The big fish Down Under: Examining moderators of the 'big-fish-little-pond' effect for Australia's high achievers

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Big-fish-little-pond effect (BFLPE) research has demonstrated that academic self-concept is negatively affected by attending high-ability schools. This article examines data from large, representative samples of 15-year-olds from each Australian state, based on the three Program for International Student Assessment (PISA) databases that focus on different subject domains: reading (2000), mathematics (2003) and science (2006). The overarching research question is whether the size or direction of the BFLPE is moderated by any of a total of 67 moderators (for example ability, study methods, motive, social constructs and Australian states) that were considered. The data showed consistent support for the BFLPE across all Australian states for all three databases. None of the constructs examined moderated the BFLPE and this finding was consistent across states. In conclusion, the BFLPE is remarkably robust in Australia and the study findings generalised well across Australian states and across all moderators investigated.

Introduction

Worldwide, educational policy statements (for example, Ministerial Council on Education, Employment, Training and Youth Affairs, 2008) emphasise the importance of developing and maintaining a positive academic self-concept but big-fish-little-pond effect (BFLPE) research has demonstrated that when high-ability students are segregated on the basis of their ability their academic self-concepts suffer. Consequently, researchers (for example, Marsh, Chessor, Craven & Roche, 1995) have called for the identification of individual differences among students that moderate the BFLPE, as this would aid in developing policies that could maximise the benefits of attending academically selective schools. BFLPE moderators are thus the focus of the present investigation.

Seaton, Marsh and Craven (2010) examined the moderating effect of 16 constructs on the BFLPE for mathematics self-concepts. Although results indicated that the BFLPE was more pronounced for students who used surface learning as a method of self-regulation, who were more anxious and who preferred to work cooperatively, the BFLPE was reasonably consistent across the remaining constructs. As this study examined differences across 41 countries, the question remains as to whether the findings are relevant for Australia. The current investigation hence examined moderators of the BFLPE as they applied to Australian students only. In addition, this study also extended the Seaton, Marsh and Craven (2010) study in other important ways. Firstly, the current study was not limited to mathematics self-concepts but also examined BFLPE moderation for mathematics, verbal and science self-concepts using three databases, making this a quasi-longitudinal study. Secondly, the current study compared BFLPE moderation across Australian states and territories. As Australian states and territories differ in their provision of education for high-ability students, any differences found between states could offer insights for BFLPE theory and inform future policy for high-ability education.

BFLPE and academic self-concept

The BFLPE posits that students who are educated in high-ability classes and schools will have lower academic self-concepts (that is, knowledge and perceptions regarding academic ability—Bong & Skaalvik, 2003) than their equally able counterparts in average- and low-ability environments. The BFLPE model predicts that, whereas individual ability is positively related to academic self-concept, class- and school-average ability are negatively related to academic self-concept. The BFLPE is characterised by this latter negative association.

In Australian BFLPE research, Marsh and colleagues (1995, Study 2) found that students in gifted and talented classes showed declines in the reading, mathematics and school components of academic self-concept over time compared to matched students from mixed-ability classes. There were no significant differences between the two groups in non-academic self-concepts. Using the Program for International Student Achievement (PISA) 2000 database, Marsh (2004) found that attending a high-ability school had a negative effect on academic self-concept for Australian high-school students and that this effect was consistent across all Australian states and territories.

Research has demonstrated that a positive self-concept is a significant factor in many different spheres (for example, Marsh & Perry, 2005), is considered to be an important objective of education (Ministerial Council on Education, Employment, Training and Youth Affairs, 2008), and is an important factor in producing optimal educational outcomes (Guay, Larose & Boivin, 2004; Marsh & Yeung, 1997b). Furthermore, academic self-concept and achievement appear to be reciprocally related: a higher academic self-concept is associated with higher academic achievement, and higher achievement is associated with higher academic self-concept (Marsh & Yeung, 1997a; Valentine & Dubois, 2005). If, as BFLPE research has shown, high-ability students attending high-ability environments have lower academic self-concepts, then it follows that they may not be reaching their full academic potential. It is hence critically important that the negative effects of the BFLPE be addressed.

High-ability education in Australian states and territories

In Australia, the states and territories are responsible for providing education and they cater for high-ability students differently. In the Northern Territory, Tasmania and the Australian Capital Territory (ACT), high-ability students are catered for within each comprehensive high school. South Australia has three schools that offer a selective class for high-ability students. Western Australia has one fully academically selective high school; Victoria and Queensland have three each. New South Wales has the highest number of selective high schools: 21 fully selective and 23 partially selective (in which some classes are grouped by high-ability). With the exception of New South Wales, there are very few selective schools in other Australian states, while the number (21) of fully selective schools in New South Wales is a small percentage (5.28%) of the total number of secondary schools in that state (NSW Department of Education and Communities, 2011).

The present investigation

Although the BFLPE has been shown to be similar across Australian states and territories (Marsh, 2004), no research to date has investigated potential BFLPE moderators from a purely Australian perspective. By identifying constructs that may increase or decrease BFLPE, we could provide information for the development of policies aimed at maximising the benefits of attending academically selective environments. Additionally, as the states and territories differ in their provision of high-ability education, any difference found between these could have important implications for BFLPE theory and future Australian state policies. Alternatively, the generalisability of the BFLPE would be enhanced if consistency was found across all student characteristics and states.

The Seaton, Marsh and Craven (2010) study focused on BFLPE moderation for only mathematics self-concept and across 41 countries in one PISA database (2003). Here we focus on results from each of the Australian states and territories, and expand consideration to include each of the three PISA databases that focuses on a different school subject: PISA 2000—reading; PISA 2003—mathematics; PISA 2006—science. The key research question considered is whether the Seaton, Marsh and Craven (2010) results are relevant for Australia. Three studies were conducted based on the three PISA databases developed by the Organisation for Economic Co-operation and Development (OECD 2001b, 2005a, 2005b). These databases are specifically designed to measure a diverse range of important constructs and so provide an ideal basis for evaluating BFLPE moderators. In addition to Australian states and territories, the present investigation examined nine constructs (see below) that could potentially moderate the BFLPE. These nine constructs were measured in both the 2000 and 2003 administrations, but only four were measured in the 2006 administration. Importantly, the items measuring the constructs were not always entirely consistent across the administrations (for construct measurement details, see OECD 2001b, 2005b).

To be consistent with the Seaton, Marsh and Craven (2010) study, the constructs examined in the present investigation were integrated within an academic self-regulation framework (Zimmerman, 1994) that comprised four dimensions: behaviour, study methods, motive and social. They are discussed briefly here with findings from Seaton, Marsh and Craven (2010) highlighted.

Behaviour—individual ability Studies have shown that differences in the sizes of BFLPEs due to individual student ability are small and not even consistent in direction. Some have shown that the BFLPE is larger for lower-ability students in high-ability schools (Coleman & Fults, 1985), while others have shown that the BFLPE is worse for higher-ability students (Reuman, 1989). Whether individual ability can moderate the BFLPE is an issue that warrants further attention.

Study methods (cognitive and meta-cognitive): memorisation, elaboration and control strategies Self-regulated learners are more effective (Boekaerts, 1997) as they use cognitive and meta-cognitive strategies that promote their learning. Memorisation strategies include using rehearsal techniques, while elaboration strategies include relating one concept to other material and integrating them. Students who use control strategies try to work out concepts they think they have not fully grasped and ensure that they remember key elements. Although Swalander and Taube (2007) demonstrated that all three of these study methods were positively related to self-concept, Seaton, Marsh and Craven (2010) found that neither elaboration nor the use of control strategies was able to moderate the BFLPE but that students who used memorisation strategies to a greater extent were more affected by the BFLPE.

Motive—intrinsic motivation, extrinsic motivation, and self-efficacy Beneficial results for both education and self-concept have been associated with intrinsic motivation (Ginsburg & Bronstein, 1993; Gottfried, 1990; Valas & Sovik, 1993), defined as performing a task because it is pleasurable per se. Extrinsic motivation—performing a task to obtain a reward—has been linked with poor academic results (Hardre & Reeve, 2003) but with positive self-concept (Seaton, Marsh & Craven, 2010). Academic self-efficacy—a person's belief that he or she can succeed in an academic task at specific levels in a particular setting (Bong & Skaalvik, 2003)—has been positively associated with academic performance (Multon, Brown & Lent, 1991) and self-concept (Marsh, Hau, Artelt, Baumert & Peschar, 2006). Seaton, Marsh and Craven (2010) found that the BFLPE was not moderated by intrinsic or extrinsic motivation. Although the BFLPE was moderated by self-efficacy, the effect size of the interaction was too small to be practically important.

Social—competitive and cooperative orientations In competitive classrooms, students' achievements are evaluated by comparing them with those of other students. In cooperative classrooms, students work together (Ravenscroft, 1997). Some studies have shown that cooperative environments produce more positive educational outcomes, while others have shown that competitive environments are better (Slavin, 1983). When individual preferences for type of learning environment are considered, both types of preferences for learning situations have been associated with better academic performance (OECD, 2001a). While cooperative environments have been associated with positive self-attitudes and self-concepts (Johnson & Johnson, 1975; Marsh & Peart, 1988), competitive environments have been linked with both lower (Marsh & Peart, 1988) and higher self-concepts (Seaton, Marsh & Craven, 2010). A cooperative orientation negatively moderated the BFLPE in the Seaton, Marsh and Craven (2010) study but a competitive orientation did not.

Hypotheses and research questions The following hypotheses and research questions were based largely on Seaton, Marsh and Craven (2010).

- A BFLPE will be present and will be similar across states and territories.
- The BFLPE will be negatively moderated by memorisation and a preference for a cooperative environment.
- The BFLPE will not be moderated by elaboration, control strategies, intrinsic motivation, extrinsic motivation, self-efficacy or a preference for a competitive environment.
- Does individual ability moderate the BFLPE?
- Are the effects of these moderators on the BFLPE similar across states and territories?

Study 1

Method

Participants Participants were 15-year-old students who participated in PISA 2000. The Australian sample comprised 5176 students in 231 schools. The verbal self-concept items were not completed by all students (*n* = 201) and four students did not have verbal achievement scores. Moreover, in five schools there were fewer than 10 students sampled (*n* = 29), a sample size considered unrepresentative of the entire school population. Only those students who completed the verbal self-concept measures and had verbal achievement scores were included. Schools with fewer than 10 students were also removed. This resulted in a total sample size of 4942 students in 226 schools (ACT = 502; New South Wales = 868; Victoria = 781; Queensland = 771; South Australia = 616; Western Australia = 588; Tasmania = 531; Northern Territory = 285).

Measures

Verbal self-concept There were three items (for the current sample, $\alpha = 0.77$). The scale was standardised across the entire sample ($M = 0$, SD = 1) and scores ranged from −3.33 to 1.81.

Dimensions of academic self-regulation Eight scales assessed: study methods (elaboration, memorisation and control strategies); motive (extrinsic and intrinsic motivation, and self-efficacy); and social (competitive and cooperative orientations) dimensions. All scales were standardised across the entire sample ($M = 0$, SD = 1). In the behaviour dimension, weighted likelihood estimates were used to estimate a student's verbal ability (OECD, 2001b).

Procedure and statistical analysis

Cases were removed and, as there were very few missing data (average 0.095% missing data across constructs), missing data were imputed. Subsequently, all moderating constructs and verbal achievement scores were standardised (M = 0, SD = 1) and quadratic achievement scores created. School-average verbal achievement variables (linear and quadratic components) were created using the standardised verbal achievement scores, but not re-standardised to ensure that all variables were kept in the same metric. Two-way and three-way interaction terms were created. The two-way interactions consisted of school-average verbal achievement with each of the moderating constructs to test the moderating effect of the individual moderators on the BFLPE. The three-way interactions consisted of school-average verbal achievement with each of the moderating constructs by state. These interactions tested whether the moderating effect of these constructs on the BFLPE was similar across states and territories. These cross-products were not re-standardised.

Multi-level modelling The structure of the data involved two levels: student (level 1) and school (level 2). A multi-level approach to analyses was adopted to accommodate this multi-level structure because, if the structure of the nested data is ignored, serious statistical problems can occur (for example, underestimation of standard errors and violations of the assumption of independence—Hox, 2002; Raudenbush & Bryk, 2002). The eight states and territories were represented by dummy variables (New South Wales was the reference variable as it is the state with the most academically selective schools).

Models Three models were tested. For all models, the outcome variable was verbal self-concept. The first model tested whether there was a BFLPE for verbal self-concept. Predictor variables were individual linear verbal ability, quadratic verbal ability and school-average verbal ability. The second model examined the moderating effect of states on the BFLPE. This model hence included the state × school-average verbal ability interactions. The third model tested the effect of the moderator across states. Predictor variables were linear, quadratic and school-average verbal ability, the moderator, the school-average verbal ability × moderator interaction, and the school-average verbal ability × moderating construct × state interactions. This latter interaction tested whether the effect of the moderating construct on the BFLPE differed across states and territories in reference to New South Wales. For analyses in all studies the significance level was set at $p<0.001$ due to the number of tests of statistical significance being conducted.

Effect sizes Effect sizes were calculated using an equation suggested by Marsh and colleagues (2009).

$$\Delta = 2 \times B \times SD_{\text{predictor}}/\sigma_e$$

Where B = the unstandardised regression coefficient in the multi-level model. $SD_{\text{predictor}}$ = the standard deviation of the predictor variable at the class level. σ_e = the raw score standard deviation of the dependent variable.

In all three studies, effect sizes of magnitude greater than, or close to +/- 0.20 were considered to be large enough to be practically important. We also considered it appropriate to interpret those of magnitude close to +/- 0.10, although we recognise that such small effect sizes may have no practical significance. Effect sizes of magnitude less than +/- 0.075 were not interpreted.

Results

Table 1 BFLPE, states, and individual ability for verbal self-concept (standard error in parentheses)

	Model 1	*Model 2*	*Model 3*
	BFLPE	*BFLPE across states*	*Individual ability*
FIXED EFFECTS			
Constant	–0.02(0.02)	–0.06(0.04)	–0.06(0.04)
Linear ability	0.32(0.02)*	0.32(0.02)*	0.32(0.02)*
Quadratic ability	0.02(0.01)	0.02(0.01)	0.03(0.01)
Schavg	–0.21(0.04)*	–0.24(0.09)	–0.18(0.04)*
ACT		0.08(0.08)	0.08(0.08)
VIC		0.10(0.06)	0.12(0.07)
QLD		–0.04(0.06)	–0.04(0.06)
SA		–0.05(0.06)	0.07(0.07)
WA		–0.06(0.06)	–0.06(0.06)
TAS		0.12(0.07)	0.14(0.07)
NT		0.17(0.11)	0.12(0.09)
SchavgXACT		0.04(0.16)	
SchavgXVIC		0.03(0.12)	
SchavgXQLD		0.11(0.13)	
SchavgXSA		0.04(0.12)	
SchavgXWA		0.11(0.14)	
SchavgXTAS		–0.02(0.11)	
SchavgXNT		0.25(0.22)	
Schavg X linear ability			–0.05(0.07)
Schavg X quadratic ability			–0.00(0.02)
IndAbXschavgXACT			–0.02(0.10)
IndAbXschavgXVIC			–0.02(0.09)
IndAbXschavgXQLD			–0.04(0.09)
IndAbXschavgXSA			–0.04(0.09)
IndAbXschavgXWA			0.08(0.10)
IndAbXschavgXTAS			0.01(0.09)
IndAbXschavgXNT			0.02(0.10)
RANDOM EFFECTS			
L2 school intercept	0.03(0.01)*[a]	0.02(0.01)*[a]	0.02(0.01)*[a]
L1 Student intercept	0.89(0.02)*	0.89(0.02)*	0.89(0.02)*

*$p<0.001$. [a]Appears non-significant due to rounding. Schavg = school-average ability; IndAb = individual ability.

The BFLPE (Table 1) A BFLPE was evident for verbal self-concept (Model 1). Individual verbal ability positively predicted verbal self-concept, but for the linear component only (linear = 0.32; quadratic = 0.02), and school-average verbal ability significantly negatively predicted verbal self-concept (–0.21; effect size, –0.33). Students who attended schools that were higher in ability by 1SD had verbal self-concepts that were 0.21SD less than equally able students who attended schools where the average ability level was lower. Compared to New South Wales, the main effects for states were not significant, suggesting that there were no differences across states in verbal self-concept (Model 2). The state × school-average verbal ability interactions were not significant, indicating that the size of the BFLPE was similar across states for verbal self-concept.

Individual ability (Model 3, Table 1) None of the individual ability with school-average verbal ability interactions, or the verbal ability × school-average verbal ability × state interactions was statistically significant. This suggests that the BFLPE was consistent across individual verbal ability levels and that all states and territories were similar to New South Wales.

Study methods (Table 2) All three study-method variables significantly positively predicted verbal self-concept: elaboration, 0.23; memorisation, 0.22; control strategies, 0.26. Higher verbal self-concepts were associated with students who used all three study methods. None of the school-average verbal ability × learning strategy interactions was statistically significant. The BFLPE was not affected by a student's use of these study methods. This was as predicted for elaboration and control strategies, but contrary to predictions for memorisation. None of the school-average verbal ability × learning strategy × state interactions was statistically significant. This suggests that the BFLPE for verbal self-concept was consistent across study methods and there were no differences between states and territories when compared with New South Wales.

Motive (Table 2) All three motive constructs were significantly positively associated with verbal self-concept: intrinsic, 0.26; extrinsic, 0.18; self-efficacy, 0.31. Motivated students had higher verbal self-concepts. None of the motive interactions with school-average verbal ability reached significance. The BFLPE was not affected by how intrinsically or extrinsically motivated or self-efficacious students felt in reading. None of the school-average verbal ability × motivation × state interactions was statistically significant, suggesting that the moderating effects of motivational tendencies on the BFLPE were consistent across states and territories.

Social (Table 2) Both social variables were significantly positively associated with verbal self-concept: competitive, 0.21; cooperative, 0.16. Higher verbal self-concepts were associated with higher preferences for both learning environments. The interactions of school-average verbal ability with competitive and cooperative orientations were not significantly associated with verbal self-concept. The result for cooperative preferences was contrary to predictions, suggesting that the BFLPE was not affected by a student's social learning preferences. None of the school-average verbal ability × learning preference × state interactions was statistically significant, suggesting that the BFLPE was consistent across preferences for learning environments and that this finding was similar across states and territories.

Table 2 BFLPE moderators for verbal self-concept

	Model 3							
	Study Methods			Motive			Social	
	Elaboration	*Memorisation*	*Control strategies*	*Intrinsic*	*Extrinsic*	*Self-efficacy*	*Competitive*	*Cooperative*
FIXED EFFECTS								
Constant	−0.04(0.04)	−0.08(0.04)	−0.06(0.04)	−0.05(.04)	−0.04(0.04)	−0.03(0.04)	−0.06(0.04)	−0.06(0.04)
Linear ability	0.29(0.02)*	0.30(0.02)*	0.25(0.02)*	0.23(.02)*	0.30(0.02)*	0.24(0.02)*	0.28(0.01)*	0.31(0.02)*
Quadratic ability	0.02(0.01)	0.03(0.01)	0.02(0.01)	0.00(.01)	0.03(0.01)*	0.01(0.01)	0.02(0.01)	0.03(0.01)
Schavg	−0.18(0.04)*	−0.19(0.04)*	−0.19(0.04)*	−0.18(.04)*	−0.16(0.04)*	−0.16(0.04)*	−0.19(0.04)*	−0.17(0.04)*
ACT	0.06(0.08)	0.09(0.08)	0.07(0.08)	0.05(.08)	0.07(0.08)	0.06(0.07)	0.07(0.07)	0.08(0.08)
VIC	0.07(0.06)	0.10(0.06)	0.09(0.06)	0.12(.06)	0.07(0.06)	0.05(0.05)	0.09(0.06)	0.10(0.06)
QLD	−0.05(0.06)	−0.04 0(.06)	−0.04(0.06)	−0.02(.06)	−0.06(0.06)	−0.04(0.05)	−0.02(0.06)	−0.04(0.06)
SA	0.02(0.06)	0.06(0.06)	0.06(0.06)	0.07(.06)	−0.01(0.06)	0.02(0.05)	0.08(0.06)	0.04(0.06)
WA	−0.05(0.06)	−0.02(0.06)	−0.02(0.06)	−0.02(.06)	−0.07(0.06)	−0.07(0.06)	−0.04(0.06)	−0.06(0.06)
TAS	0.11(0.06)	0.16(0.06)	0.14(0.06)	0.13(.07)	0.11(0.06)	0.15(0.06)	0.16(0.06)	0.12(0.07)
NT	0.11(0.09)	0.15(0.09)	0.14(0.09)	0.12(.09)	0.11(0.09)	0.11(0.08)	0.15(0.08)	0.13(0.09)
Moderator	0.23(0.02)*	0.22(0.02)*	0.26(0.02)*	0.26(.02)*	0.18(0.02)*	0.31(0.02)*	0.21(0.02)*	0.16(0.02)*
Mod X Sch–avg	−0.03(0.10)	0.01(0.10)	−0.04(0.10)	0.11(.08)	−0.05(0.07)	−0.03(0.07)	−0.01(0.07)	−0.08(0.08)
ModXschavgXACT	−0.05(0.11)	−0.13(0.13)	−0.04(0.12)	−0.15(.12)	0.03(0.09)	0.07(0.15)	0.14(0.11)	0.10(0.13)
ModXschavgXVIC	−0.01(0.13)	−0.13(0.15)	−0.02(0.16)	−0.00(.11)	−0.15(0.12)	0.07(0.11)	−0.06(0.10)	−0.03(0.11)
ModXschavgXQLD	−0.03(0.13)	0.07(0.13)	0.06(0.11)	−0.18(.11)	0.06(0.12)	0.06(0.11)	0.01(0.10)	−0.09(0.10)
ModXschavgXSA	0.00(0.13)	−0.07(0.13)	−0.11(0.13)	−0.10(.13)	−0.04(0.10)	0.00(0.09)	−0.13(0.10)	0.03(0.14)
ModXschavgXWA	0.09(0.16)	−0.16(0.17)	0.00(0.17)	−0.18(.11)	−0.01(0.10)	0.13(0.10)	0.08(0.12)	0.21(0.14)
ModXschavgXTAS	0.03(0.13)	−0.05(0.14)	−0.01(0.12)	0.00(.12)	−0.08(0.11)	0.01(0.10)	−0.06(0.09)	0.07(0.11)
ModXschavgXNT	0.13(0.13)	0.04(0.14)	0.08(0.16)	0.08(.14)	−0.08(0.16)	0.25(0.12)	−0.08(0.17)	0.02(0.15)
RANDOM EFFECTS								
L2 School intercept	0.02(0.01)*[a]	0.02(0.01)*[a]	0.02(0.01)*[a]	0.02(.01)	0.02(0.01)*[a]	0.02(0.01)*[a]	0.02(0.01)*[a]	0.02(0.01)*[a]
L1 Student intercept	0.84(0.02)*	0.85(0.02)*	0.83(0.02)*	0.84(.02)*	0.86(0.02)*	0.81(0.02)*	0.85(0.02)*	0.86(0.02)*

*$p<0.001$. [a]Appears non–significant due to rounding. Schavg = school-average ability; Mod = specific moderator.

Study 2

Method

Participants The PISA 2003 Australian sample comprised 12 551 students. Students with no mathematics self-concept scores (n = 148) and schools with fewer than 10 students (three schools, n = 20) were removed from analyses. This resulted in a total sample size of 12 383 students in 318 schools (ACT = 875; New South Wales = 2948; Victoria = 2332; Queensland =1913; South Australia = 1224; Western Australia = 1743; Tasmania = 796; Northern Territory = 552).

Measures

Mathematics self-concept There were five items (for the sample, $\alpha = 0.88$). Resulting scores ranged from –2.49 to 2.54 after standardisation across the entire sample.

Academic self-regulation Although similar to Study 1, some scale items were constructed differently (see OECD 2001b, 2005b).

Individual ability A student's mathematics ability was estimated by five plausible values. The database documentation suggests that analyses should be conducted separately with each plausible value and then all resulting parameters averaged (OECD, 2005a). Additionally, standard errors should be calculated to reflect variance both within and between plausible values. These steps were followed in the present investigation (OECD, 2005a; Raudenbush, Bryk & Congdon, 2005).

Procedure and statistical analysis

Standardisation and creation of terms Cases were removed and missing data imputed (average missing = 0.054%). Standardisation of variables and creation of linear variables and interaction terms were similar to procedures in Study 1.

Results

The BFLPE (Table 3) A BFLPE was evident (Model 1). Individual mathematics ability positively predicted mathematics self-concept (linear = 0.48; quadratic = 0.07) and school-average mathematics ability negatively predicted mathematics self-concept (–0.28; effect size, –0.29). Students who attended schools higher in ability by 1SD had mathematics self-concepts that were 0.28SD lower. The state × school-average ability interactions were not statistically significant, indicating that the BFLPE was consistent across states (Model 2).

Individual ability (Model 3, Table 3) None of the individual ability × school-average ability or ability × school-average ability × state interactions was statistically significant. This suggests that the BFLPE was consistent across individual mathematics ability levels and that all states and territories were similar to New South Wales regarding moderation.

Study methods (Table 4) Elaboration (0.34), memorisation (0.36), and control strategies (0.30) significantly positively predicted mathematics self-concept. Compared to New South Wales students, Victorian students had significantly higher mathematics self-concepts if they used elaboration (0.12), memorisation (0.12), and control strategies (0.13) as study methods.

Table 3 BFLPE, states, and individual ability for mathematics self-concept (standard error in parentheses)

	Model 1	*Model 2*	*Model 3*
	BFLPE	*BFLPE across states*	*Individual ability*
FIXED EFFECTS			
Constant	–0.07(0.01)*	–0.11(0.02)*	–0.13(0.02)*
Linear ability	0.48(0.01)*	0.48(0.01)*	0.49(0.01)*
Quadratic ability	0.07(0.01)*	0.07(0.01)*	0.09(0.01)*
Schavg	–0.28(0.02)*	–0.30(0.05)*	–0.25(0.03)*
ACT		0.05(0.04)	0.09(0.05)
VIC		0.12(0.04)	0.14(0.04)*
QLD		0.07(0.03)	0.09(0.03)
SA		0.01(0.03)	0.05(0.04)
WA		0.04(0.04)	0.06(0.04)
TAS		0.05(0.05)	0.04(0.05)
NT		–0.02(0.05)	–0.01(0.05)
SchavgXACT		0.03(0.09)	
SchavgXVIC		0.08(0.08)	
SchavgXQLD		0.03(0.07)	
SchavgXSA		0.04(0.06)	
SchavgXWA		–0.03(0.09)	
SchavgXTAS		0.16(0.10)	
SchavgXNT		–0.09(0.09)	
Sch-avg X linear ability			0.00(0.04)
Sch-avg X quadratic ability			–0.01(0.02)
IndAbXschavgXACT			–0.15(0.08)
IndAbXschavgXVIC			–0.10(0.06)
IndAbXschavgXQLD			–0.13(0.07)
IndAbXschavgXSA			–0.15(0.07)
IndAbXschavgXWA			–0.18(0.07)
IndAbXschavgXTAS			–0.03(0.10)
IndAbXschavgXNT			0.12(0.11)
RANDOM EFFECTS			
L2 School intercept	0.02(0.00)*	0.02(0.00)*	0.02(0.00)*
L1 Student intercept	0.80(0.01)*	0.80(0.01)*	0.80(0.01)*

*$p<0.001$. Schavg = school-average ability; IndAb = individual ability.

Table 4 BFLPE moderators for mathematics self-concept

	Model 3							
	Study Methods			Motive			Social	
	Elaboration	Memorisation	Control strategies	Intrinsic	Extrinsic	Self-efficacy	Competitive	Cooperative
FIXED EFFECTS								
Constant	–0.09(0.02)*	–0.12(0.02)*	–0.13(0.02)*	–0.08(0.02)*	–0.09(0.02)*	–0.11(0.02)*	–0.16(0.02)*	–0.12(0.02)*
Linear ability	0.48(0.01)*	0.44(0.01)*	0.44(0.01)*	0.36(0.01)*	0.41(0.01)*	0.23(0.01)*	0.43(0.01)*	0.49(0.01)*
Quadratic ability	0.05(0.01)*	0.07(0.01)*	0.07(0.01)*	0.04(0.01)*	0.06(0.01)*	0.04(0.01)*	0.05(0.01)*	0.07(0.01)*
Schavg	–0.23(0.02)*	–0.26(0.02)*	–0.28(0.02)*	–0.23(0.02)*	–0.24(0.02)*	–0.27(0.02)*	–0.27(0.02)*	–0.26(0.02)*
ACT	0.05(0.04)	0.05(0.04)	0.08(0.04)	0.12(0.03)*	0.03(0.04)	0.11(0.04)	0.12(0.04)	0.06(0.04)
VIC	0.12(0.03)*	0.12(0.03)*	0.13(0.04)*	0.06(0.03)	0.06(0.03)	0.16(0.03)*	0.18(0.03)*	0.12(0.04)
QLD	0.04(0.03)	0.05(0.03)	0.07(0.03)	0.06(0.03)	0.08(0.03)	0.08(0.03)	0.14(0.03)*	0.07(0.03)
SA	0.03(0.03)	0.04(0.03)	0.07(0.03)	0.08(0.03)	0.00(0.03)	0.10(0.03)[a]	0.13(0.03)*	0.02(0.03)
WA	0.00(0.03)	0.07(0.03)	0.07(0.03)	0.05(0.03)	0.04(.03)	0.09(0.03)	0.12(0.03)*	0.02(0.04)
TAS	0.03(0.04)	0.02(0.04)	0.08(0.04)	0.07(0.04)	–0.04(0.04)	0.08(0.04)	0.15(0.04)*	0.04(0.05)
NT	–0.02(0.04)	0.01(0.04)	0.05(0.04)	0.03(0.04)	–0.01(0.05)	0.07(0.05)	0.10(0.04)	0.01(0.05)
Moderator	0.34(0.01)*	0.36(0.01)*	0.30(0.01)*	0.57(0.01)*	0.37(0.01)*	0.49(0.01)*	0.37(0.01)*	0.18(0.01)*
Mod X Sch-avg	–0.00(0.04)	–0.04(0.04)	–0.01(0.03)	0.00(0.03)	0.03(0.04)	–0.01(0.05)	–0.01(0.03)	–0.02(0.03)
ModXschavgXACT	0.02(0.07)	–0.06(0.10)	–0.05(0.07)	0.06(0.08)	–0.03(0.07)	–0.12(0.06)	0.01(0.08)	0.01(0.09)
ModXschavgXVIC	–0.07(0.05)	–0.01(0.06)	–0.07(0.07)	–0.03(0.06)	–0.05(0.06)	–0.12(0.06)	0.02(0.06)	–0.08(0.05)
ModXschavgXQLD	0.05(0.06)	0.03(0.08)	0.01(0.06)	0.01(0.05)	–0.05(0.06)	0.01(0.08)	0.06(0.06)	–0.04(0.06)
ModXschavgXSA	–0.07(0.06)	–0.11(0.10)	–0.08(0.08)	–0.11(0.06)	–0.11(0.06)	–0.14(0.06)	–0.02(0.08)	–0.07(0.07)
ModXschavgXWA	–0.01(0.06)	–0.02(0.11)	–0.02(0.05)	–0.08(0.06)	–0.13(0.06)	–0.18(0.06)	–0.07(0.05)	–0.08(0.06)
ModXschavgXTAS	–0.05(0.08)	0.02(0.06)	–0.07(0.06)	0.09(0.09)	0.06(0.07)	–0.10(0.12)	0.03(0.07)	–0.07(0.09)
ModXschavgXNT	–0.12(0.09)	–0.02(0.08)	0.02(0.07)	–0.02(0.06)	0.00(0.06)	0.05(0.11)	0.00(0.10)	–0.16(0.12)
RANDOM EFFECTS								
L2 School intercept	0.01(0.00)*	0.01(0.00)*	0.01(0.00)*	0.01(0.00)*	0.01(0.00)	0.01(0.00)	0.01(0.00)*	0.02(0.00)*
L1 Student intercept	0.69(0.01)*	0.68(0.01)*	0.72(0.01)*	0.50(0.01)*	0.68(0.01)*	0.64(0.01)*	0.68(0.01)*	0.77(0.01)*

*$p<0.001$. [a]Appears significant due to rounding. Schavg = school-average ability; Mod = specific moderator.

The school-average mathematics ability interactions with elaboration, memorisation and control strategies were not statistically significant. The BFLPE was not affected by students' use of these study methods. These results were as predicted for elaboration and control strategies but inconsistent with our hypothesis for memorisation. None of the three-way interactions was statistically significant, suggesting that the BFLPE was consistent across study methods and across states.

Motive (Table 4) Intrinsic (0.57) and extrinsic (0.37) motivation and self-efficacy (0.49) were significantly positively associated with mathematics self-concept. Victorian students (0.16) had significantly higher mathematics self-concepts than New South Wales students if they reported feeling confident in their mathematics studies. Compared to New South Wales students, significantly higher mathematics self-concepts were associated with intrinsic motivation for ACT students (0.12).

The school-average mathematics ability interactions with all three motive variables were not significantly associated with mathematics self-concept. The BFLPE was not affected by students' motives. None of the three-way interactions was statistically significant, suggesting that the moderating effects were consistent across states.

Social (Table 4) Both competitive (0.37) and cooperative (0.18) preferences for the learning environment were significantly positively associated with mathematics self-concept. Compared to New South Wales students, significantly higher mathematics self-concepts were associated with a competitive orientation for students in all states except the ACT and the Northern Territory (Victoria = 0.18; Queensland = 0.14; South Australia = 0.13; Western Australia = 0.12; Tasmania = 0.15).

Contrary to predictions, the cooperative preference × school-average mathematics ability interaction was not statistically significant. But, consistent with our hypothesis, the competitive preference × school-average mathematics ability interaction was also not statistically significant. Students were affected by the BFLPE irrespective of their competitive or cooperative orientation. None of the three-way interactions was statistically significant, suggesting that the BFLPE was consistent across preferences for learning environments and across states and territories.

Study 3

Method

Participants Participants were 14 170 students in PISA 2006. Students with no science self-concept scores (n = 2432) and schools with fewer than 10 students (n = 62 in 13 schools) were removed. The final sample contained 11 676 students in 342 schools (ACT = 882; New South Wales = 2945; Victoria = 1895; Queensland = 1761; South Australia = 1374; Western Australia = 1188; Tasmania = 1052; Northern Territory = 579).

Measures

Science self-concept There were six items (for the sample, α= 0.91). Scores ranged from –2.34 to 2.31 after standardisation across the entire sample.

Dimensions of academic self-regulation Only individual ability, intrinsic and extrinsic motivation, and self-efficacy were examined in PISA 2006.

Procedure and statistical analysis

These were similar to those used in Study 2.

Results

Table 5 The BFLPE, states, and individual ability for science self-concept (standard error in parentheses)

	Model 1	Model 2	Model 3
	BFLPE	BFLPE across states	Individual ability
FIXED EFFECTS			
Constant	–0.08(0.01)*	–010(0.03)*	–0.11(0.03)*
Linear ability	0.49(0.01)*	0.49(0.01)*	0.49(0.01)*
Quadratic ability	0.09(0.01)*	0.09(0.01)*	0.08(0.01)*
Schavg	–0.19(0.03)*	–0.16(0.08)	–0.17(0.04)*
ACT		–0.06(0.05)	–0.03(0.05)
VIC		0.07(0.04)	0.10(0.04)
QLD		–0.01(0.04)	0.01(0.04)
SA		0.01(0.04)	0.01(0.04)
WA		0.06(0.05)	0.07(0.05)
TAS		–0.03(0.04)	–0.02(0.04)
NT		0.11(0.05)	0.10(0.05)
SchavgXACT		0.10(0.11)	
SchavgXVIC		–0.17(0.12)	
SchavgXQLD		0.10(0.10)	
SchavgXSA		–0.12(0.13)	
SchavgXWA		–0.03(0.11)	
SchavgXTAS		–0.03(0.13)	
SchavgXNT		0.01(0.11)	
Schavg X linear ability			0.08(0.05)
Schavg X quadratic ability			–0.03(0.02)
IndAbXschavgXACT			–0.06(0.11)
IndAbXschavgXVIC			–0.09(0.09)
IndAbXschavgXQLD			–0.18(0.09)
IndAbXschavgXSA			0.00(0.07)
IndAbXschavgXWA			–0.10(0.10)
IndAbXschavgXTAS			–0.13(0.08)
IndAbXschavgXNT			–0.07(0.10)
RANDOM EFFECTS			
L2 School intercept	0.02(0.00)*	0.02 (0.00)*	0.02 (0.00)*
L1 Student intercept	0.77(0.01)*	0.77(0.01)*	0.77(0.01)*

*$p<0.001$. Schavg = school-average ability; IndAb=individual ability.

The BFLPE (Table 5) A BFLPE was present for science self-concept (Model 1). Individual science ability was positively related to science self-concept (linear = 0.49; quadratic = 0.09) and school-average science ability significantly negatively predicted science self-concept (–0.19; effect size = –0.17). Students who attended schools higher in ability by 1SD had science self-concepts that were 0.19SD lower. Neither the main effects for states and territories nor the two-way interactions of state × school-average science ability were statistically significant, suggesting that the BFLPE was similar across states (Model 2).

Individual ability (Model 3, Table 5) None of the two-way or three-way interactions was statistically significant. This suggests that the BFLPE was consistent across individual science ability levels and across states and territories.

Motive (Table 6) All three motive variables were significantly positively associated with science self-concept (intrinsic = 0.47; extrinsic = 0.48; self-efficacy = 0.46). Compared to New South Wales students, significantly higher mathematics self-concepts were associated with self-efficacy for Victorian (0.17) students.

Table 6 BFLPE moderators for science self-concept

	Model 3		
	Intrinsic motivation	*Extrinsic motivation*	*Self-efficacy*
FIXED EFFECTS			
Constant	–0.09(0.02)*	–0.04(0.02)	–0.13(0.02)*
Linear ability	0.33(0.01)*	0.32(0.00)*	0.25(0.01)*
Quadratic ability	0.08(0.01)*	0.07(0.01)*	0.06(0.01)*
Schavg	–0.15(0.03)*	–0.15(0.03)*	–0.18(0.03)*
ACT	–0.04(0.04)	–0.06(0.04)	0.05(0.04)
VIC	0.07(0.03)	0.04(0.03)	0.17(0.03)*
QLD	–0.01(0.03)	–0.05(0.03)	0.07(0.03)
SA	–0.02(0.04)	–0.08(0.03)	0.10(0.04)
WA	0.06(0.04)	–0.04(0.04)	0.11(0.04)
TAS	–0.04(0.04)	–0.07(0.04)	0.05(0.04)
NT	0.03(0.04)	0.01(0.04)	0.08(0.04)
Moderator	0.47(0.01)*	0.48(0.01)*	0.46(0.01)*
Mod X Sch-avg	0.04(0.05)	–0.02(0.03)	–0.02(0.05)
ModXschavgXACT	–0.08(0.09)	–0.03(0.08)	–0.15(0.07)
ModXschavgXVIC	–0.03(0.07)	–0.04(0.06)	–0.01(0.08)
ModXschavgXQLD	–0.01(0.07)	–0.04(0.05)	–0.01(0.07)
ModXschavgXSA	–0.08(0.08)	–0.11(0.05)	0.02(0.06)
ModXschavgXWA	–0.03(0.08)	0.00(0.08)	0.06(0.07)
ModXschavgXTAS	0.02(0.07)	0.01(0.07)	0.06(0.06)
ModXschavgXNT	0.07(0.10)	0.01(0.06)	0.09(0.10)
RANDOM EFFECTS			
L2 School intercept	0.01(0.00)*	0.01(0.00)*	0.01(0.00)*
L1 Student intercept	0.59(0.01)*	0.58(0.01)*	0.62(0.01)*

*$p<0.001$ Schavg=school-average ability. Mod=specific moderator.

None of the three motive interactions with school-average science ability was statistically significant. The BFLPE for science self-concept was similar irrespective of students' level of motivation or self-efficacy. None of the three-way interactions for the three motive constructs was statistically significant, suggesting that the BFLPE for science self-concept was consistent across these motivational tendencies and across states.

General discussion

The present investigation extended the Seaton, Marsh and Craven (2010) study by investigating BFLPE moderators from an Australian perspective, considering differences in BFLPE moderation across Australian states and territories, and examining BFLPE moderators for verbal and science self-concepts in addition to mathematics self-concept. The BFLPE moderators were encapsulated within an academic self-regulation framework that included behaviour, study methods, motive and social dimensions. Additionally, the present investigation extended the Marsh (2004) study by demonstrating that the BFLPE was similar across Australian states and territories for verbal, mathematics and science self-concepts.

The BFLPE

Consistent with previous research (Marsh, 2004; Marsh et al., 1995), Australian students attending high-ability schools had lower verbal, mathematics and science self-concepts than their equally able counterparts who attended lower-ability schools. Effect sizes for mathematics and verbal self-concepts were both substantial enough to be practically significant. But, given the relatively smaller effect size for science (–0.17), it appears that the BFLPE is less prominent in the science domain. This suggests that the BFLPE may have stronger detrimental effects in at least some subject domains. Perhaps students regard mathematics and English as being core subjects in which it is more important to do well than in science. Or students, perhaps, have more opportunity to compare their progress in mathematics and English than they do in science.

Extending Marsh's (2004) results for academic self-concept, the present investigation found that there were no significant differences in the BFLPE between Australian states and territories for verbal, mathematics and science self-concepts. It appears that students do not have to attend an academically selective school to suffer from the BFLPE: if they attend a school where the average ability level is high, then the BFLPE can strike.

Individual ability

Previous research has shown that the moderating effect of individual ability on the BFLPE is small and not consistent in direction (Marsh et al., 1995). In the present investigation, individual ability in reading, mathematics and science did not moderate the BFLPE: students of all ability levels were prone to the BFLPE. It appears that high ability does not buffer students against the BFLPE. There were no differences across states or territories regarding the moderating effect of ability for reading, mathematics and science. Irrespective of the state or territory policy regarding selective education, the BFLPE affected students of all ability levels.

Study methods

Students had higher verbal and mathematics self-concepts when they used elaboration, memorisation and control strategies to aid their learning. These results are consistent with previous research that has demonstrated that these study methods are associated with beneficial educational outcomes and positive self-concepts (Boekaerts, 1997; Swalander & Taube, 2007).

Consistent with Seaton, Marsh and Craven (2010), neither elaboration nor control strategies moderated the BFLPE but, inconsistent with that study, memorisation did not moderate the BFLPE. As the effect size in Seaton, Marsh and Craven (2010) for memorisation was –0.157, below Cohen's cut-off for a small effect size (0.20—Cohen, 1988), the difference between the current finding and that of the Seaton study is trivial. Moreover, these findings were similar across states and territories, indicating that for Australian students, irrespective of the state or territory in which one lives and of one's use of these study methods, attending a high-ability school continued to have a negative effect on academic self-concepts.

Motive

Students had higher verbal, mathematics and science self-concepts when they were motivated either extrinsically, intrinsically or felt self-efficacious. These results are consistent with previous research that has demonstrated that these motivational constructs are associated with more positive academic outcomes and self-concepts (Gottfried, 1990; Hardre & Reeve, 2003; Marsh et al., 2006; Multon, Brown & Lent, 1991; Seaton, Marsh & Craven, 2010).

Consistent with Seaton, Marsh and Craven's (2010) findings and our hypotheses, intrinsic motivation, extrinsic motivation and self-efficacy did not moderate the BFLPE. Irrespective of a student's level of motivation, if the student attended a high-ability school then his or her reading, mathematics and science self-concepts were lower than an equally able student who attended a lower ability school. These moderating effects were similar across states and territories.

Social

Consistent with previous research demonstrating that competitive and cooperative orientations are associated with better educational outcomes (OECD, 2001a; Slavin, 1983), the present investigation found these orientations were associated with higher verbal and mathematics self-concepts. Moreover, consistent with our predictions and Seaton, Marsh and Craven (2010), a preference for a competitive environment did not moderate the BFLPE. Regardless of a student's level of preference for a competitive environment, students in high-ability schools suffered from the BFLPE.

Contrary to Seaton, Marsh and Craven (2010) and our hypothesis, a preference for a cooperative environment did not moderate the BFLPE but the effect size in the Seaton, Marsh and Craven (2010) study was –0.083. Hence, although a cooperative orientation did not moderate the BFLPE, as the effect size was small in Seaton, Marsh and Craven (2010), we conclude that the difference between the two sets of findings is trivial. It appears that Australian students in high-ability schools experienced the BFLPE irrespective of their preference for working in a cooperative environment.

Findings for cooperative and competitive orientations were similar across states and territories. It could be argued that there is much competition in academically selective schools but, even in states and territories where there were few academically selective schools, irrespective of the extent students espoused cooperative and competitive orientations, there was still evidence of a BFLPE.

Strengths, limitations and future research

The present investigation's major strengths include the large number of potential BFLPE moderators that were examined and the fact that the BFLPE was tested in three different subject domains (verbal, mathematics and science), thus allowing comparisons across subject domains and demonstrating the domain specificity of the BFLPE. Moreover, the present investigation extended Marsh's (2004) and Seaton, Marsh and Craven's (2010) studies by investigating whether the moderators have similar effects in states and territories that have differing policies for educating high-ability students. Our results indicate that despite some states and territories not espousing selective education, the BFLPE was still evident. The use of multi-level modelling is also a strength, as it can overcome the problems of single-level analyses.

An important limitation concerns the scales used. PISA did not use similar items to measure constructs across the three administrations. While the test scores and self-concept scales were comparable, the moderating constructs were different. In Study 1, items were of a general nature; in studies 2 and 3, they referred specifically to mathematics and science. Comparisons of constructs across cohorts should be made with caution, as the constructs cannot be assumed to be identical. A limitation also related to the survey items is the possibility that results to an extent may be predetermined and limited by the construct definitions but we do not think that this is the case for this investigation. For example, intrinsic motivation is broadly defined as performing a task because it is pleasurable in and of itself. Considering this definition, Seaton, Marsh and Craven (2010) argued that the BFLPE would be reduced for intrinsically motivated students as 'they may not find the accomplishments of others as threatening, or even relevant, to their self-views' (p. 395). Nevertheless, the Seaton, Marsh and Craven (2010) results and our results proved otherwise: the BFLPE was not moderated by intrinsic motivation. A similar argument could be made for all other constructs considered in this article.

Future research could take advantage of longitudinal causal modelling designs to more fully explicate the relations between individual student characteristics and the impact of attending a high-ability school. Future BFLPE research could also include an examination of the roles of academic resilience in the effect and the pressure placed on students to achieve by significant others. BFLPE moderators could also be approached through expectancy-value theory (see Wigfield & Eccles, 2000) and achievement goal theory (see Dweck & Leggett, 1988). The expectancy component of expectancy-value theory is often represented by academic self-concept, while Eccles theorised subjective task value as encompassing interest-enjoyment value, attainment value, utility value and relative cost were related to intrinsic and extrinsic motivation. Xu (2010) found that the BFLPE was relatively independent of learning and performance goals based on achievement goal theory, constructs that were not included in the present study. Nevertheless, it would be useful for future research to more fully integrate self-concept theory with these alternative theoretical perspectives.

The role of frames of reference in the BFLPE is an important avenue to pursue. Huguet and colleagues (2009) recently demonstrated the role of social comparison in the BFLPE, but the function of friendship groups and preferred workmates may also be important to consider. In addition, it would be useful to explicate the extent of the BFLPE across a wide number of subject domains.

Implications for policy, practice and theory

These are troubling findings. One might have expected that the use of positive study methods, such as control strategies and elaboration, would be beneficial for students. Similarly, one might have expected that high-ability students, intrinsically motivated students and students who felt capable of succeeding would have confidence in their abilities. The current results and those of Seaton, Marsh and Craven (2010) show that this is not the case. Considering that academic self-concept and achievement are reciprocally related (Marsh & Yeung, 1997a; Valentine & Dubois, 2005), then the importance of these results for the achievement of students in high-ability schools is evident. Policy-makers and practitioners should be urged to consider ways to alleviate the BFLPE. For example, reducing the competitive nature of schooling that emphasises normative feedback and in which students are rank-ordered may be helpful. Another approach may be to encourage students to rely on personal improvement over time rather than comparing their own performances with the achievements of others.

The present investigation demonstrated that the BFLPE generalises across the specific academic self-regulation constructs examined in this study for Australian students and that the moderation effects on the BFLPE were similar across states and territories, despite the states and territories having differing policies regarding the educational placement of high-ability students. These findings testify to the strength, validity and generalisability of the BFLPE and suggest that whether or not educational regions espouse ability segregation is of little consequence to its existence.

Keywords

ability grouping, academic ability, academic achievement, individual differences, self-concept, learning strategies

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