Finding Nemo: An Overview of New Currents in Big-Fish-Little-Pond Effect Research

Marjorie Seaton\textsuperscript{a}, Gawaian Bodkin-Andrews\textsuperscript{a}, Herbert W. Marsh\textsuperscript{b}, and Rhonda G. Craven\textsuperscript{a}

\textsuperscript{a}Centre for Educational Research, University of Western Sydney, Australia
\textsuperscript{b}Oxford University, United Kingdom

Abstract

Big-fish-little-pond effect (BFLPE) research has demonstrated that students in high-ability environments have lower academic self-concepts than equally able students in average- and low-ability settings. The present paper provides an overview of three new studies that extend knowledge of the BFLPE in both theoretical and practical ways. In particular, these studies: (a) demonstrate the generalisability of the BFLPE across 41 culturally and economically diverse countries; (b) demonstrate the generalisability of the BFLPE across various individual student characteristics; and (c) investigate the relation between the BFLPE and social comparison processes. Implications for educational policy and for teaching high-ability students are discussed.

Paper presented at the Australian Association for Research in Education, Brisbane, November 2008. Correspondence concerning this paper should be sent to Marjorie Seaton, Centre for Educational Research, Bankstown Campus, University of Western Sydney, Locked Bag 1797, Penrith South DC, NSW 1797, Australia or via email to m.seaton@uws.edu.au
The present paper presents a review of three studies that have recently been undertaken in big-fish-little-pond effect (BFLPE) research. The focus of this research has been on furthering BFLPE theory and elucidating potentially potent processes and constructs to inform new solutions for enabling high-ability students to reach their full potential. The first two of these three studies examined the generalizability of the BFLPE. The first study examined the generalizability of the BFLPE across 41 culturally and economically diverse countries (Seaton, Marsh, & Craven, in press). The second examined the generalizability of the BFLPE across a plethora of individual student characteristics (e.g., anxiety, elaboration; Seaton, Marsh, & Craven, 2008a). The third study investigated the relations between the BFLPE and social comparison processes (Seaton et al., 2008b). This paper begins with an overview of the BFLPE, continues by describing each of the three studies, and concludes by discussing the implications of BFLPE for teaching high-ability students.

The Big-Fish-Little-Pond Effect

Throughout the world there is an increasing emphasis on how to educate high-ability students most effectively. High-ability students are expected to be future leaders in fields such as medicine, law, science, business, and politics. As such, it is critically important that high-ability students are provided with the best education possible to allow them to reach their full potential. The importance of delivering the best education to these students can be argued for on the basis of enriching the intellectual climate of a nation, of strengthening a country’s socio-economic fabric, and of cultivating talent in all facets of society.

Various strategies have been employed to provide quality education for high-ability students including curriculum enrichment, acceleration, and special interest centres (e.g., Frydenberg & O’Mullane, 2000; Merrotsy, 2003). Additionally, students are often selected, on the basis of their academic ability, to attend specially designated classes or schools. However, a growing body of research evidence suggests that segregation on the basis of academic ability does not create optimum environments in which to educate high-ability students (e.g., Craven, Marsh, & Print, 2000; Davis, 1966; Marsh, 1991; 2005; Marsh & Hau, 2003; Marsh & Parker, 1984).

Marsh and his colleagues have pioneered work in this area. They have shown that attending academically selective environments can have a detrimental effect on how students perceive themselves academically (a construct referred to in the literature as academic self-concept). This research has consistently found that if students are educated in high-ability classes and schools they will have lower academic self-concepts than their equally able
counterparts who are educated in average- and low-ability environments (e.g., Marsh, 1991; 2005; Marsh, Chessor, Craven, & Roche, 1995; Marsh & Hau, 2003; Marsh, Köller, & Baumert, 2001), a phenomenon known as the “big-fish-little-pond effect” (BFLPE).

Does it matter if students do not have accurate perceptions of their academic abilities? Based on education policy and a considerable body of self-concept research, it is evident that self-concept is vitally important in producing positive educational outcomes. The significance of having a positive academic self-concept is acknowledged by education policies worldwide as a key outcome of schooling. For example, an aim of Australian education is that students should leave school with “qualities of self-confidence, optimism, high self-esteem, and a commitment to personal excellence” (Ministerial Council on Education, Employment, Training, and Youth Affairs, 1999). Moreover, one’s level of academic self-concept can influence important educational outcomes such as course selection, long-term educational aspirations, and academic attainment (e.g., Guay, Larose, & Boivin, 2004; Guay, Marsh, & Boivin, 2003; Marsh & Yeung, 1997).

Additionally, academic self-concept has been demonstrated to share a reciprocal causal relation with academic performance (Marsh & Craven, 2006). Recent research has demonstrated that academic achievement is related to academic self-concept in such a way that they causally impact on each other (Marsh & Yeung, 1997; cf. Marsh & Craven, 2005, 2006; Valentine & DuBois, 2005). High academic achievement has been shown to be related to improvements in academic self-concept, and high academic self-concept has been shown to be related to improvements in academic performance, such that they are mutually reinforcing. Logically then, for high-ability students to realise their full potential, both academic self-concept and academic achievement must be enhanced simultaneously. If, as BFLPE research shows, attending academically segregated classes and schools lowers academic self-concept, then it follows that high-ability students attending academically selective environments may not be reaching their full academic potential. Given that the effects of academic selectivity on self-concept have been demonstrated to persist for four years after graduation from high school in Germany (Marsh, Trautwein, Lüdtke, Baumert, & Köller, 2007), it is of paramount importance to more fully elucidate the BFLPE and its implications for education. This has been the focus of the three studies described in this paper.
Generalizability of the BFLPE

Methodological Overview (Common to Both Generalisability Studies - Seaton et al., in press and Seaton et al., 2008a)

The 2003 Program of International Student Assessment (PISA; Organisation for Economic Cooperation and Development [OECD], 2005) was utilised to test the generalisability of the BFLPE across 41 countries (Seaton, Marsh, & Craven, in press) and also to test its generalisability across 17 individual student characteristics (Seaton, Marsh, & Craven, 2008a). The PISA assessments are conducted every three years and are administered to 15-year-olds around the world. In 2003, over a quarter of a million students (N = 276,165) from 41 countries participated. Every PISA administration has a different focus and in 2003 that focus was on mathematics. Students completed a questionnaire, and tests in reading, mathematics, and science, which measured ability in all these areas. The questionnaire comprised items that assessed various aspects of a student’s home and school life, including mathematics self-concept items (e.g., “I get good marks in mathematics”). However, as not all students completed the mathematics self-concept items, and as mathematics self-concept was a vital ingredient in both these studies, those students who did not complete these items were removed from further analyses. Additionally, schools that were considered to be too small to be included in multilevel analyses (i.e., schools with less than 10 students may not be representative of their school as a whole) were also removed, resulting in a sample of 265,180 students, in 10,221 schools, across 41 countries.

All measures were standardised across the entire sample to have a mean of zero and a standard deviation of one. School-average mathematics ability was calculated by averaging each student’s mathematics ability score separately within each school. This variable was not re-standardised to ensure that individual mathematics ability and school-average mathematics ability were kept in the same metric. Product terms were used to test interaction effects (further methodological details relevant to each particular study are presented below; also see Seaton et al., in press and Seaton et al., 2008a, for full details).

The PISA data have a hierarchical structure: students are nested within schools, and schools are nested within countries. Ignoring such a structure and using traditional single level statistical methods for analyses can result in serious statistical problems, such as aggregation bias and misestimated standard errors (see Rowe, 2005). Hence, multilevel modelling was used to analyse data in both these studies.
Cultural and Economic Generalizability (Seaton et al., in press)

Although there has been considerable cross-national support for the BFLPE (Craven et al., 2000; Marsh, 1987, 1991, 2004; Marsh et al., 1995; Marsh & Hau, 2003; Marsh, Kong, & Hau, 2000; Marsh & Parker, 1984; Mulkey, Catsambis, Steelman, & Crain, 2005; Zeidner & Schleyer, 1998), countries previously studied have been mostly developed nations and individualist countries. The 41 nations of the large nationally representative PISA sample consisted of individualist and collectivist countries and economically developed and developing countries. Hence, it was an ideal sample with which to test the universal applicability of the BFLPE.

A bipolar scale (Individualism Index scale; Hofstede & Hofstede, 2005) was used to classify countries along an individualist / collectivist dimension. Scores at the higher end of this scale denoted that the country was higher in individualism and scores at the lower end indicated a more collectivist country. The 41 countries in this study provided a representative sample of both individualist and collectivist countries as classified by Hofstede and Hofstede. World Bank classifications (World Bank, 2007) were used to categorise the 41 countries in terms of whether each country was economically developing (scored as 0) or economically developed (scored as 1). This resulted in 14 countries being classified as developing and 27 countries being classified as developed.

Three sets of multilevel analyses were used to test predictions. The first set of analyses tested for the generalisability of the BFLPE across the entire cross-national sample. Mathematics self-concept was the outcome variable and predictor variables were individual mathematics ability, school-average mathematics ability, and their interaction. Findings demonstrated that the BFLPE was evident in this cross-national sample of culturally and economically diverse countries as, once the effects of prior achievement were accounted for, the effect of school-average mathematics ability was significantly negative (-0.30). Additionally the individual math ability by school-average math ability interaction had a statistically significant negative association (-0.05) with math self-concept. This result indicated that the BFLPE was somewhat stronger (i.e., the effect of school-average ability was more negative) for high-ability students attending high-ability schools.

In the second set of analyses, each country was tested individually. Mathematics self-concept was the outcome variable and predictor variables were individual mathematics ability and school-average mathematics ability. Results indicated that the effect of school-average mathematics ability on mathematics self-concept (the BFLPE) was negative in all 41 individual countries tested (ranging from -0.01 in Korea to -0.71 in Germany) and
significantly negative in 38 of these countries.

A third set of analyses was conducted to ascertain whether the BFLPE could be moderated by cultural orientation (i.e., score on the Individualism Index scale) or stage of economic development (i.e., the dichotomous score of zero or one as specified above). Mathematics self-concept was the outcome variable and predictor variables included individual ability, school-average mathematics ability, the moderator (either cultural orientation or economic development), and the interaction of school-average mathematics ability with the respective moderator. Although there was a small moderating effect for cultural orientation (-0.05), indicating students from individualist countries displayed larger BFLPEs than those from collectivist countries, the size of the interaction effect, given the large sample, was considered too small to be of practical importance. The BFLPE was not moderated by stage of economic development indicating that the BFLPE was similar across economically developing and economically developed countries. Consequently, it appears that the BFLPE is evident whether or not a country is individualist or collectivist, economically developed, or developing.

By demonstrating the existence of the BFLPE in such a culturally and economically diverse sample, this research provided evidence of the external validity and universal applicability of the BFLPE and established the BFLPE as a truly universally applicable theory. Consequently, it appears that the BFLPE applies to students in countries worldwide, irrespective of their country’s cultural orientation or economic prosperity.

**Generalizability across Individual Student Characteristics (Seaton et al., 2008a)**

Although researchers (e.g., Marsh, 1991; Marsh et al., 1995) have proposed that identifying individual differences between students would be a valuable tool in developing policies to minimise the negative effects and maximise the benefits of attending academically selective classes and schools, to date success in this area has been limited (e.g., Marsh, 1984, 1987, 1991; Marsh & Hau, 2003). As such, little is known about identifying strategies to counteract the effects of the BFLPE for individual students. Hence, Seaton et al. (2008a) focussed on ascertaining whether the BFLPE could be moderated by, or generalised across, a range of individual student characteristics. These individual student characteristics assessed three broad areas:

1. Measures that assessed student background (Socio-Economic Status [SES]; e.g., parental occupation, parental education, home educational resources, and cultural possessions within the home);
2. Individual differences in learning styles. These included individual ability, self-regulated learning strategies (elaboration, memorisation, and control strategies), motivation to learn (extrinsic and intrinsic motivation), individual preferences for learning environment (competitive and cooperative preferences), and self-related cognitions (mathematics self-efficacy and mathematics anxiety); and

3. Individual perceptions of the school environment such as a sense of belonging to the school, student teacher relations, and attitudes to school.

Separate analyses were conducted for each potential BFLPE moderator (four SES moderators, ten individual differences in learning moderators, and three perceptions of the school environment moderators). Mathematics self-concept was the outcome variable in all analyses. Individual mathematics ability, school-average mathematics ability, the potential moderator, and the interaction of school-average mathematics ability with the relevant moderator variable were predictor variables.

Small significant moderating effects for the BFLPE were found for SES (highest in occupation = 0.01 and cultural possessions = -0.02), individual differences in learning (memorisation = -0.09; control strategies = -0.02; extrinsic motivation = 0.03; math self-efficacy = -0.04; math anxiety = -0.10; preference for a cooperative learning environment = -0.05), individual perceptions of the school environment (attitudes to school = 0.03; sense of belonging = 0.03), and individual ability (-0.05). Results for SES suggested that the BFLPE – the negative effect of school-average ability – was marginally smaller for students in high-ability schools when a parent was employed in a more prestigious occupation, but larger when there were more cultural resources available at home. Results for individual differences in learning and individual perceptions of the school environment suggested that smaller BFLPEs were associated with students who: (a) were motivated extrinsically; (b) had more positive attitudes to school; or (c) felt a sense of belonging to the school. However, these interaction effects were trivial and may simply be an artefact of the large sample size. Larger interaction effects were found for constructs that were associated with more pronounced BFLPEs. Larger BFLPEs were associated with students who: (a) used memorisation or control strategies as learning techniques; (b) preferred to work in a cooperative environment; (c) were of higher-ability; (d) felt more able to succeed in mathematics; or (e) were anxious; although the size of the first four effects was small considering the size of the sample and the power of the tests.

The sample on which these analyses were based was extremely large (N = 265,180). Large samples can produce significant small effects that would not reach significance in a more moderately sized sample (Howell, 1997). Hence, the small interaction effects found in
this study should be treated cautiously. When effect sizes were calculated for the significant
interactions, only that of anxiety was considered to have any substantive value (-0.19), being
similar to Cohen’s (1988) suggestion as to what represents a small effect size (+/-0.20). Thus,
due to the large size of the sample and the generally small size of the interaction effects found
for these moderating constructs, it appears that the BFLPE generalises well across these
individual student characteristics, perhaps apart from that of anxiety. However, as seen in
Figure 1, even in the case of anxiety, low anxiety students still displayed a BFLPE, albeit
smaller than high anxiety students.

The BFLPE and Social Comparison (Seaton et al., 2008b)

Background

Researchers who study the BFLPE propose that its theoretical basis lies in social
comparison theory (e.g., Marsh et al., 1995; Marsh & Hau, 2003; Marsh et al., 2000). These
authors suggest that students compare their achievements with those of their classmates as
one means of evaluating their performance. They further speculate that it is these comparisons
with classmates, forced on students by the environment in which they find themselves, that
lead to lowered academic self-concepts (e.g., Marsh et al., 1995; Marsh & Hau, 2003; Marsh
et al., 2000). However, until recently, this link between comparisons and the BFLPE was not
specifically incorporated with social comparison research in educational settings. This is
unfortunate as such information could assist in informing school-based intervention strategies
aimed at countering the negative effects of the BFLPE and allowing students to benefit from
academically segregated education. The first step in studying the relation between the BFLPE
and social comparison processes was undertaken by Seaton et al. (2008b) – an investigation
(and a fruitful collaboration) brought about by a challenge made by Wheeler and Suls (2005).

In their discussion of ways in which social comparisons can influence achievement
motivation and competence perceptions, Wheeler and Suls (2005) were the first to note a
contradiction between the BFLPE results of Marsh and his colleagues and the social
comparison findings of Blanton, Buunk, Gibbons, and Kuyper (1999) and Huguet, Dumas,
Monteil, and Gestenoux (2001). Both these studies found that students compared themselves
with other students who were slightly outperforming them academically, and that controlling
for prior grade, these upward comparisons with selected targets significantly predicted higher
grades in subsequent tests. Whereas participants’ own grades predicted comparative
evaluation in all academic subjects, choosing to compare themselves with a more able
student, however, had no effect on self-evaluations. Blanton et al. concluded that “participants
reflected more on their own abilities than on the performances of their targets of comparison when they made their comparative evaluations” (p. 426).

However, as noted by Wheeler and Suls (2005), whereas the Blanton et al. (1999) and Huguet et al. (2001) studies imply that upward comparisons improve academic performance, BFLPE findings imply that comparisons deflate self-evaluations of academic ability and lower academic self-concepts have been associated with lower achievement (e.g., Chapman, Turner, & Prochnow, 2000; Hansford & Hattie, 1982). As a result, Wheeler and Suls challenged Marsh to explain the apparent contradiction between BFLPE results in relation to social comparison and academic self-concept, and the social comparison findings of Blanton et al. and Huguet et al. in relation to actual performance (J. Suls, personal communication, September 11, 2003). In answering this challenge, Marsh invited the authors of Blanton et al. to collaborate with him in a further analysis of their findings in order to explore whether the BFLPE co-existed with their original results. Subsequently, Huguet et al. (P. Huguet, personal communication, April 29, 2004), in response to Wheeler and Suls’ identification of the apparent discrepancy in the literature and Marsh’s proposed further analysis, suggested that all parties engage in a joint venture to investigate the relation between the BFLPE and social comparison choices.

Consequently, the Seaton et al. (2008b) study represents the collaborative effort undertaken to reconcile the contradiction between BFLPE results and those of social comparison research. This was accomplished by re-analysing the social comparison studies of Blanton et al. (1999) and Huguet et al. (2001) to identify whether the negative effects of the BFLPE on self-concept co-existed with, or were moderated by, the positive effects of upward comparison on performance.

**Method**

Participants in the Blanton et al. (1999) study were 876 students in four Dutch high schools. Participants in the Huguet et al. (2001) study were 1,156 students in 12 French high schools. In both these social comparison studies, the participants, first-year high school students, nominated the student in each of their academic subjects with whom they preferred to compare their grades. Participants’ school reports were used to assess performance and the direction of comparisons. Thus, objective measures of performance and comparison direction were obtained. Students also completed a measure of self-evaluation, whereby they compared their academic abilities in all academic subjects with those of their classmates. To test the BFLPE, an academic self-concept measure is normally used, but as the Blanton et al. and
Huguet et al. studies were not designed to test the BFLPE, they contained no such measure. Consequently, the self-evaluation measure, was used in place of an academic self-concept measure.

All measures were standardised across the entire sample ($M = 0, SD = 1$). A class-average achievement measure was calculated by averaging students’ grades in each class, and cross-products were calculated to test interaction effects. The response variable was self-evaluation and predictor variables were grades, class-average achievement, their interaction, the grade of the comparison person, and the interaction of the comparison person’s grade and class-average achievement. Once again, students were nested within classes within schools. Hence, as these data had a hierarchical structure, analyses were conducted using multilevel modelling.

**Results**

In preliminary analyses, Blanton et al.’s (1999) and Huguet et al.’s (2001) original results were replicated, demonstrating that comparisons with superior others were predictive of subsequent higher grades. In main analyses for the Blanton et al. data, self-evaluation was positively significantly predicted by individual grades (ranging from 0.32 to 0.78) and significantly negatively predicted by class-average achievement for all academic subjects tested (ranging from -0.34 to -0.62), thereby demonstrating the existence of the BFLPE. Of particular interest was whether the comparison person’s grade would continue to have no effect on self-evaluation in the presence of the BFLPE and whether class-average achievement could be moderated by a student’s comparison choice. The main effect of the comparison person’s grade and the class-average achievement X comparison person’s grade interaction were not statistically significant for any of the academic subjects tested. The latter result indicated that the BFLPE was not moderated by selected social comparisons.

Results were similar in the Huguet et al. (2001) data. Individual grades significantly positively predicted self-evaluation (ranging from 0.64 to 0.74) and the effect of class-average achievement on self-evaluation (the BFLPE) varied from -0.15 to -0.42 and reached significance for all but one academic subject tested. The main effect of the comparison person’s grade had a small positive effect on self-evaluation (ranging from 0.04 to 0.12) that was significant for all but one of the academic subjects tested. However, as in the re-analysis of the Blanton et al. (1999) data, the class-average achievement X comparison person’s grade interaction was not statistically significant for any of the academic subjects tested.
These results indicated that comparisons with superior others did not moderate the BFLPE. Rather the BFLPE co-existed with selected upward comparisons that enhanced performance. Evidently, choosing to compare with a more able individual student enhances performance, but at the same time makes one feel distinctly inferior about one’s abilities. These results have important implications for BFLPE and social comparison theories in that they suggest that selected social comparisons with an individual may not be responsible for the BFLPE. So, do social comparison processes underpin the BFLPE? What might be happening is that the BFLPE may be the product of forced comparisons with a generalised other (i.e., the average person, typical others, or some kind of average or aggregate mark). So, by virtue of being in the school system, students may not be able to help but compare themselves with the average student in their class or grade – the comparison with the average or generalised other is forced on them by the environment in which they find themselves. Or perhaps the combination of selected individual comparisons with forced generalised comparisons may be responsible for the effect. Further research is required to explicate the mechanisms underlying the BFLPE and in particular to establish the form and nature of the generalised other. Moreover, future research could examine the processes by which forced comparisons with the generalised other and selected individual comparisons may operate together in the formation of the BFLPE.

**Summary and Conclusions**

The three studies described in this paper have advanced current knowledge of the BFLPE from both a theoretical and practical perspective. Taken together, the first two studies (Seaton et al., in press; Seaton et al., 2008a) attest to the universal applicability of the BFLPE. Not only is the BFLPE applicable to students worldwide, it also generalises across various individual student characteristics. These findings lend credence to the view that the BFLPE is an extremely robust effect. The latter study described (Seaton et al., 2008b) has begun the process of elucidating the psychological processes thought to underlie the BFLPE – social comparison processes. Results indicated that the comparisons that individuals select co-exist with, and do not moderate, the BFLPE. Not only have these three studies advanced theoretical knowledge of the BFLPE, they have provided valuable information on which future research can be based. For example, as the social comparison study (Seaton et al., 2008b) was based on data that were not designed to test for a BFLPE, it lacked elements necessary for BFLPE
research: namely a standardised achievement test and a psychometrically sound measure of academic self-concept. Future research could replicate these results using more suitable instrumentation.

From a practical perspective, constructs were identified in the second of these studies (Seaton et al., 2008a) that alleviated or reduced the BFLPE, and so may provide directions for formulating future policy and for teaching practice. Although there are limitations associated with these findings (they were based on a single wave of correlational data and so any causal relations cannot be elucidated and the interaction effects were considered to be trivial in light of the large sample used), nevertheless these results do offer potential for intervention strategies. For example, academically selective schools should be made aware that the BFLPE may be exacerbated for anxious students and put policies in place to reduce situations that aggravate anxiety. Interventions that focus on reducing anxiety levels in susceptible students in high-ability environments may also help to counteract the BFLPE. Promoting a sense of belonging in high-ability classes and schools and encouraging more cooperative learning environments, especially in academically selective schools, may also be beneficial. Moreover, strategies that enhance motivation, promote a sense of belonging to the school, and encourage more positive attitudes to school may counter the negative effects of the BFLPE. However, further longitudinal research is necessary to fully elucidate the relations between these moderators and the BFLPE.

In summary, these three studies have added to theory and knowledge of the BFLPE. They have also identified important avenues that can be pursued in future intervention strategies in order to alleviate the negative effects associated with the BFLPE, thus allowing high-ability students to benefit from selective education and reach their full potential.
References


Figure 1. Math Anxiety by School-Average Ability Interaction

Note. Based on predicted values. High school-average ability = 1 standard deviation above the mean for school-average math ability and low school-average ability = 1 standard deviation below the mean. Similarly, high math anxiety = 1 standard deviation above the mean for math anxiety, and low math anxiety = 1 standard deviation below the mean. Individual ability is held constant.