Get Into Vocational Education (GIVE): Motivating Underperforming Students

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This study explores the effects of a vocational education-based program on academic motivation and engagement of primary school aged children. The *Get Into Vocational Education* (GIVE) program integrated 'construction' and the mathematics, English and science lessons of a Year 4 primary classroom. This paper focuses on investigating the components of the GIVE program that led to student changes in mathematical academic motivation and engagement resulting in outstanding gains in NAPLAN Numeracy results. The components proposed to have contributed to effectiveness of the GIVE program are: teacher and trainer expectations, task mastery and classroom relationships. These findings may be useful to researchers and educators who are interested in enhancing students' mathematical academic motivation.

The rapid development of mining and coal gas liquefaction throughout Queensland will require many thousands of additional trades-people. To address this shortage of skilled workers, Queensland needs to either increase the number of local people with appropriate qualifications or import skilled workers. Educational programs, such as *Get into Vocational Education Program (GIVE)*, are needed to promote interest and provide initial training. Importantly, these programs need to encourage participants from local groups that in the past have not been a major source of such skilled workers. One such group is the underperforming students in local schools, many of whom have a desire to enter employment as apprentices but lack the prerequisite literacy and mathematics and/or have already disengaged from school. This is a problem that is not solely the result of the students' Years 8-10 schooling: Often these students leave primary school without the prerequisite academic and social abilities that will underpin success in secondary school and future employment. This paper reports upon the delivery of the GIVE program in a Year 4 classroom, in which timber construction was selected as a trades-related context through which to target the development of motivation and academic achievement. The shifts in student motivation over the course of the GIVE program are examined and linked to mathematics academic gains, as evidenced in NAPLAN numeracy results.

Academic Motivation

Martin (2001) developed a 'Student Motivation and Engagement Scale' which is based upon literature regarding: student motivation in relation to the pedagogy used by the teacher (Teven & McCroskey, 1997); the teacher-student relationship in the classroom (Kelly & Hansen, 1987)'; and adult expectations (Dandy & Nettlebeck, 2000). Martin also considered the links between students' motivation and academic engagement: For example, Valentine, Cooper, Battencourt, and DuBios (2002) reported that extra-curricular programs can enhance academic engagement and achievement if the program is related to the students' actual school life. Martin's (2001) scale groups motivation facets into those that reflect enhanced motivation and those that reflect reduced motivation, which Martin refers to as

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'boosters' and 'guzzlers' respectively. Martin (2001) identified four guzzlers (anxiety, uncertain control, failure avoidance and self-handicapping) and six boosters (planning, mastery orientation, study management, self-efficacy, value of schooling and persistence). Using LISREL procedures, Martin confirmed a strong factor structure of the scale. Martin validated the scale in terms of literacy and numeracy in an Australian context.

Hoachlander (2008), in the context of high school education, identified four guiding principles in relation to vocational education. Firstly, deliver a school curriculum that motivates and engages the student to succeed in both school and at a vocation or career. Secondly, consider the pedagogical presentation of the literacy, mathematics and science learnings, rather than considering what is to be taught. The academic expectations should not be lowered, in-fact they should be increased as the students participate in an authentic workplace dealing with authentic problems. Thirdly, present a curriculum that appeals to all students, irrespective of their academic ability. The curriculum should not be limiting – it needs to be broad to allow for the selection of apprenticeship trade careers or a university education (e.g., electrician or an electrical engineer). Fourthly, assess student achievement in multiple areas of the curriculum. It was with this type of thinking regarding integrated, vocationally-based contextualisation, that the GIVE program was developed.

The focus of this paper is upon the impact that a construction skills-based program (which promoted integrated and meaningful links between the classroom and the workplace) had upon motivation and academic achievement. The three boosters of self-efficacy, value of schooling and persistence were selected as the facets of motivation to explore, since Martin (2001) suggested these are closely linked to students' motivation to learn.

The GIVE Program

The GIVE program aims to build awareness of, interest in, and familiarity with vocational employment as a future career pathway and opportunity for advancement; enhance literacy, numeracy and science knowledge and achievement; and provide motivation to stay on at school and build towards a productive future. To achieve these aims, the GIVE program was designed as a term-long (nominally 10 week) program tailored to learners' needs by considering the curriculum (as specified by national, state and sector-level authorities) and local industry. The latter consideration stems from the researcher and schools' partnership with local industry, which provided the relevant and authentic opportunities and technical expertise for the vocation-based contextualisation of English, mathematics and science learning. Mathematics topics explored in the construction unit were: number (including place value and fractions), measurement, time and geometry (in particular, the creation of 2D representations of 3D objects).

Method

Sample and procedure. The program was delivered to a Year 4 class of 21 students (aged 8-9 years) who were taught by two teachers during Term 4 of the 2010 school year. Of these 21 students, only the data relating to 16 of the is considered in this paper; the remaining five students entered the school after the Year 3 NAPLAN test and/or left the school before the Year 5 NAPLAN test. Pre-post interview data was collected from both the student and teacher participants. In both cases, a 10-point Likert scale was used to ascertain perceptions of the three factors (the boosters): self-efficacy, value of schooling and persistence. For the students, small focus group discussions were used in which the students were asked to self-report their perceptions (which were verified by their peers). Both teachers were asked to use the same Likert scaled based system to independently rate each

student with regards to the three factors. This process was performed both before and after delivery of the GIVE construction program.

Instruments and analysis. Each student focus group was shown the rating scale. The interviewer explained the usage of the scale, and a sample item "I think I will like the GIVE program" was presented to check for understanding. The students were then presented with a series of three cards, each with a statement relating to the three boosters under investigation (refer to table 1). For each statement, the students were asked to rate themselves using the 10 point Likert scale ('1' strongly disagree to '10' strongly agree) and to discuss, and thus verify, their rating with their peers.

For each factor, the class mean was calculated and then used to determine the student self-reported mean. The two teachers' ratings of each student were compared and the mean calculated for each student; there were no cases of substantial differences of teacher's perceptions of a student. The individual teacher-perceived student means were themselves averaged to determine the class mean for each of the three factors. The pre-post self-reported and teacher-perceived ratings were compared for changes in motivation and engagement. NAPLAN data from when the participating students were in Year 3 and Year 5 was used to compare changes in each student's mathematics ability.

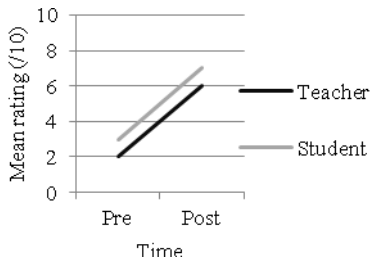
Table 1.
Motivation and Engagement Stimuli

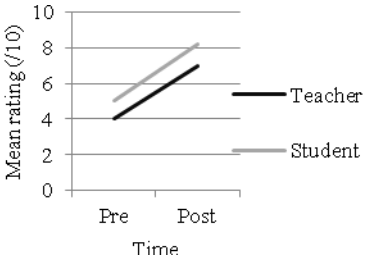
Factor	Student statement	Teacher statement
Self-efficacy	If I try hard, I believe I can do my schoolwork well	This student believes that if he/she were to try hard, then he/she do their well in their schoolwork
Value of schooling	Learning at school is important to me	This student believes that learning at school is important
Persistence	If I can't understand my work, I keep trying until I understand it	If this student doesn't understand the work, he/she will keep trying until he/she does understand it

Results and Discussion

Observational data revealed significant improvements in a number of areas. Firstly, school attendance for the participating class rose from its normal level of 50-60% to 100% (full attendance) in Week 2 and stayed at 100% well beyond the duration of the program. Secondly, classroom and playground behaviour (which commonly involved repeated negative instances each week and school suspensions) improved to the point where there were only two playground instances of negative behaviour across the period of the program, neither of which were instigated by students participating in the GIVE program.

The mean student self-ratings and the mean teacher-ratings in regards to the three factors of self-efficacy, value of schooling and persistence are shown in Figures 1a-1c. The influences that the changes in these three factors have had upon motivation and in turn academic achievement are discussed in the following sub-sections.





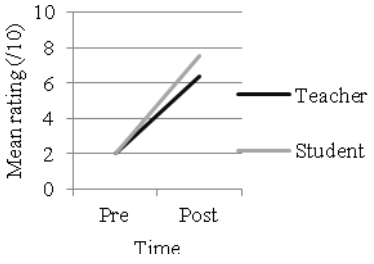


Figure 1a. Self-efficacy *Figure 1b.* Value of schooling *Figure 1c.* Persistence

Self-efficacy. The belief in ability and the confidence to succeed at school was initially perceived to be low by both the students and the teachers. The mean rating provided by the students was 3/10, slightly higher than the teacher's perception (2/10). Figure 1a indicates that both the students and teachers perceived a four point improvement in self-efficacy following the GIVE program.

During the program, students were not given the opportunity to quit or not finish an activity. There was an expectation that all students would succeed and complete all tasks, thus showing students that they could indeed succeed at school. At times, frustrations impeded satisfaction when the student set unrealistically high expectations in relation to their construction work:

> Yea like, I imagined my tow truck to be really sleek, and smooth running – like on a real truck. But I didn't measure properly. My wheels were crooked. I am not so good at dividing, but still it worked OK. I got to drill and screw new axle holes so I get it now (Larry).

Value of schooling. The usefulness of what is learnt at school was initially perceived to be in the mid-range by the students (mean rating of 5/10). A number of students realized that they needed to be able to read and write, but "once I have got that, why do I have to keep doing it, like you do English all the time, but I can already read and write" (Larry). Another student commented that:

> A lot of the stuff you have to do is boring, and I never use it like plus-ing and take-aways. I am not good at that and I don't see why I have to do it. They have calculators to do it (Penny).

The teachers also felt the students had little value for school work "as they don't see its relevance. If it does not relate specifically to what they did yesterday or today, then forget it!" (Teacher 1). However, almost nine weeks later, the mean student perception of the value of schooling had shifted considerably to 8.2/10. Many students commented on the link between mathematics and everyday life: "I need to be able to make good measurements or my truck will look dumb. I don't want everyone to know I can't measure, so I have to work at it in class" (Mitchell). Larry was aware of his changes as he said "last time I thought school was boring and not got anything to do with me, but now I can see it has".

Persistence. Initially, the drive to keep trying if at first unsuccessful was a difficult notion for the students to understand. The pre-program mean student-reported persistence rating was quite low (2.1/10). This was not surprising, considering many students rated themselves at 1/10 "because I don't start my work, so how can I keep trying?" (Michael). The teachers also rated the students as having very low persistence initially, due to apathy. However, the GIVE program provided many challenges for the students, and as the students

became more willing to engage in an activity, they all seemed to develop some form of persistence.

> It is harder to keep trying in maths 'cause I don't know all my times tables. I know what I want to do, like times 'n stuff, but I cannot do it without knowing times tables. We used to be allowed to use a calculator, but now we can't, so I am learning them [times tables] 'cause I need to figure out how much wood to ask for my trinket box (Louise).

Persistence was the factor which shifted the most over the duration of the program. Students' mean self-rating of perception shifted by a rating of 4.4 points, and the teacher's perception of student persistence increased by 5.5 points. By the conclusion of the GIVE program, all students were self-starters on any given academic activity in the classroom: They had the ability to attempt an activity, and modify their strategy if they perceived they were not doing it properly.

Academic achievement. The participating students' NAPLAN results were used as the basis for commenting upon academic achievement. Figure 2 shows the NAPLAN growth of the Year 4 class (Year 3 data was collected 16 months prior to, and Year 5 from 8 months after, the GIVE program). It should be noted that between the two NAPLAN tests the school did not implement any targeted interventions other than the GIVE program.

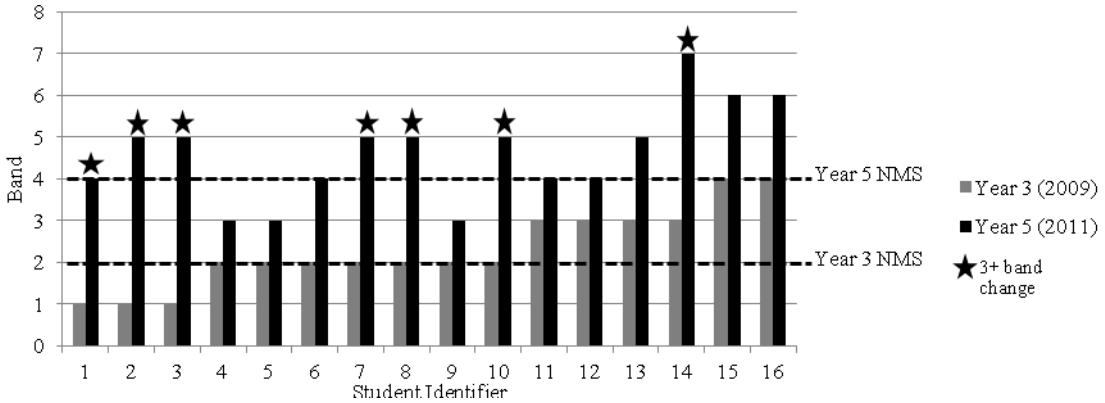


Figure 2. NAPLAN numeracy data

The changes from Year 3 to Year 5 indicate substantial growth for the majority of the 16 students participating in the study. In 2009, three students were below the National Minimum Standard (NMS) (18.75%); seven students were performing at the NMS (43.75%), and six students performed above NMS (37.5%). The year 5 results showed marked improvement: the three students who previously below the NMS were now performing at or above the NMS. In fact, most students experienced personal growths of 2 or more bands, with almost half jumping 3 or more bands.

Implications

Like Hoachlander's (2008) identification of principles for high school vocational education, this study has led to the identification of three practical implications drawn from the GIVE experience. These implications are proposed to be crucial to increasing motivation and engagement and are linked to mathematical academic growth. In the following sub-sections, each implication is discussed in turn, including vignettes to illustrate the implication in action.

Teacher and trainer expectations. At no time were the students permitted to opt out or not complete a task. It was clear to the students that the teachers and trainers had high expectations. In particular, all students were expected to master the skills – both in the classroom and in the workshop. The following vignette illustrates the impact of teacher expectations being understood by the student. With the students knowing what was expected of them at all times, and when combined with the knowledge that they had the power to positively impact on their school lives, and life in general, it is proposed that teacher and trainer expectations impacted positively on academic motivation. Students of all abilities became more motivated to engage with class work as they had the confidence, or self-efficacy, to believe in themselves and their abilities. The students understood that the teachers and trainers expected then to be capable and responsible at all times.

Vignette 1 – The camera man. A number of students were asked to take on additional responsibilities based upon student ability e.g. to be a team leader (Foreperson). However one role was deliberately given (by the Researcher) to the most disruptive and violent boy in the class – that of reporter and camera man. This boy, Michael, was given unlimited access to the video camera, much to the envy of his peers. After two days, the teacher began to suggest that Michael also needed to do the class work or he would not be ready to go to the workshop as he would not have his plans and measurements done to make the tow truck. As Michael understood the expectations of being the cameraman, as well as a student in the class, he reluctantly attempted the class activities. By the end of week one, Michael was achieving accurate measurements, and beginning to assist other students who were struggling – especially in the workshop. He discontinued his disruptive violent behaviours. Over time he became adept at managing a high standard in his class work and construction work, whilst capturing interesting video footage and interviews. Michael's post test for numeracy was 29/30, a marked improvement on his pre-test of 2/30.

Persisting for success. Closely related to the high expectations of the teachers and trainers was an emphasis on mastering tasks and the promotion of success. Students knew it was OK not to master a task on the first attempt provided they gave it another go. The students saw their teachers make mistakes in the workshop, but they also saw the teachers try and try again. This 'persistence' spread to the classroom and even had students requesting to take extra paper home to have another go for homework, or to stay in at break time to have another go, or to finish an activity. The class became a close knit learning community as the students grappled with mathematical concepts well beyond their years. The following vignette illustrates the impact of persistence.

Vignette 2 – Tow truck speed. The construction of tow truck required accurate measurement and technical drawing skills. The completed tow truck was then used to develop science inquiry and number skills. The students used balloons to create balloon powered tow trucks and extended this activity to conducting speed trials of the trucks. To calculate speed they used the formulae Speed = Distance / Time. The notion of formulae and substitution was discussed. Using calculators a few students were able to calculate speeds and plot performance graphs. Using a form of peer tutoring, most teams were able to develop good understanding of calculating speed, plotting and comparing a number of tow truck speeds. Louise commented upon the notion of 'time trials' in a car race to get top position at the race start. Other students were able to relate to this real world link and one student wondered if he could look up swimming race times from the Olympics and then calculate how fast the swimmer was going.

The use of formulae and variable substitution, along with the ability to apply the learnings in the real word, was enabled by mastering practical hands on skills in the workshop and using the product in the classroom to develop theoretical concepts. The students knew that they needed to be accomplished in both the workshop and classroom to succeed, and that they had multiple opportunities to master skills. Using activities that were challenging but achievable, that linked the workshop with the classroom clearly enhanced the student perception of the value of schooling. It is proposed that task mastery and peer relationships impacted positively on academic motivation and engagement to grapple with mathematical and scientific concepts well above the Year 4 level.

Classroom relationships. The usual classroom relationship of teacher and student quickly changed. In the following vignette, Michael (M - the cameraman) was one of the first to notice this and he made queries about the changes with the researcher (R) as he set up his camera equipment one morning:

> *Vignette 3: Changed relationships.* (M) You know, I don't get red cards (detention notices) from Miss any more. I think she likes me now. (R) Why do you think she disliked you before? (M) Well, I always messed around and now I don't. I like this sort of school. I see I can do it and need my maths and reading 'n stuff. Like, she is a different person when she goes into the workshop, not telling me what to do and stuff. It's like she is too busy to pick on me 'cause she is learning her skills too. (R) Do you think you might not be making her agro now, so she doesn't have anything to give you a red card for? (M) Maybe, I'm getting things done. But I used to get in trouble for wandering around, and now I don't, but I wander around just the same but with the camera. (R) Perhaps you have a purpose to your wandering now. Like you have a purpose to do the class work? (M) Yea, maybe. Might ask her. Can I interview her? (R) Remember our deal? You can interview anyone who is doing what they should be doing. Is Miss doing the right thing? (M) Yea, she's learning. Michael, did the interview with the teacher, and asked: "Miss, you are learning to drill for the first time, so you are like us – students! I like this idea, you being like a student too. Do you like this?" The teacher explained that "yes, I am a student now, but I am always a student. I am always learning – it's what makes me a human being. Are you always learning Michael?" Michael replied that he "wasn't always learning – I only learn when I do maths and skills and stuff".

Michael, like the other students, responded well to the GIVE program and began to review what it meant to be a student. Relationships between the students themselves improved, as well as those between the students and the adults in the program (teachers, trainers, Principal and researcher). With positive relationships in the classroom, parents reported the students were keen to get to school, keen to attack homework in the afternoon. It is proposed that classroom relationships impact positively on academic motivation. Students saw teachers in a new light, teachers wasted less time on discipline matters, and students began to see the relevance of their schooling.

Conclusion

This paper reports on a study that investigated the motivation and engagement of underperforming Year 4 students. The students undertook a term long integration of mathematics, English and science via the vocational education-based context of 'construction'. Within a very short time, students became motivated to engage with their class work. The data from the program indicates student gains on key components of

motivation over the course of the school term and up to 12 months beyond. Three implications were identified: (a) that teacher and trainer expectations impact positively on mathematical academic motivation; (b) that persistence impacts positively on mathematical academic motivation and engagement enabling students to perform well above the expected level, and (c) that classroom relationships impact positively on mathematical academic motivation.

In summary, this paper has demonstrated how a vocationally-based program can be used in a primary school setting to motivate learners, engage them in the curriculum and enhance their academic skills, whilst simultaneously promoting their interest and awareness regarding trades-based employment. These findings are significant for researchers and educators who wish to enhance student's mathematical academic motivation.

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