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Andrew J. Martin[a] ⓘ, Paul Ginns[b] ⓘ, Michael Anderson[b], Robyn Gibson[b] and Michelle Bishop[c] ⓘ

[a]School of Education, University of New South Wales, Sydney, Australia; [b]School of Education and Social Work, University of Sydney, Sydney, Australia; [c]Department of Educational Studies, Macquarie University, Sydney, Australia

ABSTRACT

Among a sample of 472 Indigenous high school students, juxtaposed with 15,884 non-Indigenous students from the same 54 schools, we investigated variation in motivation and engagement from school to school, and the role of motivation and engagement in predicting various academic outcomes (aspirations, buoyancy, homework completion, and achievement). We found significantly lower mean-levels of motivation and engagement among Indigenous students. Importantly, however, after accounting for age, gender, socio-economic status (SES), and prior achievement, the motivation and engagement differences between Indigenous and non-Indigenous students were markedly reduced. We also found that Indigenous students' positive motivation and engagement (e.g. self-efficacy, mastery orientation, etc.) predicted academic outcomes to a significantly greater extent than their negative motivation and engagement (e.g. anxiety, self-handicapping, etc.) predicted these outcomes. Findings are discussed with particular focus on how they may be helpful in identifying ways to enhance the educational outcomes of Indigenous students.

Introduction

On many measures, Indigenous students achieve at significantly lower levels than non-Indigenous students[1] (e.g. Arens et al., 2014; Trudgett, 2013). The achievement gap between Indigenous and non-Indigenous students in Australia is particularly stark (De Bortoli & Thomson, 2010; Thomson et al., 2013) and on some factors larger than the achievement gaps found for Indigenous students in other settler nations (e.g. Song et al., 2014). There are many reasons for this gap, traversing

personal, social, and contextual factors. For example Indigenous students experience substantial educational disadvantage and are subjected to ongoing negative expectations from others about their academic potential (e.g. Bodkin-Andrews & Carlson, 2016; Dockett et al., 2006; Martin, 2006; Pirbhai-Illich et al., 2017). There is also a history factoring into these achievement gaps that emanates from government and educational policies that resulted in exclusion, segregation, or assimilation of Indigenous students, as well as a disconnection from their culture such as through constraints on language and cultural traditions (Fordham & Schwab, 2007; Ranzijn et al., 2009). At the same time, it is important to recognise educational progress on some fronts has been made. These include increased enrolments in pre-school and school; improvements in school completion; some narrowing of literacy and numeracy gaps; gains in grade progression and retention; improvement in vocational and training enrolments; and gains in undergraduate degree enrolments (Australian Bureau of Statistics, 2016; Department of Education, Science, and Training, 2002; Department of Prime Minister & Cabinet, 2018; Gore et al., 2017).

While recognising the many influences on Indigenous students' educational development, this study adopts a psycho-educational lens to explore Indigenous students' academic motivation and academic engagement and their role in academic outcomes. Research into the motivation and engagement factors that underlie Indigenous students' academic outcomes has the potential to inform educational intervention to help improve their educational pathways. In this study, we seek to examine Indigenous students' status with regard to a wide range of motivation and engagement factors, the role of various background factors in contributing to the motivation and engagement of Indigenous and non-Indigenous students, and the extent to which multidimensional motivation and engagement predict Indigenous students' academic outcomes.

Conceptual and empirical underpinnings

Martin (2006) and McInerney (2000) have emphasised a need to empirically explore multidimensional motivation and engagement among Indigenous students and the role of motivation and engagement in Indigenous students' academic outcomes, including in the context of individual, and socio-demographics. Their calls followed prior conceptualising in relation to other ethnic minorities, such as that by Graham (1994; also see Graham & Hudley, 2005) who articulated a multidimensional motivational psychology for African-American students. In a preliminary investigation of multidimensional motivation and engagement, Martin et al. (2013a) found that Indigenous and non-Indigenous students were broadly similar on positive motivation and engagement factors (e.g. mastery orientation, valuing of school, task management, planning, and persistence). Notably, however, they also scored significantly higher on negative dimensions of motivation and engagement (e.g. failure avoidance, anxiety, uncertain control, self-handicapping, and disengagement). Martin et al. (2013a) concluded that there appeared to be a motivational readiness among Indigenous students to engage with school, but in the presence of maladaptive motivation and engagement (comprising negative motivational constructs, such as

anxiety, failure avoidance, self-handicapping, etc.), alongside well-documented systemic and institutional barriers (Moodie et al., 2019; Ranzijn et al., 2009), this readiness may be hampered – potentially leading to significantly poorer educational outcomes. Also of note, in almost all cases the 'negative' effects for Indigenous students declined after including socio-economic indicators, suggesting that at least part of their problematic motivation was a function of their lower socio-economic status (SES; indeed, also a function of a history of exclusion, segregation, and forced disconnection from culture; Bishop & Durksen, 2020; Ranzijn et al., 2009).

It is important to note that the study by Martin et al. (2013a) was a somewhat limited investigation focussed on differences in motivation and engagement between Indigenous and non-Indigenous students without accounting for between-school differences (and containing no objective achievement data). In contrast, the present investigation begins where that 2013 study concluded. Specifically, this study: (a) employs a multilevel design (that accounts for the fact students are nested within schools – not typically accommodated in empirical work); (b) includes objective achievement data (to build on the large body of psycho-educational research that is self-reported; Graham, 2015); (c) explores for potential between-school differences in Indigenous students' motivation and engagement (to our knowledge no such research has been conducted among Indigenous students); and (d) examines the extent to which multidimensional motivation and engagement predict Indigenous students' academic outcomes, after accounting for potentially influential factors, such as SES, etc. (low SES is a known barrier to Indigenous students' outcomes (Australian Institute of Health and Welfare, 2017), but we do not know so much about how it moderates motivation effects).

Indeed, our study not only expands on the work by Martin et al. (2013a), it continues a line of related psychological research among Indigenous students. For example, researchers have suggested non-Indigenous students are more inclined to value performance goals, competition, future time orientation, and individuality whereas Indigenous students are more inclined to value group orientation, present-time orientation, and non-competitive environments (Fogarty & White, 1994; McInerney, 2000). Issues of identity and self-concept are also implicated. Munns (1998) has suggested that Indigenous students experience difficulties maintaining a positive academic self-concept and positive academic identity because of the alienation they can experience at school. In fact, because different schools accommodate Indigenous identity in different ways (Groome & Hamilton, 1995) and Indigenous students may enrol in diverse school types (ranging from scholarships at elite and highly resourced boarding schools in the city to local [regional, rural, and remote] government/systemic schools that may be under-resourced; Martin et al., 2014), issues around identity and school-type may also be a source of between-school differences. Other relevant psychological dynamics involve fear of failure. According to Munns (1998), 'the classroom appeared to be the site of their [Indigenous students'] greatest danger' (1998, p. 179). These various lines of psycho-educational research identify numerous motivation and engagement factors relevant to Indigenous students' educational experiences. This being the case, this study adopts a multidimensional approach to motivation and engagement.

Multidimensional motivation and engagement: the Motivation and Engagement Wheel

Researchers have identified the yields of studying motivation from a multidimensional perspective (Murphy & Alexander, 2000; Pintrich, 2003). However, in advocating for multidimensional approaches to motivation, they have also lamented the fact that motivation research can be diffuse and piecemeal, leading to difficulties in gaining a sense of consistent findings and well-framed implications for practice. Following prior motivation research among Indigenous students (Martin et al., 2013a), we adopted the multi-dimensional Motivation and Engagement Wheel (Martin, 2007, 2009) as the operational framework for this research. The Wheel comprises 11 first-order factors subsumed under positive and negative dimensions: positive motivation and engagement (self-efficacy, valuing school, mastery orientation, planning, task management, and persistence) and negative motivation and engagement (anxiety, failure avoidance, uncertain control, self-handicapping, and disengagement).

Martin (2007) has argued that: (a) when using the Wheel factors as predictors and to resolve any potential collinearity among them, it is feasible to adopt an overarching (e.g. higher-order) approach to capture broad patterns of students' orientation to their studies; and (b) when using the Wheel factors as outcome variables, it is feasible to model them as 11 first-order factors (as collinearity is not such an issue in this setup). Accordingly, when investigating the predictive role of motivation and engagement, we modelled it as two overarching orientations (positive motivation and engagement, and negative motivation and engagement) and when investigating them as outcome variables, we did so in terms of their 11 first-order factors. We also point out that although we adopted the Motivation and Engagement Wheel (and the Motivation and Engagement Scale (MES) to assess it; Martin, 2007, 2009), there are other notable examples of multidimensional conceptualising and instrumentation, including Patterns of Adaptive Learning Survey (PALS; Midgley et al., 1997), the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991), the Student Engagement Instrument (SEI; Appleton et al., 2006), and the Inventory of School Motivation (ISM; McInerney et al., 2001). These include dimensions of motivation that the Wheel does not – such as perceived goal structures (PALS), intrinsic and extrinsic goal orientation (MSLQ), etc.

Positive motivation and engagement

The positive motivation and engagement factors in the Wheel are well-established in diverse research and theorising among Indigenous students. For example, a sense of efficacy (or self-concept; Craven et al., 2005) in academic capacity has been identified as critically important for Indigenous students' educational outcomes (Purdie et al., 2000). Achievement goals are also implicated; as noted, non-Indigenous students are more inclined to value performance goals, whereas Indigenous students are more inclined to value group-goal orientations (Fogarty & White, 1994; McInerney, 2000). A valuing of education emerges as a key factor in Indigenous students' educational outcomes. For example McInerney (2012) identified that facilitating conditions for Indigenous students' achievement involved them liking school and valuing education.

Similarly, others have identified various factors impacting Indigenous students' school attendance, including the need to make school more interesting (see also Bourke et al., 2000). Other positive factors involve self-regulatory dimensions (e.g. planning and monitoring, task management, and persistence; Martin, 2007, 2009; Zimmerman, 2002) that have been promoted by successful teachers of Indigenous students (Boon, 2016). Taken together, self-efficacy, mastery orientation, valuing, planning and monitoring, task management, and persistence are positive motivation and engagement factors that have roots in research examining Indigenous and non-Indigenous students' educational status and development.

Negative motivation and engagement

There are also negative dimensions of motivation and engagement implicated in Indigenous students' educational development. One line of relevant theory and research in Indigenous education concerns fear of failure. Also, as noted above, others have pointed to negative stereotypes and negative expectations of Indigenous students (Gray & Beresford, 2008) that may further fuel these students' fear of failure. According to Martin and Marsh (2003), there is a process of failure dynamics that encompasses initial anxiety, failure avoidance, and uncertain control. If these factors persist, students may then respond in self-protective ways such as through self-handicapping (e.g. procrastination and withdrawing effort). Eventually, self-handicapping strategies do not have their self-worth protection benefits and students may then come to accept failure and disengage from school (Covington, 2000). Accordingly, negative motivation and engagement factors that are implicated in the failure dynamics identified with disadvantaged ethnic minorities include anxiety, failure avoidance, uncertain control, self-handicapping, and disengagement. In addition, some of these factors are recognised as implicated in specific cultural values. For example failure avoidance encompasses (among other things) a fear of disappointing parents which can have distinct salience in some cultures more than others (Martin & Hau, 2010).

Academic outcomes

In the first part of our investigation, we examine motivation and engagement as an important end in itself (e.g. comparing mean-levels of multidimensional motivation and engagement among Indigenous and non-Indigenous students). In the second part of our investigation, we investigate the role of motivation and engagement in predicting Indigenous students' academic outcomes. Among the diversity of potential educational outcomes to investigate, we focus on four outcomes on which Indigenous students are known to struggle.

The first relates to how these students navigate academic adversity. Indigenous students face significant educational and other adversity – spanning socio-economic, institutional, and systemic barriers that impact educational development (Andersen & Walter, 2010; Fordham & Schwab, 2007; Martin, 2006; Ranzijn et al., 2009; Vass, 2015, 2016). This being the case, academic buoyancy (the capacity of a student to successfully navigate academic adversity) has been identified as important for Indigenous

students (Martin, 2006; Martin et al., 2013b). This study is an opportunity to investigate the extent to which their motivation and engagement may support their academic buoyancy. Second, it is also the case that in the face of their educational disadvantage and others' negative expectations of them, Indigenous students are at risk of lower educational aspirations (Martin et al., 2013a). We seek to identify the role of Indigenous students' motivation and engagement in predicting their educational aspirations. Third, there are out-of-school learning opportunities that have the potential to support students' academic outcomes beyond what is covered in class. For example homework is an out-of-school activity that has the potential to consolidate what has been learned in class that day and provides an opportunity to extend the student beyond that (Cooper et al., 2006). Our study therefore explored the role of motivation and engagement in predicting homework completion. Finally, as noted earlier, Indigenous students achieve at significantly lower levels than non-Indigenous students (e.g. Arens et al., 2014; Trudgett, 2013) and closing the achievement gap between Indigenous and non-Indigenous students is identified as a major national priority (De Bortoli & Thomson, 2010). Academic achievement is thus another academic outcome we investigate.

Factors implicated in motivation and engagement

There are personal and background characteristics of individuals to account for when studying motivation and engagement among Indigenous students (Martin, 2006). Richer et al. (1998) observe that part of Indigenous students' educational disadvantage is a function of economic disadvantage (that in turn is a function of a history of exclusion, segregation, dispossession, and forced disconnection from culture; Fordham & Schwab, 2007; Phillips, 2012; Ranzijn et al., 2009). Thus, prior research has underscored the importance of disentangling socio-demographic/socio-economic factors from the outcomes of Indigenous students (Martin et al., 2013a). Indeed, Indigenous status aside, there are various background factors that have each shown associations with motivation, engagement, and/or achievement for students generally. For example younger students and girls tend to be higher in motivation and engagement (Martin, 2007, 2009). Lower SES is linked to lower levels of achievement (Rothman & McMillan, 2003; Sirin, 2005), as is gender (such that boys tend to achieve more poorly; Voyer & Voyer, 2014). Prior achievement is also important to include as current levels of motivation and engagement are in part a function of one's achievement history (Schöber et al., 2018).

Aims of this study

Using multilevel hierarchical regression, we examined for differences in motivation and engagement between Indigenous and non-Indigenous students, controlling for key background attributes (age, gender, SES, and prior achievement) and the multilevel structure of the data (students [Level 1] clustered within schools [Level 2]). We were further interested in identifying the extent to which motivation and engagement were predictive of academic outcomes (aspirations, buoyancy, homework completion, and

achievement) and accordingly conducted a second set of multilevel hierarchical regression analyses to examine this.

Method

Procedure

Ethics approval was provided by the relevant University Human Research Ethics Committee associated with each part of the data (see Participants below describing the data). Parents/caregivers provided signed consent for their child to participate. Surveys were administered to participants during their normally scheduled lessons. Teachers supervising survey completion were issued with a standard set of instructions. Anonymity was assured (no student names or student identification numbers were requested) and students were encouraged to respond as frankly and fully as possible. Surveys were completed by students independently in class, but they were allowed to ask their teacher for help if they experienced problems reading or understanding survey items or aspects of survey formatting. Relative to the eligible sampling frame, the survey response rate was estimated at approximately 75% (with most non-responders being absent on the day or not receiving parental/carer consent). However, because we could not access data on non-responders, we were not able to formally ascertain how representative responders and non-responders were.

Participants

Because Indigenous students typically comprise small numbers in any given school (Indigenous people comprise approximately 3% of the total Australian population; Australian Bureau of Statistics, 2016), we generated a large sample of Indigenous students by drawing from five research projects conducted over the past decade. These studies have each been the basis of published work on other substantive topics – such as motivation and engagement among non-Indigenous populations, academic buoyancy, adaptability, the effects of boarding school, growth goals, and growth mindset (e.g. Burns et al., 2017, 2019; Martin, Mansour, et al., 2013; Martin, Nejad, et al., 2013; Martin et al., 2009, 2014, 2016). There has been one study on motivation and engagement among Indigenous students that shares approximately half the data with this study (Martin et al., 2013a – described in the Introduction).

Our study comprised a large sample (compared to most other studies of Indigenous students) of 472 Indigenous students (non-Indigenous students, $N = 15,884$) who were in Year 7 (13%; non-Indigenous = 11%; mean age = 12.21 years, SD = 0.57), Year 8 (21%; non-Indigenous = 23%; mean age = 13.33 years, SD = 0.60), Year 9 (21%; non-Indigenous = 25%; mean age = 14.31 years, SD = 0.60), Year 10 (22%; non-Indigenous = 22%; mean age = 15.25 years, SD = 0.63), Year 11 (15%; non-Indigenous = 12%; mean age = 16.08 years, SD = 0.62), and Year 12 (8%; non-Indigenous = 7%; mean age = 16.82 years, SD = 0.65). It is noted that $N = 472$ Indigenous students in our study correspond to a 2.9% proportion relative to the total sample, a figure just under the population proportion of Indigenous people in Australia – 3.3% (Australian Bureau of Statistics, 2016). Students were from 54

mainstream schools in major urban centres on the west and east coasts of Australia. Most were independent schools ($n = 38$ schools), followed by government schools ($n = 10$), and systemic Catholic schools ($n = 6$). Twenty-five schools were co-educational, 14 comprised all girls, and 15 comprised all boys. Students in these schools generally represented mixed levels of ability, but there was a school-level trend of higher achievement as indicated by data from Australian, Curriculum, Assessment and Reporting Authority (ACARA).

The average age of Indigenous students was 14.42 years (SD = 1.57; non-Indigenous $M = 14.43$, SD = 1.42). Fifty-one percent were boys; 49% were girls (non-Indigenous students: boys = 55% and girls = 45%). We standardised the Australian Bureau of Statistics Index of Relative Socio-Economic Advantage and Disadvantage classification to assign SES levels with an overall mean of zero. Indigenous students' SES score was −1.05 (SD = 1.28; non-Indigenous students $M = 0.03$, SD = 0.97). Students' prior achievement was assessed *via* their results in yearly nation-wide testing of numeracy and literacy (National Assessment Program in Literacy and Numeracy [NAPLAN]) administered by ACARA. We standardised the average of students' literacy and numeracy bands by grade level, with Indigenous students scoring a mean of −0.78 (SD = 1.05; non-Indigenous students $M = 0.03$, SD = 0.90).

Materials

Motivation and engagement

Motivation and engagement were measured using the MES – High School (MES-HS; Martin, 1999–2018). As described in Martin, Burns, et al. (2017) and Martin, Ginns, et al. (2017), positive motivation and engagement were assessed *via* self-efficacy, mastery orientation, valuing, planning behaviour and monitoring, persistence, and task management. Negative motivation and engagement were measured with anxiety, failure avoidance, uncertain control, disengagement, and self-handicapping. Each factor was operationalised with four items (hence, it is a 44-item instrument) rated on a scale of 1 (strongly disagree) to 7 (strongly agree). Prior research into the MES-HS has shown a strong factor structure, reliable and normally distributed dimensions (including for Indigenous students; Martin et al., 2013a), and significant associations with diverse academic outcomes (Green et al., 2007; Liem & Martin, 2012). Sample items for each factor, factor structure, reliability, skewness, and kurtosis for motivation and engagement factors in this study are shown in Supplementary Material.

Academic outcomes

Four academic outcomes were assessed: educational aspirations, academic buoyancy, homework completion, and test achievement. Educational aspirations were drawn from Martin (2007, 2009), assessed *via* four items, and were rated on a scale of 1 (strongly disagree) to 7 (strongly agree). Academic buoyancy was measured with the Academic Buoyancy Scale (Martin & Marsh, 2008) which also comprises four items, all about students' academic setbacks and challenges and rated on a scale of 1 (strongly disagree) to 7 (strongly agree). Homework completion (Green et al., 2007) was a

single-item indicator rated by the student on a 1 (never) to 5 (always) scale. Sample items and acceptable reliability are presented in Supplementary Materials.

Achievement was assessed with literacy and numeracy test items – completed once respondents had finished answering the survey items. As described in Martin, Burns et al. (2017), the literacy component comprised 10 multiple-choice items that increased in difficulty. To correctly answer the items, students required knowledge of spelling, and comprehension. The numeracy component also contained 10 multiple-choice items that increased in difficulty. Sample items and acceptable reliability are presented in Supplementary Materials. To correctly answer the items, students required a broad range of mathematical knowledge and skill. Correctly answered questions were summed to create a raw score for each of numeracy and literacy. These were then transformed to a z-score for each year level. The z-scores for numeracy and literacy were aggregated (mean-score) to create a total achievement score, subsequently used in analyses.

Socio-demographics and prior achievement

Socio-demographic data included gender (0 = girls; 1 = boys), age (operationalised as a continuous score), and SES (based on the Australian Bureau of Statistics Index of Relative Socio-economic Advantage and Disadvantage transformed from the home postcode of students). Students' prior achievement was based on their self-reported results in nation-wide assessment of literacy and numeracy (NAPLAN; Cronbach's $\alpha = 0.82$) administered by ACARA (2014). Statistics for these background and prior achievement variables for Indigenous and non-Indigenous students were presented in Participants, above.

Statistical analyses

Multilevel modelling comprised three parts and was conducted using MLwiN version 2.18 (Rasbash et al., 2010). In the first part, multilevel hierarchical regression analyses were conducted in two steps. Step 1 entered Indigenous status (no/yes) as a predictor of each motivation and engagement factor. Step 2 added (alongside Indigenous status) age, gender, SES, and prior achievement as predictors of each motivation and engagement factor. We opted for this order of entry because Indigenous status is correlated with other background factors (e.g. SES, gender; Biddle & Meehl, 2016; Turrell & Mengersen, 2000) that impact motivation and engagement. Thus, we purposefully entered variables in this order so as to ascertain the effect of Indigenous status without accounting for these background factors and then to ascertain its effect when these background factors were included. This helped us to disentangle variance attributable to Indigenous status and variance attributable to other background factors. In the second part of analyses, these multilevel hierarchical regression models were run again but this time testing for random effects in each predictive parameter (i.e. whether the relationship between predictor and dependent measure varied as a function of Indigenous status). These latter analyses were important because they assessed the extent to which predictive effects generalised across schools – or whether they operated for some schools differently from others. In the third part of analyses,

multilevel hierarchical regression analyses were conducted to ascertain the extent to which positive and negative motivation and engagement predicted Indigenous students' academic outcomes (aspirations, buoyancy, homework completion, and achievement).

Results

Preliminary descriptive statistics and measurement properties for Indigenous students

Prior to the central multilevel modelling, we conducted preliminary analyses of descriptive statistics, reliability, factor structure, and variance components. Given space restrictions, all these are detailed in Supplementary Material. However, here we briefly summarise main preliminary findings. These show that alongside standard deviations, the skewness and kurtosis values suggested each factor was approximately normally distributed for Indigenous students. Results also show acceptable reliability (Cronbach's alpha and coefficient omega) for Indigenous students. The 11-factor motivation and engagement model was examined using confirmatory factor analysis; this demonstrated acceptable fit for Indigenous students (see Supplementary Material for factor loadings and latent correlations). Multigroup invariance tests in Supplementary Material also show invariance in measurement properties between Indigenous and non-Indigenous students for this 11-factor motivation and engagement model. Finally, in variance components analyses, there tended to be more between-school variability for Indigenous students than for non-Indigenous students (see Supplementary Material for percentage variance between schools).

Predictive modelling: the association between Indigenous status and motivation and engagement

We then explored the extent to which Indigenous and non-Indigenous status predicted each motivation and engagement factor, controlling for age, gender, SES, and prior achievement and accounting for the multilevel structure of the data (L1 = student; L2 = school). To do so, we employed MLwiN to conduct multilevel hierarchical regression modelling. In assessing these effects, due to the multiple testing and to guard against Type I error, we applied a Bonferroni correction (0.05/22 tests) yielding a revised significance level of $p < .002$. As shown in Table 1, for Step 1 and at $p < .002$, Indigenous students were significantly lower in self-efficacy (unstandardised $B = -0.30$) and mastery orientation ($B = -0.21$). At $p < .002$, Indigenous students were significantly higher in failure avoidance ($B = 0.60$), uncertain control ($B = 0.54$), self-handicapping ($B = 0.59$), and disengagement ($B = 0.36$).

At Step 2, after controlling for age, gender, SES, and prior achievement, Indigenous students remained significantly lower on some motivation and engagement factors, but the extent to which this was the case was markedly reduced (from Step 1) and they were no longer significantly lower on any of the positive motivation and engagement factors that were statistically significant at Step 1. For Step 2 and at $p < .002$, Indigenous students remained significantly higher in failure avoidance (unstandardised

Table 1. Multilevel hierarchical regression model with Indigenous/non-Indigenous status predicting motivation and engagement.

	Self-efficacy Est (SE)	Valuing Est (SE)	Mastery Est (SE)	Planning Est (SE)	Task manage Est (SE)	Persist Est (SE)	Anxiety Est (SE)	Failure avoid Est (SE)	Uncertain cont Est (SE)	Self-handicap Est (SE)	Disengage Est (SE)
Step 1											
Fixed effects											
Indigenous (Y)	−0.30[e] (.05)*	−0.08 (.05)	−0.21[a] (.05)*	−0.06 (.06)	−0.12 (.06)	−0.14[c] (.05)	0.19 (.07)	0.60[g] (.07)*	0.54[g] (.07)*	0.59[g] (.06)*	0.36[c] (.06)*
Random effects											
Level 2 (School)	0.03 (.01)*	0.03 (.01)*	0.03 (.01)*	0.06 (.01)*	0.07 (.02)*	0.04 (.01)*	0.10 (.02)*	0.08 (.02)*	0.07 (.02)*	0.06 (.01)*	0.10 (.02)*
Level 1 (student/Resid)	1.01 (.01)*	1.10 (.01)*	.94 (.01)*	1.48 (.02)*	1.47 (.02)†	1.22 (.01)*	1.82 (.02)*	2.06 (.02)*	1.81 (.02)*	1.68 (.02)*	1.63 (.02)*
−2*log-likelihood	46,664	48,022	45,578	52,896	52,881	49,750	56,340	58,357	56,234	55,039	54,506
Step 2											
Fixed effects											
Indigenous (Y)	−0.17[f] (.06)	−0.01 (.06)	−0.14[b] (.06)	−0.06 (.07)	−0.08 (.07)	−0.05[d] (.07)	0.19 (.08)	0.48[h] (.09)*	0.31[h] (.08)*	0.49[h] (.08)*	0.31[d] (.08)*
Age	−0.05 (.01)*	−0.14 (.01)*	−0.05 (.01)*	−0.11 (.01)*	−0.06 (.01)*	−0.08 (.01)*	0.09 (.01)*	0.12 (.01)*	0.06 (.01)*	0.11 (.01)*	0.19 (.01)*
Gender (M)	−0.11 (.03)*	−0.08 (.03)	−0.21 (.03)*	−0.19 (.04)*	−0.31 (.03)*	−0.13 (.03)*	−0.57 (.04)*	−0.03 (.04)	0.05 (.04)	0.21 (.04)*	0.16 (.04)*
SES	−0.03 (.01)*	−0.05 (.01)*	−0.04 (.01)*	−0.05 (.02)	−0.05 (.02)	−0.05 (.02)	0.01 (.02)	−0.03 (.02)	−0.04 (.02)	−0.02 (.02)	0.02 (.02)
Prior achievement	0.32 (.01)*	0.17 (.01)*	0.18 (.01)*	0.21 (.01)*	0.21 (.01)*	0.33 (.02)*	−0.09 (.02)*	−0.14 (.02)*	−0.42 (.01)*	0.27 (.01)*	−0.20 (.01)*
Random effects											
Level 2 (school)	0.02 (.01)	0.02 (.01)	0.02 (.01)	0.07 (.02)*	0.07 (.02)*	0.03 (.01)*	0.08 (.02)*	0.10 (.02)*	0.06 (.02)*	0.05 (.01)*	0.11 (.03)*
Level 1 (student/Resid)	0.92 (.01)*	1.06 (.02)*	0.87 (.01)*	1.40 (.02)*	1.38 (.02)*	1.10 (.02)*	1.73 (.02)*	2.06 (.03)*	1.68 (.02)*	1.61 (.02)*	1.61 (.02)*
−2*log-likelihood	28,890	30,322	28,353	33,198	33,136	30,802	35,532	3645	35,226	34,770	34,752
Δ −2*log-likelihood	17,774	17,700	17,225	19,698	19,745	18,948	20,808	22012	21,008	20,269	19,754

*$p < .002$ (after Bonferroni correction).

For each motivation and engagement factor, the following superscripts denote significant differences between Step 1 and Step 2: superscripts [a] and [b] at $p < .10$; superscripts [c] and [d] at $p < .05$; superscripts [e] and [f] at $p < .01$; superscripts [g] and [h] at $p < .001$.

We note the negative SES effect for self-efficacy, valuing, and mastery orientation and further investigated this. We re-ran the models for self-efficacy, valuing, and mastery orientation without prior achievement (as SES is associated with achievement; Sirin, 2005) and found that all three SES predictive effects were no longer statistically significant – suggesting that after controlling for prior achievement, there is less adaptive variance remaining for SES (leading to its significant negative effects).

Table 2. Multilevel regression model predicting external correlates for Indigenous students.

	Aspirations Est (SE)	Buoyancy Est (SE)	Homework Est (SE)	Achievement Est (SE)
Fixed effects				
Positive motivation	0.99 (.06)***	0.45 (.08)***	0.26 (.05)***	0.37 (.13)**
Negative motivation	−0.14 (.06)*	−0.02 (.08)	−0.16 (.05)**	−0.15 (.13)
Age	0.10 (.04)*	0.01 (.05)	−0.06 (.03)*	−0.10 (.14)
Gender (M)	0.05 (.12)	0.32 (.15)*	−0.21 (.09)*	−0.59 (.28)*
SES	−0.06 (.05)	−0.10 (.06)	0.03 (.04)	0.28 (.16)
Prior achievement	0.07 (.06)	0.14 (.07)*	0.08 (.05)	−0.07 (.12)
Random effects				
Level 2 (school)	0.01 (.01)	0.06 (.06)	0.01 (.01)	0.01 (.01)
Level 1 (student/residual)	0.93 (.08)***	1.44 (.12)***	0.62 (.05)***	1.03 (.19)***
−2*log-likelihood	806	943	694	156

*$p < .05$, **$p < .01$, and ***$p < .001$.

$B = 0.48$), uncertain control ($B = 0.31$), self-handicapping ($B = 0.49$), and disengagement ($B = 0.31$). Moreover, as shown in Table 1, for each of self-efficacy, mastery orientation, persistence, failure avoidance, uncertain control, self-handicapping, and disengagement, there was a significant reduction in the absolute predictive parameter size for Indigenous status from Step 1 to Step 2. Thus, for Indigenous students, a good portion of their motivation and engagement was accounted for by their age, gender, SES, and prior achievement.

Finally, at Step 2, we assessed the extent to which Indigenous status effects for each of the motivation and engagement factors varied as a function of Level 2 (school) – i.e. from school to school. We found that none of the Indigenous status effects for motivation and engagement factors significantly varied as a function of school. Thus, predictive parameters for Indigenous status in Table 1 generalised across schools (though, as described above, variance components effects for motivation and engagement factors varied across schools – and more so for Indigenous students than for non-Indigenous students – see Table S4 in Supplementary Materials).

Predictive modelling: the association between motivation and engagement and academic outcomes

Using MLwiN, a final set of analyses examined the extent to which motivation and engagement predicted academic outcomes for Indigenous students. For parsimony (and to avoid known collinearity issues when using the specific motivation and engagement factors as predictors; Martin, 2007, 2009), we modelled positive motivation and engagement as one factor and negative motivation and engagement as another factor (this two-factor model yielding acceptable fit in confirmatory factor analysis; $\chi^2 = 25,328$, $df = 890$, CFI = 0.90, and RMSEA = 0.041). Again, age, gender, SES, and prior achievement were included in modelling as covariates. We also accounted for the multilevel structure of the data (L1 = student; L2 = school). All findings are shown in Table 2 and central substantive results are shown in Figure 1. Positive motivation and engagement significantly predicted educational aspirations (unstandardised $B = 0.99$, $p < .001$), academic buoyancy ($B = 0.45$, $p < .001$), homework completion ($B = 0.26$, $p < .001$), and achievement ($B = 0.37$, $p < .001$). Negative motivation and engagement predicted outcomes to a much lesser extent, only significantly
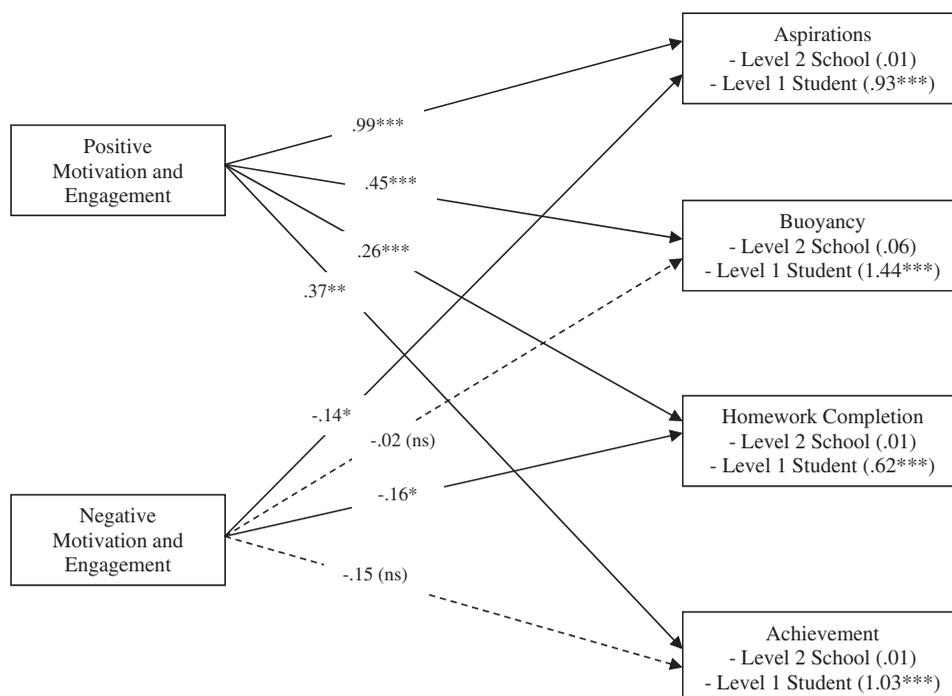
Figure 1. Positive and negative motivation and engagement predicting educational outcomes for Indigenous students, controlling for age, gender, SES, and prior achievement. $*p < .05$, $**p < .01$, and $***p < .001$, ns: not statistically significant. Note 1. Unstandardised coefficients are shown; Note 2. L1 and L2 are random variance estimates; Note 3. Dashed lines represent non-significant ($p > .05$) parameters.

predicting lower educational aspirations ($B = -0.14$, $p < .05$) and homework completion ($B = -0.16$, $p < .05$) – not academic buoyancy or achievement. Thus, although Indigenous students were markedly higher in negative motivation and engagement (Table 1), their negative motivation and engagement did not play as much of a noticeable role (relative to their positive motivation and engagement) in their academic outcomes.

Although our focus is on Indigenous student outcomes, as a point of juxtaposition we re-ran the above analyses for non-Indigenous students. Analyses revealed that positive motivation and engagement significantly predicted educational aspirations (unstandardised $B = 0.71$, $p < .001$), academic buoyancy ($B = 0.33$, $p < .001$), homework completion ($B = 0.35$, $p < .001$), and achievement ($B = 0.11$, $p < .001$). Negative motivation and engagement significantly predicted lower educational aspirations ($B = -0.16$, $p < .001$), academic buoyancy ($B = -0.39$, $p < .001$), homework completion ($B = -0.08$, $p < .001$), and achievement ($B = -0.12$, $p < .001$). Thus, when conducting a descriptive comparison of the two sets of results, it is evident the effects of positive motivation and engagement are parallel for Indigenous and non-Indigenous students; however, the (adverse) effects of negative motivation and engagement are stronger for non-Indigenous students than Indigenous students.

Discussion

Motivation, engagement, and academic outcomes

Alongside investigating Indigenous students' motivation and engagement as a desirable end in itself, we also examined their motivation and engagement as a means to desirable ends. Here, we found that positive motivation significantly predicted all four of the outcomes. However, negative motivation predicted only two of the outcomes. Also, the strength of the parameters connecting positive motivation with the academic outcomes was substantial, whereas the strength of the two negative motivation effects was relatively modest. Like Indigenous students, positive motivation and engagement significantly predicted all academic outcomes for non-Indigenous students. However, unlike the Indigenous students, non-Indigenous students' negative motivation and engagement predicted all outcomes (*vs*. only two outcomes for Indigenous students) and relatively strongly. Thus, the (adverse) effects of negative motivation and engagement seem more wide-ranging and stronger for non-Indigenous students than Indigenous students. Putting the findings together, then, although Indigenous students were significantly higher on negative motivation, their negative motivation did not connect to academic outcomes nearly to the extent that their positive motivation did (given that negative motivation predicted only two outcomes for Indigenous students, while their positive motivation predicted all outcomes – see Figure 1). This, then, may be seen as something of a buffering of their negative motivation in the sense it did not translate to academic outcomes to the extent it might have. This does not diminish the importance of addressing their negative motivation (as this is an undesirable end in itself), but it does emphasise the importance of and opportunity for promoting and sustaining their positive motivation.

The role of background characteristics

There were two main purposes for including socio-demographic and prior achievement factors in modelling. The first was to disentangle these factors from the predictive effects of Indigenous/non-Indigenous status on motivation and engagement (Table 1). The second was to enable an assessment of the unique effects of motivation and engagement in predicting Indigenous students' academic outcomes beyond the effects of background factors (Table 2). As noted, with regard to the former, we identified significant decline in mean-level differences between Indigenous and non-Indigenous students on motivation and engagement factors when these background attributes were included (Table 1). This speaks to the role of socio-economic and educational disadvantage in Indigenous students' academic development (Australian Bureau of Statistics, 2016; Dockett et al., 2006). Indeed, Groome and Hamilton (1995) found that schools doing a relatively better job of educating Indigenous students were those that recognised and addressed the role of poverty in Indigenous students' educational development – and more recent authors have further emphasised that this poverty and disadvantage emanate from a history of institutionalised marginalisation – including in schools (Fordham & Schwab, 2007; Phillips, 2012; Ranzijn et al., 2009), signalling the need for policy-level attention as well as school-level action. With

regard to the socio-demographic findings in Table 1, the roles for age and gender among Indigenous students were also evident. These are discussed in Supplementary Materials.

Implications for practice and policy

With regard to educational practice, the predominantly higher mean-levels of negative motivation and engagement are telling. They suggest it is important to target Indigenous students' uncertain control, failure avoidance, self-handicapping, and disengagement. For uncertain control, students are encouraged to see the connection between effort (controllable) and academic outcomes (Craven et al., 1991; Martin, 2007, 2009). Control is also developed through teacher feedback that is timely, task-focussed, and improvement-oriented (Hattie, 2009). In particular, it is important for educators to administer task-based feedback, and soon after task completion so it is immediately clear how a student can improve (Craven et al., 1991; Martin et al., 2001). Policy efforts to enhancing control may involve greater emphasis on local (community-based) decision-making, including Indigenous input and control over some components of curriculum, pedagogy, resource selection, and practice (Hickling-Hudson & Ahlquist, 2003a; Malin & Maidment, 2003). Indeed, De Plevitz (2007) attributed a Eurocentric model of schooling to disengagement among Indigenous students (e.g. higher non-attendance) attendance, while others have identified a prevalence of 'White-washed' school environments that obscure or deny Indigenous knowledges – including that related to local knowledge (Hickling-Hudson & Ahlquist, 2003b; Vass, 2012).

We also suggest that promoting a greater sense of control is key to addressing disengagement: an ongoing sense of low control can lead to students accepting failure and giving up (Covington, 2000; Peterson et al., 1993). This may involve explicitly teaching students ways they can take control of their academic lives, such as through providing task-based feedback that provides concrete instruction on how to improve (Martin et al., 2001). With regard to failure avoidance and self-handicapping, research and theory have identified the need to target students' underlying fear of failure (Covington, 2000). This includes showing students that mistakes and poor performance are diagnostic information for how to improve (Covington, 2000; Martin & Marsh, 2003) – and do not reflect a lack of worth (Covington, 2000). At the policy level, some have suggested that policies aimed at closing the achievement gap risk implying a 'naturalisation' of educational failure which consequently lays blame on the Indigenous student as a problem to be 'fixed' (Lingard et al., 2012). There is thus a need to investigate the prevalence of system-level deficit discourses (that are implicated in maladaptive orientations to failure) about Indigenous students and how these shape policy and impact subsequent educational outcomes.

Although some findings in our study involved troubling differences between Indigenous and non-Indigenous students (the former group significantly higher on most negative motivation and engagement factors), we also identified parity on positive motivation and engagement factors (after accounting for background characteristics, such as SES, etc.) and markedly positive motivational effects among Indigenous

students (viz. their positive motivation predicting higher aspirations, buoyancy, home-work completion, and achievement). In unearthing these positive findings, this study argues for the role of human strengths in promoting positive outcomes (e.g. see Fredrickson, 2001). In so doing, this study of Indigenous students offers potential to progress broader understanding (beyond Indigenous students) of psycho-educational constructs and their processes (also see Graham, 1994 on how culture-specific research can contribute to understanding human behaviour more broadly). In fact, it is evident that pedagogical recommendations for enhancing Indigenous students' outcomes may apply to all students. For example, Craven et al. (1999; see also Burgess et al., 2019) emphasised the importance of the teacher organising the environment to facilitate student learning, having good knowledge of learning theory and learners (including their home environment and prior experiences), suspending personal judgement, and fostering classrooms where a variety of views are explored and respected. Considering all these elements of pedagogy, it may be that assisting Indigenous students and non-Indigenous students need not be a zero-sum game; though, it would be interesting to determine if they yield a distinctly positive effect for Indigenous students (as Craven et al., 1999 suggest), thereby helping close achievement gaps between Indigenous and non-Indigenous students.

Limitations, future directions, and conclusion

We point out some limitations to the study that may also provide direction for future investigations. First, we have already noted that although we frame our study from a predominantly between-group perspective (Indigenous and non-Indigenous students), we emphasise the importance of interpreting findings in the context of significant within-group variation among Indigenous students. In most analyses, we built within-group variation into statistical modelling, but we nevertheless reiterate that as with any group of students, Indigenous students comprise a heterogeneous group for whom appropriately targeted and differentiated instruction is needed. Second, not-withstanding our achievement data, we relied on students' self-reports. Although these data are appropriate for examining intra-psychic phenomena, such as motiv-ation, students may misinterpret questions or fail to respond in-line with behaviour (Karabenick et al., 2007). Including additional data, such as teacher reports, parent/caregiver responses, or observations is important for future research. Also relevant to our measures, we point out that our homework item did not tap into students' effort (it was focussed on completion); some students may try hard on their homework, but not complete it. Future research would do well to administer homework items that also access students' effort on it. Future research might also ask teachers to report on students' homework completion. Third, although we controlled for prior achievement and intake characteristics, such as SES, the bulk of our data were cross-sectional, limit-ing (for example) conclusions about 'effects' of motivation and engagement. Although academic outcomes, such as achievement are recognised as following from motivation and engagement (e.g. Hattie, 2009), follow-up research to ours might look to longitu-dinal data to further explore our findings. Also to note are limitations of trying to sep-arate out socio-demographic effects; for example we gathered broadly based SES data

(that reflected neighbourhood SES determined by numerous factors reflecting relative advantage/disadvantage of a given postcode) and so we could not pinpoint granular SES factors that may be implicated in an individual student's motivation and engagement. Finally, following Martin (2006) and McInerney (2000), our study was predominantly an intrapersonal (i.e. focussed on individuals' intra-psychic attributes such as motivation, etc.) investigation of Indigenous students' motivation. Although we did include socio-economic data and we did investigate contextual factors in terms of school effects, etc., future research should build on our research by accounting for a broader range of contextual factors, including where possible historical and structural factors that may be implicated in Indigenous students' academic lives. In so doing, we will even better understand Indigenous students' motivation and engagement and the factors that can enhance and sustain their academic development.

Note

1. At the outset we acknowledge that the terms 'Indigenous' and 'Aboriginal' are considered colonial constructs – we use them in line with the predominant nomenclature in this space.

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ORCID

Andrew J. Martin http://orcid.org/0000-0001-5504-392X
Paul Ginns http://orcid.org/0000-0003-0714-5205
Michelle Bishop http://orcid.org/0000-0002-3292-2355

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