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Brief report

The big-fish-little-pond effect on mathematics self-concept: Evidence from the United Arab Emirates

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ABSTRACT

This study examined the big-fish-little-pond effect (BFLPE; Marsh, 1987) on mathematics self-concept of 7404 adolescents (female = 3767 [51%], male = 3637 [49%]; M_{age} = 15.85 years, SD = 0.28) from 456 schools in the United Arab Emirates, one of the Arab states of the Persian Gulf. The results of multilevel regression analyses indicated good support for the BFLPE's theoretical predictions: the effect of individual student mathematics achievement on individual student mathematics self-concept was positive and statistically significant, whereas the effect of school-average mathematics achievement on individual student mathematics self-concept was negative and statistically significant. Moreover, the interaction between school-average mathematics achievement and individual student mathematics achievement was small and non-significant. Implications of the findings for policy and practice are briefly discussed.

1. Introduction

A large of body of research in the realm of positive psychology has documented the crucial role that academic self-concept plays in adolescent students' academic engagement and performance across cultures (e.g., Areepattamannil & Freeman, 2008; Areepattamannil, 2012a, 2012b; Areepattamannil, Freeman, & Klinger, 2011; Areepattamannil et al., 2016; Green et al., 2012; Marsh & Martin, 2011; Ng, Lay, Areepattamannil, Treagust, & Chandrasegaran, 2012). As a result, a substantial body of research, employing varied theoretical frameworks, has examined how adolescents form their academic self-concepts (e.g., Huguet et al., 2009; Marsh, Kuyper, et al., 2014). One of the predominant theoretical models employed to explain the formation and development of academic self-concepts among children and adolescents has been the big-fish-little-pond effect (BFLPE; Marsh, 1987, 2016; Marsh et al., 2008) based on the social comparison theory (see Festinger, 1954; Huguet et al., 2009).

The BFLPE primarily posits that the effect of individual student achievement on academic self-concept is positive, whereas the effect of school-average achievement on academic self-concept is negative (Marsh, 1987, 2016). A growing body of research has demonstrated the validity and generalizability of the BFLPE across several countries around the world (e.g., Chiu, 2012; Liem, Marsh, Martin, McInerney, & Yeung, 2013; Marsh, 2016; Marsh, Abduljabbar, et al., 2014; Marsh et al., 2015; Marsh & Hau, 2003; Nagengast & Marsh, 2012; Scherer & Siddiq, 2015; Seaton, Marsh, & Craven, 2009). Of these studies,

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however, a very small body of research has specifically examined the BFLPE in the domains of mathematics achievement and mathematics self-concept. Moreover, the lion's share of these studies were based on nationally representative samples of children and adolescents drawn from international large-scale student assessments such as the Program for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS).

For example, Seaton et al. (2009), drawing on data from the second cycle of the PISA, evaluated the BFLPE on mathematics self-concept among 15-year-old students hailing from 41 PISA 2003 participating countries. The authors found that individual student mathematics achievement was significantly positively related to mathematics self-concept, a finding conforming to one of the theoretical predictions of the BFLPE. The results of the study also demonstrated that school-average mathematics achievement was significantly negatively associated with mathematics self-concept, a finding attesting to the existence of the BFLPE in mathematics in these PISA 2003 participating countries (mean effect size = −0.49). In addition, the authors also examined whether or not the negative effect of school-average mathematics achievement on mathematics self-concept (i.e., the size of the BFLPE) varied with levels of individual student mathematics achievement. They found that all students suffered the BFLPE, irrespective of their academic ability levels; however, the BFLPE was stronger for higher-achieving students attending higher-achieving schools. Recently, Salchegger (2016), using Seaton et al.'s (2009) BFLPE estimates, reported that the BFLPE for mathematics self-concept was stronger in those PISA 2003 participating countries that had earlier explicit school-level tracking.

Furthermore, Chiu (2012), Marsh, Abduljabbar, et al. (2014), and Marsh et al. (2015) also found support for the BFLPE among primary (i.e., Grade 4) as well as secondary (i.e., Grade 8) students in 27 TIMSS 2003 and 14 TIMSS 2007 participating countries, respectively. The mean effect size of the BFLPE in these studies ranged from −0.13 to −0.53. Further, Marsh et al. (2015) reported that the BFLPE was more pronounced among Grade 8 students than among Grade 4 students. A very few single-country studies have also provided empirical support for the BFLPE's theoretical predictions with respect to mathematics self-concept. For instance, Liem et al. (2013) assessed the BFLPE in a sample of 4461 students enrolled in Grades 7–9 in Singapore. The authors demonstrated that the effects of class-, stream-, and school-average mathematics achievement on mathematics self-concept were significantly negative, thereby lending empirical evidence for the BFLPE on mathematics self-concept in Singapore. Moreover, Scherer and Siddiq (2015), using the Norwegian sample of the PISA 2012 dataset, examined the BFLPE for paper-and-pencil and computer-based mathematics assessments. The authors found that the BFLPE for mathematics self-concept was significant and negative for both paper-and-pencil and computer-based mathematics assessments (effect size = −0.33, −0.40, respectively).

Nevertheless, the majority of studies to date on the BFLPE for mathematics self-concept primarily relied on Western samples. Whereas few studies on the BFLPE focused on samples drawn from a small number of East Asian and Southeast Asian countries, fewer studies have investigated the BFLPE for mathematics self-concept in West Asian, Middle Eastern countries. Moreover, to the best of our knowledge, no study to date has tested the BFLPE's theoretical predictions with respect to mathematics achievement and mathematics self-concept in the United Arab Emirates, one of the countries in the Persian Gulf. Although hitherto research on the BFLPE for mathematics self-concept has documented the occurrence of the BFLPE in several countries across the globe, the size of the BFLPE varied substantially across countries (see Marsh et al., 2015; Seaton et al., 2009), suggesting that country-specific factors might be contributing significantly to huge variations in the size of the BFLPE (see Salchegger, 2016). Such country-specific factors may severely limit the cross-national or cross-cultural generalizability of the BFLPE for mathematics self-concept. Moreover, prior BFLPE studies on mathematics self-concept have identified significant variations in the BFLPE by age (e.g., Marsh et al., 2015), indicating that the size of the BFLPE for mathematics self-concept may vary substantially across age groups. Finally, previous BFLPE research based on the various waves of the PISA and the TIMSS datasets have also reported significant variations in the BFLPE in the same countries that took part in all cycles of the PISA and the TIMSS studies so far, thereby limiting the stability of the BFLPE across different student cohorts within a country (e.g., Chiu, 2012; Liou, 2014; Marsh, Abduljabbar, et al. (2014); Marsh, Kuyper, et al., 2014; Marsh et al., 2015). In light of these reasons, it is crucial to examine the BFLPE for mathematics self-concept among understudied or not yet understood adolescent student populations across the world, which, in turn, may provide further empirical evidence for the BFLPE's cross-national as well as cross-cultural and developmental generalizability.

Hence, the present study aimed at testing three of the BFLPE's theoretical predictions using a nationally representative sample of 15-year-old students in the United Arab Emirates. The following hypotheses guided the study:

Hypothesis 1. The effect of individual student mathematics achievement on individual student mathematics self-concept would be positive and statistically significant.

Hypothesis 2. The effect of school-average mathematics achievement on individual student mathematics self-concept would be negative and statistically significant.

Hypothesis 3. The interaction between school-average mathematics achievement and individual student mathematics achievement would be small or statistically non-significant.

The hypotheses 1 and 2 tested the classical BFLPE model. The hypothesis 3 examined whether or not the size of the BFLPE for mathematics self-concept varied with the level of individual student mathematics achievement, i.e., whether or not the negative effect of school-average mathematics achievement was smaller or larger for students of different mathematics achievement levels. Because the size of the BFLPE is assumed to be consistent across differing levels of individual student achievement, low- and high-achieving students tend to suffer the BFLPEs (Marsh & Hau, 2003).