1</td>
<td>.49**</td>
<td>.82**</td>
</tr>
<tr>
<td>Factor 2</td>
<td>.04</td>
<td>.49**</td>
<td>1</td>
<td>.58**</td>
</tr>
<tr>
<td>Factor 3</td>
<td>.14</td>
<td>.82**</td>
<td>.58**</td>
<td>1</td>
</tr>
</tbody>
</table>

**Correlation significant at p<.01 level.

See figure 2 for a path framework of the tabular data.
Achievement scores correlated positively but at a low level with the three factors. Analysis of subscales within factors revealed that achievement scores correlated strongly and positively with subscales on resource management, self-regulated learning, leisure time skills, self-efficacy to meet others’ expectations, and self-assertiveness. It is interesting that achievement scores revealed a high percentage of students in the not achieved category. See Table 6 for summary of academic achievement results in mathematics.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Frequency(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellence</td>
<td>16.00</td>
</tr>
<tr>
<td>Merit</td>
<td>9.00</td>
</tr>
<tr>
<td>Achieved</td>
<td>21.05</td>
</tr>
<tr>
<td>Not achieved</td>
<td>42.70</td>
</tr>
<tr>
<td>Did not sit</td>
<td>11.25</td>
</tr>
<tr>
<td>n=137</td>
<td></td>
</tr>
</tbody>
</table>

Table 6. Achievement results in mathematics in the mid-year exams

Discussion

The four research hypotheses were affirmed. Results showed that participants generally had a moderately high level of mathematics self-efficacy, and self-efficacy for related constructs, with means ranging from 3.13 to 3.84. It appears that the research participants believe in their capability to achieve their goals in mathematics with the knowledge and skills they have. Self-efficacy in mathematics positively correlated with self-efficacy in related constructs, and with achievement in mathematics. Perceived efficacy in motivation strategies, cognitive strategies, self-regulated learning, resource management, leisure time skills and extracurricular activities, meeting others expectations and self-assertiveness also correlated positively with achievement in mathematics. However, many of the correlations were not very high.

To investigate how the main domains of self-efficacy correlated with self-efficacy in mathematics factor analyses were computed on the subscale scores. The results revealed three clear factors. Four subscales loaded highly on the first factor. This factor comprised subscales on self-efficacy in: (a) self-assertiveness, (b) to meet others’ expectations, (c) leisure time skills and extracurricular activities, and (d) self-regulated learning. An analysis of the items in these subscales reveal that the statements had a behaviour and emotional orientation, together with planning, goal settings, use of strategies, and time management. The second factor had all five subscales specific to mathematics in the New Zealand curriculum framework, namely self-
efficacy in applying knowledge and skills of mathematics which is considered to be a cognitive-behavior orientation. The third factor had high loading from 3 subscales. These included self-efficacy for: (a) cognitive strategies, (b) motivational strategies, and (c) resource management strategies. Analysis of the statements in the subscales indicate that the focus in these statements were on planning, forethought, goal setting, strategies for learning, persistence, monitoring progress, modifying the plan, and time management, that is, a highly cognitive orientation to dealing with tasks.

The results of this study also validated the extensive research on self-efficacy and academic achievement (Bandura, 1986; Bempechat & Drago-Severson, 1999; Covington, 2000; Pajares, 1996; Pajares & Miller, 1997; Pajares & Valiante, 1997; Patrick, Hayes & Ryan, 1997; Schunk, 1995; Zimmerman, Bandura & Martinez-Pons, 1992). These studies highlight the following:

1. A positive correlation between self-efficacy and academic achievement.
2. Perceived self-efficacy impacts on cognition, motivation, emotions and behaviour through control and self-regulation.
3. Cognitive self-efficacy has a causal influence on motivation.
5. Underpinning motivation and self-regulated behaviour are goal setting, which has been reported as an important cognitive process which impacts on achievement outcomes.
6. Perception of self-efficacy enables participation in activities, more resilience, leading to further acquisition of competencies.
7. Behavioral self-efficacy impacts on goal setting, cognition, affect and choice of environment.

Participants in this study had moderately high self-efficacy in mathematics and in motivation strategies, cognitive learning strategies, resource management, and self-regulated learning. Behavioral self-efficacy was also high as evident in the scores on self-efficacy to enlist support, participation in leisure time skills and extracurricular activities.

Results showed that student self-efficacy for mathematics did not translate into mathematics achievement. Analysis of examination results in mathematics reveal that while 46.5% students combined to form the achieved, merit and excellent category in mathematics, 42.70% did not achieve, and 11.25% did not sit the examinations. There was low positive correlation between the three main factors of self-efficacy and academic achievement. The highest positive correlation between achievement scores and self-efficacy subscales were with resource management strategies and self-regulated learning. Self-regulation is defined as the self-directive process by which learners transform their mental abilities into academic skills (Zimmerman, 2002). The participants also had high self-efficacy for resource management strategies which included many items relevant for self-regulation.

Among reasons cited by researchers for discrepancies between self-efficacy and achievement, the source of self-efficacy information, value of the task undertaken, and the presence or absence of skills required to accomplish the task are to be considered. (Dornyei, 2001) cautions that self-efficacy beliefs are only indirectly related to actual competence and abilities because they are a complex process of self-persuasion that is based on cognitive processing of diverse sources of information. Sources of self-efficacy information include; other people’s opinions, feedback, evaluation, encouragement, past experiences; observing peers; information about task strategies. Bandura states that while efficacy can enhance motivation, students cannot produce ‘new fangled performances’ if the subskills for the exercise of personal agency are absent (Bandura, 1997). In a similar vein (Schunk, 1994) states that high self-efficacy will not produce competent performances in the absence of requisite knowledge and skills. Outcome expectations, valuing the learning task are factors to be considered. In situations where misjudgment are perceived as
inconsequential there is likely to be less serious appraisal of self-efficacy (Bandura, 1997). (Tschannen-Moran, Hoy, & Hoy, 1998) state that self-efficacy has to do with the self-perception of competence. It is not the actual level of competence. “In most cases, slightly overestimating one’s actual competence has the most positive effect on performance” (p.211). This was not true for this research. Inadequacies of the sampling process should be considered in interpreting the results. Lack of response from many schools which were approached precluded access to a representative sample. Three out of eleven schools consented, narrowing the choice to a convenience sample.

Before any further conclusions can be drawn as to the reasons underlying these disparities, the researcher plans to consult authorities from the two schools to seek information about what they believe could be some of the underlying causes. The evaluation report on school improvement initiatives in multicultural schools in New Zealand highlights lack of control over external factors such as poverty, health, housing, employment, and family affecting adversely on learning opportunities and student achievement (Hill & Hawke, 1998). Self-esteem and motivation were two aspects identified as impacting on students’ ability and achievement (Sinclair, Bates, & Gavin, 2001).

Further data analyses, with the complete set of scores from questionnaires which are yet to be obtained, and the academic achievement scores from the final examination might reveal results from which we can draw valid conclusions. Regression analyses will provide results from which we can have insights into the predictive utility of the research findings. Finally, analysis of demographic information and qualitative data from the survey on agency might provide answers about culturally contextualised agentic beliefs, which could be a significant factor impacting academic achievement.

Conclusions and recommendations

An attempt has been made to assess self-efficacy in the context of the three domains, that is, cognitive, behavioral and emotional self-efficacy. A self-report scale was designed which assessed self-efficacy as a multi-dimensional construct. The processes of cognition, motivation, self-regulation, resource management, and self-assertiveness through which self-efficacy regulates human functioning were assessed in the context of self-efficacy in mathematics, and mathematics achievement. Bandura (1986) states that any attempt to study all these reciprocal actions at once would produce investigatory paralysis. Results of the study revealed three clear factors which could be classified into the three domains of self-efficacy, and there was high correlation between them. This research validates studies which shows a positive correlation between self-efficacy and academic achievement, and achievement in mathematics. While participants reported moderately high levels of efficacy, a sizeable number scored in the ‘not achieved’ category in mathematics. Since there is a demonstrated relationship between self-efficacy and academic achievement of students, and in the light of the findings from this study, the following recommendations can perhaps be considered. See Table 7 for a summary on recommendations to enhance mathematics self-efficacy and academic achievement through relevant teaching-learning interventions, together with highlights from life-centred psychological principles and teaching-learning principles in a multicultural context (APA, 1997; Banks, Cookson, Gay, & Hawley, 2001; Centre for Positive Practices, 2003). It is proposed that these recommendations will enrich the New Zealand teaching-learning context.
Table 7. Teaching-learning interventions and principles

<table>
<thead>
<tr>
<th>Enhance self-efficacy in mathematics</th>
<th>Enhance academic achievement</th>
<th>Tailored to a multicultural context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observing peers as models</td>
<td>Learning processes</td>
<td>Student learning</td>
</tr>
<tr>
<td>Opportunities for social comparison</td>
<td>Goal setting: appropriate</td>
<td>Safe and orderly environment</td>
</tr>
<tr>
<td>among peers is an important</td>
<td>strategies for integrating</td>
<td>time actively engaged</td>
</tr>
<tr>
<td>sources of one’s perceived</td>
<td>new knowledge, self-regulation, reflection based on feedback which is ongoing, and ownership of responsibility for learning.</td>
<td></td>
</tr>
<tr>
<td>self-efficacy.</td>
<td>Metacognitive strategies</td>
<td></td>
</tr>
<tr>
<td>Feedback</td>
<td>Instructional methods which focus on student reflections on how they think and learn, most appropriate learning strategies to be used, monitoring progress and dealing with problems.</td>
<td></td>
</tr>
<tr>
<td>Feedback from multiple sources of</td>
<td>Learning tasks and context</td>
<td></td>
</tr>
<tr>
<td>information i.e., strategies used,</td>
<td>Providing tasks which are interesting and relevant, appropriate to the learner’s level of development to achieve success. Contexts which provide for collaboration on instructional tasks, respect and value diversity, encourage flexible thinking, and positive interpersonal support.</td>
<td></td>
</tr>
<tr>
<td>effectiveness of strategies used by peers’ models.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Models displaying coping strategies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>are very effective for struggling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>students. Coping models combined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>with mastery models are useful</td>
<td></td>
<td></td>
</tr>
<tr>
<td>instructional strategies.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observing oneself</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watching recordings of oneself solve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>problems, both during the learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>process, and after mastering them</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Student learning
Safe and orderly environment, time actively engaged in learning, economy of learning resources, helping students to deconstruct socially constructed knowledge, learn about shared values and group difference, access to non-formal learning contexts and extracurricular activities with strong leadership and team-focuses.

Teacher learning
Uncover and identify personal attitudes toward racial, ethnic, language and cultural groups, acquire knowledge about diverse cultures and ethnic groups, acquire knowledge and skills to develop and implement an equity pedagogy which provides all students equal opportunity to attain academic and social success.

School Organisation
Participation by a variety of stakeholders including students, teachers, parents. Equitable funding, increasing teacher quality, encouraging parents’ involvement.
REFERENCES


