The immigrant paradox and math self-concept : An SES-of-origin-country hypothesis

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The immigrant paradox and math self-concept: An SES-of-origin-country hypothesis

The immigrant paradox is the phenomenon where recent immigrants have better outcomes than individuals from native-born families. Although limited past research has shown the paradox to exist for math self-concept, neither its exact nature nor a theoretical explanation for its existence have been reported. Using Australian cohort data from the Programme for International Student Assessment (PISA) 2003 (N = 12,551) and 2012 (N =14,481), we first establish that immigrant students have higher math self-concepts than native students, controlling for gender and absolute parental socioeconomic status (SES), and show that it is similar to—albeit weaker than—the expectation-achievement gap. We then provide an *SES-of-origin-country hypothesis* as a contextual explanation for this effect; we show that the immigrant paradox for both math self-concept and educational expectations substantially reduces when accounting for parents' SES relative to their country-of-origin. Our findings suggest that the paradox for math self-concept and educational expectations may partly result from immigrant parents' socioeconomic advantage in their home countries.

1. Introduction

1.1. *Math self-concept*

Academic self-concept—a student's self-perceptions of their academic abilities and competencies—is an important educational construct. Not only is it an important outcome in its own right, but it also predicts academic achievement, long-term educational attainment, persistence, course-selection, and other education outcomes

beyond what is explained by prior achievement, IQ, and other psychological variables such as intrinsic value (Guo et al., 2015; Marsh et al., 2018). Indeed, some sociological models of educational attainment posit self-concept as the critical mechanism linking background variables and achievement with educational aspirations and choices (Breen & Goldthorpe, 1997; Goldthorpe, 2007). Self-concept also positively impacts other psychological variables, such as interest and satisfaction in school (Marsh et al., 2005). Underscoring its importance, the Organization for Economic Co-operation and Development (OECD) has noted that academic self-concept is also "closely tied to students' economic success and long-term health and wellbeing" (OECD, 2003, p. 9).

Previous research studies that have examined the antecedents of academic self-concept formation have shown that it depends substantially on the frame-of-reference against which students judge themselves, as well as on feedback from significant others (e.g., peers, teachers, parents). These frames of reference are contextual effects that are typically associated with average achievement levels of other students in one's class, school, or country (Marsh & Parker, 1984; Marsh & Seaton, 2015), and have provided theoretical explanations for seemingly paradoxical results. For instance, although individual-level math achievement positively predicts individual-level math self-concept, school-average math achievement negatively predicts individual-level math self-concept while accounting for individual-level math achievement—the big-fish-little-pond effect (BFLPE; Marsh & Parker, 1984). These contextual, frame-of-reference effects generalize over Programme for International Student Assessment (PISA) countries, making them some of the most universal findings in educational research (Marsh, 2016; Marsh et al., 2020). These studies

tend to focus on the domain of mathematics given its relatively consistent curriculum (compared to verbal subjects, for instance) across countries.

One such example is a recent study by Marsh (2016), which showed strong theoretical and empirical support for the BFLPE and other contextual frame-of-reference effects (e.g., relative year in school—being either one school year ahead or behind same-age students) in relation to math self-concept across 41 countries in the PISA 2012 cohort. In addition to providing robust cross-cultural generalizability for such contextual effects, Marsh also found that recent immigrants had higher levels of math self-concept compared to native students (controlling for achievement, absolute socioeconomic status [SES], and other background variables).

1.2. *The immigrant paradox*

The finding that recent immigrants have better outcomes than native individuals has previously been shown for a host of educational and physical and mental health variables (Cobb et al., 2019; Coll & Marks, 2012). This trend is commonly referred to as the immigrant paradox (Kao & Tienda, 1995; Ogbu, 1987), as immigrants show advantages despite the considerable barriers they face when migrating to a new country (e.g., potential language barriers and lower economic resources; Coll & Marks, 2012). Although there is some meta-analytic evidence for the presence of the immigrant paradox (e.g., Pinquart & Ebeling, 2020; Tilley et al., 2021), we note that the literature is inconsistent with regard to its definition and operationalization. While some define the paradox as a phenomenon where immigrants have better outcomes compared to their native-born counterparts (e.g., Feliciano & Lanuza, 2017; Turney & Kao, 2012), others describe it as a trend whereby later immigrant generations are associated with worsening outcomes (compared to recent immigrants) despite

exacerbating risk factors (e.g., Crosnoe, 2012; Raffaelli et al., 2012). Similarly, while some studies compare outcomes of different immigrant generations against those of native individuals (firstand/or second-generation immigrants versus individuals from native-born families; e.g., Areepatamanil & Freeman, 2008; Shajek et al., 2006; Turney & Kao, 2009), others also compare outcomes among different immigrant generations (first-generation immigrants versus second-generation immigrants; e.g., Bacio et al., 2013; Sam et al., 2008). Owing to these inconsistencies, previously published articles have called for studies to explicitly state their operational definition of the paradox (Marks et al., 2014). Thus, in the current paper, we define the immigrant paradox as the phenomenon where recent immigrants have better outcomes than individuals from native-born families and operationalize this as a comparison between immigrant and native students.

In addition to the definition and operationalizations of the phenomenon, inconsistencies with regard to finding evidence for the immigrant paradox have also been shown to be, in part, because the paradox is more likely to be seen when the samples considered comprise older rather than younger children, the outcomes studied are social behaviors and psychological factors as opposed to test performance, and when SES is accounted for (Crosnoe, 2012; Marks et al., 2014). Finding evidence for the paradox is also dependent on how the native and immigrant groups are defined (e.g., whether all immigrants are grouped together or broken down by generation), the host country considered (as different countries have different immigrant populations and migration policies), and the historical time at which the study was undertaken. These differences in results demonstrate that examining differences between immigrant and native individuals is a complex undertaking, and

studies that consider this topic must elucidate the context in which they are undertaken. Therefore, we make the details of the samples used, outcomes studied, how and when we control for SES, as well as how we define immigrant groups, explicit in this paper (see Section 2).

1.3. *Math self-concept and the immigrant paradox*

Marsh (2016) is one of the few studies to have examined the immigrant paradox in relation to math self-concept (also see Areepattamannil & Freeman, 2008). Studies examining the immigrant paradox within the educational literature are largely focused on educational aspirations (the highest level of education students want to complete; e.g., Salikutluk, 2016) and expectations (the highest level of education students think they are likely to complete; see Pinquart & Ebeling, 2020 for a meta-analysis). Some past research shows that this difference in levels of aspirations and expectations between immigrant and native students is present despite immigrant students commonly having similar, and sometimes even lower, levels of achievement than native students. In addition, research has also shown weaker correlations between the educational expectations and achievement levels for immigrant students than for native students (Kao & Tienda, 1995). Thus, immigrants' aspirations and expectations are disproportionately high given their achievement levels. The paradox is, therefore, sometimes labeled as the expectation-achievement gap (also known as the aspirations-achievement paradox or immigrant optimism; Salikutluk, 2016).

There is some initial evidence to suggest that the immigrant paradox for self-concept may be similar to the expectation-achievement gap. Marsh (2016) controlled for achievement levels in his models, suggesting that immigrants have higher relative levels of math self-concept (i.e., given the same level of math achievement, an

immigrant student would have higher levels of math self-concept than a native student). Although Areepattamannil and Freeman's (2008) study was concerned with the impact of self-concept on achievement, they showed that on average, immigrants had higher levels of math self-concept without controlling for achievement (suggesting higher absolute levels). They also demonstrated smaller correlations between math self-concept and math performance for immigrants than for native students (note, immigrants were grouped together and not split by immigrant generation). In their report on PISA 2003, the OECD (2006) mentioned that immigrants tended to have greater levels of math self-concept but lower levels of math performance, compared to native students. In the present investigation, we seek to further clarify the immigrant paradox for math self-concept in relation to the expectation-achievement gap.

In addition to examining the nature of the paradox for math self-concept, providing an explanation for the paradox is imperative. This is because of the importance of self-concept for other outcomes (as stated in Section 1.1), as well as evidence from expectancy value theory showing that the more successful a student expects they will be at math, the more likely they are to engage with it (Wigfield & Eccles, 2000). An immigrant paradox for math self-concept may lead immigrant students to make more ambitious math-related choices than they would have otherwise made.

1.4. Relative SES as a contextual effect

Recently, Feliciano and Lanuza (2017) proposed an explanation for the immigrant paradox for students' educational attainment (i.e., the highest level of education completed by an individual). They high-lighted the importance of a contextual or frame-of-reference effect in relation to *relative* as well as *absolute* levels of parental

education. In simple terms, the absolute level of education is the number of years of education (e.g., 10 years) or the highest level of education (e.g., high school or a bachelor's degree) completed by an individual. In contrast, the relative level of education would be their level of education in the context of, or compared to, the education level of others (i.e., higher or lower). Feliciano and Lanuza's (2017) novel contribution was to show that, in an American sample, education levels of immigrant parents relative to their country-of-origin made a small positive contribution to the prediction of student educational attainment, in addition to absolute parental education levels. Further, relative parental education level reduced the difference between immigrant groups and native-born Americans in terms of student educational attainment.

Such a contextual approach may also help us explain why immigrant students have higher math self-concepts than native students. The rationale for this is as follows. The same level of absolute education may confer different socioeconomic benefits in the country from where the parents emigrated. Taking the Feliciano and Lanuza (2017) study as an example, completing high school in America, where on average, individuals completed 13.4 years of education, would confer a different status to completing the same level of education in Mexico, where the average level of education is 8.6 years (UNDP, 2019). In addition, research has shown that although immigrants may endure a change in their relative standing in society when they migrate from their country-of-origin to their new host country (in the previous example, being relatively highly educated in comparison to other individuals in the origin country, to then having a relatively lower education level in comparison to the new host country counterparts), they bring with them cultural skills, beliefs, and

aspirations associated with their previous class status (e.g., Feliciano & Lanuza, 2017; Paterson, 2018). Even students who are second-generation immigrants (i.e., those born in the host country with foreign-born parents) can be said to enjoy their parents' pre-migration SES because the cultural practices of their parents may still be in line with that of their home country (Breen & Goldthorpe, 1997; Lareau, 2011). Therefore, immigrants' high SES relative to others from their home country may not be apparent when only absolute indicators of SES (e.g., highest level of parental education) are utilized.

Previous research on self-concept has shown that students from high SES backgrounds (in absolute terms) have greater levels of self-concept (Marsh, 2016; OECD, 2014). Getting a more complete sense of immigrant students' SES background by accounting for their origin country context may help explain why immigrant students show higher levels of math self-concept than natives. Recent studies from other fields have demonstrated the importance of immigrants' SES relative to their country-of-origin. However, this has been examined primarily in relation to objective educational outcomes like achievement (e.g., Engzell, 2019; Ichou & Wallace, 2019), rather than education-related psychological outcomes like self-concept. This is an important consideration given the role self-concept plays in predicting educational outcomes (Marsh & Seaton, 2015) and also in the choices young people make in relation to their educational plans (Wigfield & Eccles, 2000). In the present investigation, therefore, we integrate traditional frame-of-reference approaches used in self-concept research (e.g., Marsh, 2016) with the relative SES approach, to examine why immigrant students may have higher math self-concepts than students from native-born families.

1.5. *The present study*

We use nationally representative samples of 15-year-old students from Australia, to first explore the immigrant paradox for math self-concept in line with the expectation-achievement gap (i.e., examine whether immigrants have disproportionately high math self-concepts given their levels of math achievement). We then confirm the immigrant paradox for math self-concept when using traditional, absolute indicators of SES (in line with Marsh, 2016) and finally, examine the contextual effect of relative SES in math self-concept formation—the primary aim of our paper. All our analyses are also conducted with educational expectations as the outcome, to better situate our findings within the literature on the expectation-achievement gap.

1.5.1. *The Australian migration context*

Utilizing Australian data to examine the immigrant paradox provides us with a sample comprising a large proportion of immigrants who have migrated from developed as well as developing nations. Australia is one of the world's major 'immigration nations' (along with New Zealand, Canada, and the USA; Kymlicka, 2007). The latest Australian census revealed that the Australian population comprised approximately 26% first-generation immigrants and 21% second-generation immigrants (Australian Bureau of Statistics, 2017).

To provide a brief overview of the cross-section of immigrants in Australia, permanent migrants enter Australia via one of two distinct programs—the Migration Program for skilled and family migrants, or the Humanitarian Program for refugees and those in refugee-like situations. Within the Migration Program, historically, more migrants have arrived under the family stream than the skill stream. However, over

the last two decades, the focus has moved from increasing the country's population to attracting skilled migrants to meet Australia's labor needs (Phillips & Spinks, 2012). In 1996–97 skilled migration made up 47% of the Migration Program, and that figure rose to 68% in 2011–2012 (Phillips & Spinks, 2012). In terms of the sources of immigration, until recently, the UK had been the primary source for permanent migration to Australia, with an increase in the number of migrants arriving from Asian countries such as China and India over the last couple of decades (Simon-Davies, 2018; we provide an overview of the origin of the immigrants in our samples in Supplementary Materials 1, Table S1).

Australia's skilled migration policy tends to draw migrants who are relatively advantaged in their country-of-origin, as they are typically highly educated, able to financially support their migration, and meet the increasingly rigorous thresholds for skilled migration (Green et al., 2007). Therefore, these immigrants' high SES (relative to others from their home country) may not be obvious when compared with individuals from Australian-born families (a country with high average levels of SES). We combine the rationale that immigrants' true SES is masked when using only absolute measures of SES, with past evidence that children from higher SES backgrounds have greater self-concepts, to test an *SES-of-origin-country hypothesis*. Specifically, accounting for the average SES of the parents' country-of-origin, in addition to absolute parental SES, will help explain the difference between immigrant and native students' math self-concepts.

1.5.2. *SES operationalization*

We focus on parents' education as our main indicator of SES. This is consistent

with recent comparative educational studies (Volante et al., 2019) and because years of education provides a clear, comparable metric with rich international data (i.e., the same metric can be used at the individual level and at the country level). In addition, an individuals' educational level is the only SES component (out of the three main components of income, occupation, and education) that remains consistent before and after migration. That is, if an individual reports they have completed tertiary education before migration, the act of migrating to another country will not change their level of education. In contrast, their occupation, and consequently their income level, are likely to change as a function of migrating as they would need to find new employment. Indeed, immigrants tend to be overqualified for their post-migration jobs (e.g., Green et al., 2007). Our indicator of SES—education—is operationalized here as both absolute (i.e., parent's years of education) and relative to the parent's country-of-origin (i.e., by also accounting for the average years of education in the parent's country-of-origin).

1.5.3. *The BFLPE*

We also test the BFLPE as an alternative contextual explanation to, and critical control of, our relative SES measure. Previous research has shown that an individual's math self-concept is substantially informed by peers in one's school (e.g., Marsh et al., 2020). In addition, past research in relation to the immigrant paradox in America has shown that the schools that immigrants go to may be an important consideration (Crosnoe & Turley, 2011). For instance, Crosnoe and Turley (2011) stated that partly because of high rates of school segregation of Latin American children, adolescents from Latin American immigrant families tend to be concentrated in disadvantaged schools with lower levels of academic achievement.

As the BFLPE shows that school-average achievement negatively predicts individual-level self-concept, immigrants' higher self-concept may, in part, be due to the lower average achievement levels in the schools they attend.

1.5.4. Hypotheses

Our hypotheses for the present investigation are as follows:

1. Given initial past findings regarding differences between immigrant students' and native students' math self-concepts (Areepattamannil & Freeman, 2008; Marsh, 2016; OECD, 2006), we expect immigrants to have disproportionately higher math self-concepts relative to their math achievement levels.
2. In relation to our SES-of-origin-country hypothesis, we expect that accounting for our relative SES measure will (i) predict student math self-concept over and above absolute SES; (ii) negatively predict student math self-concept such that students with parents from low SES countries (i.e., countries with lower average years of education than Australia's average) will show higher levels of math self-concept (because of their parents' higher SES relative to the average SES in the country-of-origin); and (iii) substantially reduce or eliminate the immigrant paradox.

As the BFLPE and relative SES contextual effects have not been examined simultaneously in past research, we leave as a research question whether school-average achievement will affect (i) the immigrant paradox for math self-concept (and educational expectations), and

(ii) the effect of absolute and relative SES on this paradox. We also leave as a research question how our results from models predicting math self-concept will be similar to those with educational expectation as the dependent variable.

2. Methods

2.1. *Datasets*

We used the Programme for International Student Assessment (PISA) extended datasets for Australia for the 2003 (12,551 students, 321 schools) and 2012 (14,481 students, 775 schools) cohorts. Both datasets had mathematics as the focal domain and are publicly available through the Australian Council for Education Research website (acer.org/au/ pisa/publications-and-data). These datasets were used instead of the cross-national PISA databases as they included detailed information about the students' and parents' countries of origin (the cross-national PISA datasets usually included only the three most common origin countries for each host country). The Australian-specific datasets, therefore, allowed us to more fully ascertain the SES of the parents' origin countries (see Section 2.2.2). This enabled us to test the SES-of-origin-country hypothesis, which would not have been possible with the cross-national PISA datasets. Still, we utilized the complete PISA 2003 and 2012 datasets to show that, cross-nationally, immigrant students had higher levels of math self-concept and educational expectations compared to native students, with and without controlling for absolute achievement, and with and without controlling for absolute SES (with a marginally stronger paradox when controlling for achievement and absolute SES – separately and together). These results, along with descriptive statistics, are presented in Supplementary Materials 2, Tables S2–S5. PISA utilizes a two-stage stratified sampling design; the first stage systematically samples schools from a comprehensive national list of all eligible schools with 15-year-old students, while the second stage involves sampling thirty-five (where available) 15-year-old students from each school. Further details about the dataset and sampling procedures are available in the PISA 2003 and PISA 2012 technical reports (OECD, 2005; 2014).

The authors' university does not require ethics approval for secondary data analyses of publicly available data such as PISA.

2.2. *Measures*

The following variables were used in both Australian datasets:

2.2.1. *Dependent variables*

Math self-concept was ascertained using the weighted total score in the PISA dataset. PISA used five items to determine this total score (e.g., "I have always believed that mathematics is one of my best subjects"), each rated on a 4-pronged scale ranging from "very likely" to "not at all likely". Items were reverse-scored such that higher scores were indicative of a more positive math self-concept.

Educational expectations was calculated using a combination of binary items each of which assessed whether a student expected to complete a certain level of education (i.e., "which of the following do you expect to complete?"). In 2003, questions asked about education up to lower secondary (using the International Standard Classification of Education [ISCED] Level 2), vocational/prevocational upper secondary (ISCED 3B/3C), upper secondary (ISCED 3A), non-tertiary post-secondary (ISCED 4), vocational tertiary (ISCED 5B), and theoretically-oriented tertiary and post graduate (ISCED 5A/6). The same questions were asked in 2012, without ISCED Level 4. In each dataset, the binary items were combined into a single scale, with higher scores indicative of expectations to complete a higher level of education.

2.2.2. *Independent variables*

Immigrant status was coded using the definitions provide by PISA (using only

data from students with information about both parents' countries of origin; PISA 2003: N = 12,108; PISA 2012: N = 13,889)—native students were those who were either born in Australia or overseas with at least one parent born in Australia; second-generation immigrants were students born in Australia with both parents born overseas; first-generation immigrants were students born overseas with both parents also born overseas.

Five plausible values were used for *math achievement*. PISA obtains these plausible values via models using item response theory to infer students' abilities based on their performance on the test (for details, see Chapter 5 of the PISA Data Analysis Manual). This variable represents the mathematical literacy exhibited by the test-taker to formulate, employ, and interpret mathematics in various settings, with higher scores indicative of greater math achievement. For models with educational expectations, we ran alternate models operationalizing achievement as the average of the plausible values associated with math, science, and reading achievement (which were strongly correlated with each other, at $r > 0.78$), creating five new plausible values. The pattern of results from these models did not change the conclusions, and were therefore, not included for simplicity and to parallel our models with math self-concept.

Absolute parental education level was converted from the ISCED-coded highest educational level of parents to years of education, with higher values indicating a higher education level. The *SES indicator of the parent's origin country,* our relative SES and primary contextual measure, was operationalized as the mean years of education in the origin country (i.e., the average number of years of education completed by individuals aged 25 or older; obtained from: hdr.undp.org/en/data) for

the parent with the highest education level. For cases where parents had equal levels of education, the mother's country-of-origin was used as there were fewer missing cases (results were similar when using father's country-of-origin). Any missing data for this variable was first informed by mother's country-of-origin and then father's country-of-origin. The 2003 education index was used for the PISA 2003 data, while the 2012 index was used for the PISA 2012 data, with higher values indicative of more average years of education in that country. *School-average achievement*, our alternative contextual measure, was calculated as the mean math achievement in each school (after standardizing individual-level math achievement across the full sample).

2.2.3. *Covariates*

Gender was coded as -1 (females) and 1 (males) rather than 0 and 1, to aid comparison of first- and second-generation immigrants to native students, our reference group. The default PISA measure of SES (eco-nomic, social, and cultural status; ESCS) was not included in the models as it incorporated parental education level, which we required including separately in the models. Thus, the two other components of this default measure were used separately: *parental occupation status* and *home possessions*. PISA obtained the *parental occupation status* from the International Socio-Economic Index of occupational status (ISEI) code for the parent with the highest occupation status. The *home possessions* variable (a proxy for family wealth) was a summary index of all household items and the number of books at home. While the 2012 dataset included this variable, we calculated it for 2003 using scores of the first component from principal component analysis of the corresponding raw items (both the PISA-derived 2012 variable and the calculated 2003 variable had similar

correlations with other measures).

2.3. *Analytic procedure*

The following procedure was conducted separately for the 2003 and 2012 datasets (R code for analyses has been added to the Open Science Framework: https://osf.io/uaj5q/). Missing data was dealt with using multiple imputations. Five imputed datasets were created in R (Version 3.6.2; R Core Team, 2020) using the package Amelia II (Honaker et al., 2011) with School ID as the clustering variable. Multilevel models were conducted using lme4 (Bates et al., 2015). One plausible value for math achievement was assigned to each imputed dataset, as outlined in the PISA technical report (OECD, 2014). Analyses were then conducted five times, using each imputed dataset once, and results were combined using Rubin's (1987) approach. In the multilevel models, all variables were at the student level (L1), except school-average achievement which was a school-level (L2) variable (see Section 2.2.2). A random intercept for school was included to account for the stratified, two-stage sample design for selection of schools and of students within schools. Non-categorical L1 variables were standardized across the whole sample, and all models were weighted using the final survey weight provided in the datasets (OECD, 2005; 2014). Results are, therefore, based on a standardized effect-size metric that facilitates interpretation and comparison with previous (and subsequent) research. All models presented control for the covariates of gender, parental occupation status, and home possessions, unless stated otherwise. Results were similar when the models did not include covariates.

3. Results

Descriptive information and zero-order correlations for all study variables are

presented in Supplementary Materials 3, Tables S6–S11, for each cohort overall as well as separately for native students, first-generation immigrants, and second-generation immigrants.

3.1. *Exploring the immigrant paradox*

3.1.1. *Models without controls*

In Table 1, we present models with math self-concept (Models 1 and 2), educational expectations (Models 3 and 4), and math achievement (Models 5 and 6) as dependent variables, without any controls or independent variables other than immigrant status. These models, therefore, highlight whether immigrant and native students differ on these constructs in absolute terms, while accounting for the nested structure of the data. Results show that in both 2003 and 2012, firstand second-generation immigrant students had higher levels of math self-concept and educational expectations compared to native students (the reference group). In contrast, only second-generation immigrant students had higher levels of math achievement compared to native students, and only in the 2012 cohort (the difference in math achievement was still smaller than the differences in math self-concept and educational expectations). Thus, first- and second-generation immigrant students had higher levels of math self-concept and educational expectations compared to native students in absolute terms, while largely having comparable levels of math achievement.

3.1.2. *Controlling for achievement*

Table 2 presents results from six weighted random-intercept multi-level models with math self-concept as the outcome in PISA 2003 (Models 7A-7F), with parallel results from PISA 2012 presented in Table 3 (Models 8A-8F), while controlling for our

covariates. Models 7A and 8A do not include math achievement as a predictor, while Models 7B and 8B do. Results indicate that, in both cohorts, first- and second-generation immigrant students had higher levels of math self-concept compared to native students regardless of achievement levels (although the paradox was slightly stronger when achievement was controlled for in 2003, and slightly weaker in 2012). Similar results were evident for models with educational expectations as the outcome (Table 4, Model 9A-B; Table 5, Models 10A-B), although the immigrant paradox was stronger for this construct.

3.1.3. ***Relationship between math self-concept (and educational expectations) and achievement by immigrant category***

We examine whether the relationship between math self-concept (and educational expectations) and math achievement was similar for native and immigrant students through correlations and interactions effects. Where correlations of 0.1, 0.3, 0.5 can be interpreted as small, medium, and large effect sizes, respectively (Cohen, 1992), all groups had medium positive correlations between math self-concept/ educational expectations and math achievement (Supplementary Materials 3, Tables S9–S11). We included interaction terms between immigrant status and achievement (Supplementary Materials 4, Tables S12 and S13) in multilevel models predicting math self-concept and educational expectations. For math self-concept, there was a small but significant negative interaction between first-generation immigrants and achievement in 2003, suggesting that for these immigrants, an increase in achievement levels corresponded to a smaller (compared to native students) increase in math self-concept levels. However, this interaction was not statistically significant in the 2012 cohort, questioning the robustness of this finding. The interaction terms

for second-generation immigrants and achievement levels were not significant in either cohorts, suggesting that the relation between achievement and self-concept for second-generation immigrants and for native students was similar. In contrast, for educational expectations, significant negative interactions were found for both immigrant categories and achievement in both cohorts. This suggests that the relationship between achievement and educational expectations was stronger for native students than it was for students in either immigrant category.

Thus, we can conclude that the immigrant paradox for math self-concept is somewhat similar to the expectation-achievement gap, in that immigrant students tend to have higher levels of math self-concept than native students, but similar levels of math achievement. In addition, the relationship between math self-concept and achievement is more similar for native and immigrant students, than the relationship between educational expectations and achievement. This indicates that the disproportionality between immigrants' math self-concept and their math achievement levels was not as large or as consistent as it was for educational expectations.

3.2. *Absolute and relative SES as predictors*

Models 7C and 7D (Table 2) test whether controlling for absolute and relative SES impact the immigrant paradox for math self-concept in 2003, with parallel analyses for 2012 presented in Models 8C and 8D (Table 3). Conditioned on math achievement and absolute SES, first- and second-generation immigrants still had higher math self-concepts compared to native students (with results almost identical to those from Models 7B/8B). In contrast, when the SES indicator of the parent's origin country was included in Models 7D/8D, the immigrant paradox disappeared for second-

generation immigrants and was substantially reduced for first-generation immigrants. This relative SES variable had a negative effect on math self-concept, suggesting that students whose parents emigrated from countries with lower mean education levels tended to have higher math self-concepts (see Section 3.3). While the pattern of results from the two cohorts were similar, the initial difference between immigrant and native students was marginally smaller in PISA 2012, as was the negative effect of the relative SES measure.

A similar pattern of results was evident for models where educational expectations was the outcome (Table 4 Model 9C-9D; Table 5, Models 10C-10D). Specifically, the immigrant paradox for educational expectations in both cohorts remained when we controlled for absolute parental SES, but reduced substantially for both first- and second- generation immigrants when we controlled for relative SES.

We note here that the inclusion of the interaction terms between immigrant status and achievement (Supplementary Materials 4, Tables S12 and S13) did not have an effect on the immigrant paradox (i.e., the difference in math self-concept/educational expectations between immigrant and native students), nor did it impact the explanatory power of our relative SES measure. In fact, relative SES slightly reduced the size of the interaction between first-generation immigrant status and achievement for self-concept in 2003 (and had no impact on the non-significant interactions in these models). It also slightly reduced the sizes of interactions between first- and second- generation immigrant status and achievement for educational expectations in 2003, with almost no change in parallel models for 2012. Thus, the effect of relative SES was robust to the inclusion of interaction terms.

3.3. *School-average achievement as a predictor*

School-average achievement is known to have a substantial negative effect on student-level self-concept (BFLPE; Marsh & Parker, 1984). Thus, we included school-average achievement into our models in both cohorts to see whether the immigrant paradox was affected by this variable, and whether our relative SES variable still had an impact on the paradox when controlling for school-average achievement. Results indicated that while school-average achievement did have a substantial negative effect on students' math self-concepts, it had no impact on the immigrant paradox (Table 2, Model 7E and Table 3, Model 8E). That is, the estimates for first- and second-generation immigrants were similar to those from Models 7A-7C/8A-8C. Further, when both school-average achievement and relative SES were added to the model (Models 7F/8F), results were similar to Model 7D/8D, where only relative SES was included. School-average achievement did not have a significant effect on educational expectations nor did it impact the immigrant paradox for this construct (Table 4, Models 9E-9F and Table 5, Models 10E-10F). This demonstrates that the contextual effect of the SES level of the parent's home country, is separate from that of school-average achievement.

3.4. Differentiating between immigrants from high and low SES countries

To provide a simpler contrast for illustrative purposes, and further examine how our relative SES measure impacts the immigrant paradox, we created a dummy-coded variable using the immigrant status and relative SES variables. Immigrant students who had a lower value for mean years of education at parent's origin country than that of Australia's (<11.8 years for PISA 2003; <12.8 for PISA 2012) were coded as coming from "Low SES" countries, while those with values equal to or greater than that of Australia's (≥11.8 in PISA 2003; ≥12.8 in PISA 2012) were coded as coming from

"High SES" countries. This Low/High SES dichotomy was then combined with student immigrant status. Conditioned on math achievement, absolute parental education level, and the covariates, it was only immigrant students whose parents originated from Low SES countries (i.e., countries with a lower mean education level than that of Australia's), who showed the immigrant paradox in relation to math self-concept (Table 6, Models 11 and 12). Immigrant students with parents from High SES countries did not show the paradox, and in fact, first-generation immigrant students from High SES countries showed significantly lower math self-concepts than native students. This indicates that parents of immigrant students who come from Low SES countries, have higher SES relative to the SES of their country-of-origin. For educational expectations (Table 6, Models 13 and 14), again, it was only immigrants from Low SES countries that showed higher levels of educational expectations.

In addition, first-generation immigrant students with parents from Low SES countries seemed to have similar self-concepts and educational expectations compared to second-generation immigrants with parents from Low SES countries. Similarly, first-generation immigrant students with parents from High SES countries had similar self-concepts and educational expectations as second-generation immigrant students with parents from High SES countries. This suggests that it was the country- of-origin rather than the immigrant generation that was more important for self-concept and educational expectation levels (Supplementary Materials 5, Tables S14–S17).

3.5. *Sensitivity analyses*

3.5.1. *Alternate SES operationalization*

In line with a Reviewer's suggestion, we tested our main models using only the absolute SES indicator of parental education level, without controlling for home possessions and parental occupation level. Results were similar to our main models, and are presented in Supplementary Materials 6, Tables S18–S19. We further tested the robustness of the SES-of-origin country hypothesis by utilizing income, instead of education level, as the SES indicator in alternate models. Country-level income was operationalized as growth domestic product per capita (hdr. undp.org/en/data), while individual student-level income was operationalized as home possessions, a proxy for family wealth. Results were again similar and are presented in Supplementary Materials 6, Tables S20–S21.

3.5.2. *Immigrant status recategorization*

As the PISA-defined native group was fairly broad, we reran our main analyses by splitting this group into children with both parents born in Australia and children with one parent born in Australia (and one born overseas). We treated students with two Australian-born parents as the new reference group in our analyses. Results revealed that, in both cohorts, first- and second-generation immigrants still showed higher math self-concepts than this new reference group (with no difference between students with two Australian-born parents and students with one Australia-born parent in 2003, with the latter group showing lower self-concept levels than the former in 2012). Notably, the inclusion of absolute parental SES did not impact the paradox, while the addition of relative SES reduced it (see Supplementary Materials 6, Table S22). Similar results were observed for educational expectations (with the exception of students with two-Australian born parents and one-Australian born parent showing no difference in either cohort; Supplementary Materials 6, Table

S23).

3.5.3. *Age of arrival*

Next, we examined whether time spent in Australia impacted math self-concept levels. We reran our main analyses by substituting the categorical immigrant status variable with a continuous indicator of the age at which students arrived in Australia. Students who did not have a response to this question (i.e., those born in Australia) were given a value of 0, and the rest of the responses ranged from 1 (arrived at the age of 1) to 16 (arrived at the age of 16). Results in both cohorts revealed a positive main effect for age of arrival, such that students who arrived at an older age (i.e., more recently immigrated) had greater math self-concepts (i.e., a larger immigrant paradox). The addition of absolute parental SES had no effect on this finding, while the relative SES measure reduced it (Supplementary Materials 6, Table S24). A similar pattern of results was evidenced for educational expectations (Supplementary Materials 6, Table S25).

3.5.4. *Language spoken at home*

Many of the immigrants in Australia are from English-speaking countries that share strong cultural similarities (e.g., England, New Zealand; Supplementary Materials 1, Table S1). Immigrants from these countries may not encounter the typical difficulties associated with migration and acculturation, such as the lack of acceptance by the dominant cultural group (Nesdale & Mak, 2000). To examine whether the immigrant paradox is similar for English and non-English speaking immigrants, we conducted analyses in parallel to our Low/High SES dichotomy (i.e., Models 11-14). Language spoken at home was a categorical variable coded as 0 = students who spoke English at home (the test language in Australia) and 1 = those

who did not. We combined this variable with students' immigrant status (Supplementary Materials 6, Table S26). In both cohorts, the paradox was stronger for non-English-speaking immigrants. Specifically, it existed for immigrants who did not speak English, was weak for second-generation immigrants who spoke English (in 2003, and non-significant in 2012), and was non-significant for first-generation immigrants who spoke English. In both cohorts, again, the addition of absolute parental SES did not impact the paradox, while the addition of relative SES substantially reduced it (and negated it for English-speaking second-generation immigrants in PISA 2003). In models with educational expectations as the dependent variable, the paradox was again stronger for first- and second-generation immigrants who did not speak English at home, although it was also significant for immigrants who did speak English at home (with substantially smaller betas; Supplementary Materials 6, Table S27). The inclusion of absolute parental education did not affect these results, while the inclusion of relative SES reduced the paradox for all groups.

The correlation between language spoken at home and our relative SES measure was strong (r = -0.48 in 2003 and -0.52 in 2012; Supplementary Materials 3, Table S8), suggesting a potential overlap between these two measures. We therefore examined the number of immigrants in the Low/High SES and English/Non-English categories (Supplementary Materials 6, Table S28). In both cohorts, while approximately 95% of immigrants from High SES countries spoke English at home, 65% of second-generation immigrants and 50% of first- generation immigrants from Low SES countries spoke English at home. This is indicative of an overlap between language spoken at home and our relative SES measure, as the number of immigrants who spoke English reduced with the decline in the average SES of the country-of-

origin. Thus, a greater immigrant paradox in math self-concept (and educational expectations) for immigrants who did not speak English at home is akin to our analyses with the Low/High SES dichotomy.

4. Discussion

Previous studies have shown immigrant students to have higher math self-concepts than native students (Areepattamannil & Freeman, 2008; Marsh, 2016). However, the exact nature of this paradox has not yet been examined and neither has a theoretical, contextual explanation for this paradox for self-concept been provided. In the present study, we examine these issues using data from the Australian PISA 2003 and 2012 cohorts.

In the first half of this paper, we replicated past research to show the immigrant paradox for math self-concept, and then extended it to demonstrate that this paradox is similar to—but not as large as—the immigrant paradox for educational expectations (i.e., the expectation-achievement gap). That is, while we found that immigrants had higher math self-concepts than native students, in both absolute terms and relative to their math achievement levels, the difference between immigrant and native students was larger for educational expectations. In addition, we found a weaker relationship between achievement and educational expectations for both first- and second-generation immigrants than for native students. However, the relationship between achievement and self-concept tended not to vary as a function of immigrant status. Thus, at least for first- and second-generation immigrant students in Australia, the relationship between their levels of math achievement and math self-concept was mostly similar to the relationship between these constructs for students from native-born families.

In the second half, we bring together two lines of research. On the one hand, research on self-concept has shown that its formation is highly dependent on contextual factors, such as school-average achievement. On the other hand, past research on the immigrant paradox on outcomes such as achievement and attainment has highlighted the importance of relative SES measures (e.g., Engzell, 2019; Feliciano & Lanuza, 2017; Ichou & Wallace, 2019). We, therefore, examined a potential contextual explanation for this paradox for math self-concept—the SES-of-origin-country hypothesis—by accounting for the average years of education in the parents' home countries, in addition to parents' absolute years of education.

Specifically, our results from both cohorts showed that our primary contextual variable of parents' country-of-origin: (i) predicted student math self-concept over and above absolute parental SES; (ii) negatively predicted student math self-concept such that students with parents from lower SES countries (compared to Australia) showed higher math self-concepts and vice-versa; and (iii) eliminated the immigrant paradox for second-generation immigrants and substantially reduced the paradox for first-generation immigrants. We, therefore, provided a contextual or frame-of-reference explanation for this paradox, and confirmed the SES-of-origin-country hypothesis. Indeed, our relative SES measure also helped explain, in part, the gap in educational expectations between immigrant students and native students. Our sensitivity analyses provided further evidence for this finding in relation to both math self-concept and educational expectations.

4.1. ***The expectation-achievement gap and the immigrant paradox for math self-concept***

Our findings on the expectation-achievement gap are in line with those from

previous research; immigrant students tend to show higher levels of educational expectations (i.e., expect to complete a higher level of education), even when they have similar or lower levels of achievement compared to native students. The significant negative interactions between immigrant status and achievement in predicting educational expectations in our study further confirm this pattern. Some researchers have interpreted this gap and the weaker association between expectations and achievement as overoptimism on the part of immigrants. While such optimism is not uncommon even for native students (e.g., small-medium correlations between expected and actual achievement), it has been shown to be greater for immigrant students (as well as those from ethnic minority and low SES backgrounds; Pinquart & Ebeling, 2020). This overoptimism may, in part, be due to the selectivity inherent in the process of migration (Chiswick, 1999; Feliciano, 2005; Lessard-Phillips et al., 2014), especially in our samples given the extent of Australia's skilled-migration policies. Individuals who successfully migrate to a new country such as Australia, and then adapt to the everyday challenges associated with migration, tend to be highly motivated, diligent, willing to put in effort, and have a desire to succeed (Crosnoe, 2012). These characteristics, in combination with the high importance placed on education by immigrants (Feliciano, 2006), might explain the disproportionately higher educational expectations given achievement levels.

Important to our current aims, we show a similar—albeit weaker pattern—for math self-concept. Not only is there a smaller paradox for math self-concept than for educational expectations (as suggested by smaller beta estimates), but there is less likelihood that a differential relationship exists between achievement and self-concept for immigrant students compared to native students (as suggested by largely

comparable correlations, as well as only one interaction being significant, and weakly so). Although both constructs involve subjective evaluations, these differences may be because educational expectations is a future-oriented evaluation while self-concept is more short-term. This may imply that changes in achievement levels may be reflected more quickly in changes in self-concept than in long-term educational expectations. There is some evidence to suggest that the positive reciprocal relationship between math achievement and math self-concept is similar for immigrant and native students (Mo¨ller et al., 2014), but that the longitudinal relationship between achievement and educational expectations is weaker for ethnic minority groups (Pinquart & Ebeling, 2020). However, to our knowledge, these two constructs have not been examined in the same longitudinal study in relation to achievement, and therefore, our supposition requires further exploration. Still, our study contributes to the literature by showing that the immigrant paradox for math self-concept is similar to, but not as big as, the expectation-achievement gap. Our results also suggest that the differences between immigrant and native students, for both math self-concept and educational expectations, are due in part to our SES-of-origin-country hypothesis.

4.2. *The importance of relative SES measures*

Accounting only for absolute measures of SES paints an incomplete picture and does not predict children's educational outcomes in immigrant families as well as it does for children in native-born families (Feliciano & Lanuza, 2017). Parents of immigrant students are usually more educated than the average person in their home country (Antecol et al., 2003; Cobb-Clark, 2000; Feliciano & Lanuza, 2017; Green et al., 2007), which may not be evident when making comparisons with those in their new host

country. This is especially the case in countries such as Australia (as well as Canada, New Zealand, Sweden, Switzerland, and the USA) where a large proportion of migrants are granted permanent residency on the basis of skilled migration programs. On average, individuals in Australia complete 12.9 years of education, while the average level of education in China (source of 8.3% of the overseas born population in Australia; Australian Bureau of Statistics, 2017) is 7.9 years (UNDP, 2019). In both our samples, immigrant students' parents had absolute levels of education similar to the parents of native students, masking their advantage in relation to their home country counterparts. Past research has revealed that immigrants place high importance on education, and that immigrants with higher levels of pre-migration education (i.e., higher education level in relation to others in their home country) have higher educational aspirations and expectations for their children (Feliciano, 2006). Immigrant parents may use their high pre-migration socioeconomic position as a benchmark that they do not want their children to fall below (Breen & Goldthorpe, 1997). As outlined in the Introduction (Section 1.1), self-concept formation depends substantially on feedback from important others, including parents. Thus, a parent's views and expectations of their child, and the context within which the child is brought up (i.e., high SES background in comparison to those from their home country), form part of the child's frame-of-reference. Children's SES background is an important predictor for numerous educational outcomes, such that those from high SES families show higher levels of academic self-concept, educational expectations, aspirations, achievement, and attainment (e.g., Chesters, 2019; Marsh & Seaton, 2015).

In line with our results, we may presume that these contextual effects of country-of-

origin operate for first-generation immigrants, as well as for second-generation immigrants. As stated earlier (Section 1.4), although second-generation immigrant students have not lived in their parents' country-of-origin, the cultural practices of their parents in their new host country are still aligned with that of their home country to some extent (Feliciano & Lanuza, 2017; Paterson, 2018). The skills, beliefs, aspirations, and expectations associated with their previous class status are then transferred onto the children of immigrants (Lareau, 2011) via family narratives that are internalized by them (Fern´andez-Kelly, 2008; Louie, 2012). There is also some evidence in the literature for a larger immigrant paradox for first-generation immigrants than for second-generation immigrants, for outcomes such as educational expectations, aspirations, achievement, and attainment (Coll & Marks, 2012).

Therefore, an individual's SES in comparison to that of their home country counterparts partly explains why we see higher educational outcomes for immigrant students. Indeed, our results showed that simply accounting for absolute parental SES levels did not affect the immigrant paradox for math self-concept or for educational expectations. However, when contextual information about parents' countries of origin was accounted for—improving the accuracy of the SES experienced by immigrant students—this paradox was substantially reduced. Thus, differences in socioeconomic backgrounds of immigrants are not adequately captured by absolute measures of SES, requiring a contextual, country-of-origin approach.

4.3. *The effect of school-average achievement*

Our results showed that both contextual effects contribute to math self-concept, separately and independently. Although the theoretical basis for the BFLPE for self-concept is well-established, none has previously been provided for the immigrant

paradox for math self-concept. Here we provide this theoretical rationale based on the SES-of-origin-country hypothesis. We further showed that the contextual effect of country-of-origin and the contextual effect based on school-average achievement were independent of each other. Specifically, the addition of school-average achievement did not impact the immigrant paradox or the main effect of the average SES in the country-of-origin. Similarly, the addition of the average SES in the country-of-origin did not impact the main effect of school-average achievement. Hence, the BFLPE is driven by the frame-of-reference effect in relation to school-average achievement, whereas the immigrant paradox is driven by the frame-of-reference effect in relation to SES relative to country-of-origin. Previous research in relation to the immigrant paradox in America has shown that the schools that immigrants go to may be an important consideration (Crosnoe & Turley, 2011). For instance, Crosnoe and Turley (2011) stated that partly because of high rates of school segregation of Latin American children, adolescents from Latin American immigrant families tend to be concentrated in disadvantaged schools with lower levels of academic achievement. However, in our study, accounting for school-average achievement did not have an impact on the immigrant paradox or on the contextual effect of parent's origin country. This may be due to the extent of skilled immigration in Australia, and the fact that, in our samples, immigrant and native students tend to go to schools with similar levels of school-average achievement (Supplementary Materials 3, Tables S6–S7). It is possible that school-average achievement may have a differential effect on the immigrant paradox for math self-concept in countries where the majority of immigrants are from low SES families (both in relation to the host country and their countries of origin) or where

the proportion of school segregation of immigrant students is higher.

We note here that school-average achievement did not predict students' educational expectations. There is a dearth of past research on this topic, with only one study (to our knowledge) published so far. Go¨llner et al. (2018) showed a negative effect of school-average achievement on the educational expectations of high school students in the USA. As our findings were inconsistent with this past study, more research is required to make a decisive conclusion about the association between these two constructs. Nevertheless, in our study, school-average achievement did not impact the immigrant paradox for educational expectations, nor did it interfere with the contextual effect of relative SES on educational expectations, for either the 2003 or the 2012 cohort.

4.4. *Limitations and future directions*

The present study focused on one country that has high levels of skilled migration. Future research could examine the generalizability of our results regarding the importance of relative SES, not only to samples from other countries with high levels of skilled migration (e.g., New Zealand; Ministry of Business, Innovation & Employment, 2018), but also to samples from countries with a lower proportion of skilled migration (e.g., Germany; Statistisches Bundesamt, 2018). Relatedly, within Australia, research could compare the strength of the immigrant paradox and the effect of relative SES for permanent migrants from the three different streams, i.e., skilled, family, and humanitarian (information that was not available to us in the datasets used). The strength of the paradox and the effect of country-of-origin may be different for students with parents migrating via the family and humanitarian streams, than through the skilled stream. These immigrant parents may not have had

a socioeconomic advantage compared to their origin country-counterparts, as they would not necessarily have been highly educated (a requirement for immigrants via the skilled stream; Phillips & Spinks, 2012).

Our study used cross-sectional data from two cohorts. Our groups of first- and second-generation immigrant students had parents who migrated during different periods; while first-generation immigrant students might have moved to Australia relatively recently compared to when the PISA data were collected (i.e., 2003 and 2012), the parents of the second-generation immigrant students moved to Australia much earlier. Thus, the context during the migration of the two groups may have differed in meaningful ways, with different migration policies operating during each time period, which we were unable to account for with the present datasets. Future research could, if feasible, account for information about the period of migration (e.g., proportion of skilled and unskilled migrants, attitudes towards immigrants in the host country). That said, our results are robust to the extent that they were replicated in two cross-sectional cohorts, nine years apart, and for both math self-concept and educational expectations, suggesting the generalizability of the effects and support for the SES-of-origin-country hypothesis. In this respect, it is stronger than the typical cross-sectional study based on a single wave of data. In addition, as we focused on the immigrant paradox for math self-concept, future research is also required to examine the generalizability of our results to different domains of academic self-concept (e.g., verbal, science). Some past research has explored whether immigrant and native students differ on levels of verbal self-concept, but has not been conclusive. While Shajek et al. (2006) found that immigrants have lower levels of reading self-concept, Areepattamannil and Freeman (2008) found no

differences, and B´ecares and Priest (2015) found immigrants to have higher levels of reading self-concept. This may be due to the differing countries under examination; the first study was conducted in Germany, the second in Canada, and the third in the USA. This is an important consideration given that Germany has a lower proportion of skilled migrants than the other two countries.

We must caveat our interpretation of the SES-of-origin-country effect by highlighting the overlap between the language spoken by the students and their parents' countries of origin; the number of immigrants who spoke English reduced with the decline in the average SES of the country-of-origin. We do not know whether students from high SES countries did not show the paradox because there was little difference between their pre-migration and post-migration SES, or whether they spoke English (the primary language spoken in Australia) and, therefore, did not encounter language barriers. Future research may be able to disentangle these effects by examining different post-migration countries that differ in terms of country-average SES, languages spoken, as well as migration policies.

Previous studies that have examined effects of pre-migration SES have done so using measures of contextual attainment. These measures consider not only the parents' geographical context, but also their historical context (e.g., Feliciano & Lanuza, 2017; Ichou & Wallace, 2019). That is, they account for the parents' SES relative to the educational attainment of their origin country counterparts who are of the same age as the parent. For our study, we were unable to place the parents' educational levels in a historical context because information about their age was unavailable to us. Even so, our simple country-of-origin measure (i.e., accounting for the mean years of education in the origin country in addition to absolute parental

SES) had a significant impact on the immigrant paradox for math self-concept and for educational expectations. We suspect that the amount of variance accounted in this paradox would be even greater had we included the historical aspect to our relative SES measure. Future studies that have the necessary data to measure contextual attainment can examine the relative contribution that our simple country-of-origin measure makes in the immigrant paradox as compared to measures of contextual attainment.

5. Conclusion

Our study adds an important new direction to the literature on the immigrant paradox for math self-concept. Future research could ascertain the extent to which our results are generalizable to immigrants in other countries and under different migration streams, using different measures of relative SES, and different subjects. We predict that the inclusion of relative SES variables, in line with the SES-of-origin-country hypothesis, would at least add to the predictive utility of traditionally used measures of absolute SES (e.g., parental years of education or occupational status) when examining the academic outcomes of immigrant students—especially those that involve subjective evaluations. The importance of such variables, that contextualize immigrants' lives not only within the host country but also their countries—of—origin, will only continue to grow. The migration policies for Australia, and other countries with skilled migration policies, will continue to increase their thresholds for skill-levels; younger applicants with higher education levels will be given increasing precedence (Phillips & Spinks, 2012), thereby broadening the gap between absolute and relative SES. Thus, the use of both absolute and relative SES measures will bring us one step closer to understanding immigrants' unabridged

experiences.

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Table 1

Results from survey-weighted multilevel models without covariates in PISA 2003 and 2012 – Australia, comparing immigrant groups.

	Math Self-Concept				Educational Expectations				Math Achievement			
	2003: Model 1		2012: Model 2		2003: Model 3		2012: Model 4		2003: Model 5		2012: Model 6	
	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*
Reference Group: Native Students (Intercept)	−0.025	0.014	−0.030*	0.012	−0.023	0.021	0.018	0.015	0.042	0.027	0.074*	0.021
2nd Generation Immigrants	0.137*	0.030	0.166*	0.033	0.193*	0.028	0.189*	0.025	−0.051	0.030	0.096*	0.025
1st Generation Immigrants	0.196*	0.030	0.200*	0.030	0.215*	0.029	0.142*	0.025	−0.051	0.030	−0.012	0.026

Note. The estimates provided for 1st and 2nd generation immigrants represent the estimated differences between that immigrant category and native students. Parameter estimates that differ from zero by more than two standard errors (*SE*) are statistically significant ($p < .05$), indicated by *.

Table 2

Results from survey-weighted multilevel models predicting math self-concept, in PISA 2003 – Australia, comparing immigrant groups.

	Model 7A		Model 7B		Model 7C		Model 7D		Model 7E		Model 7F	
	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*
Reference Group: Native Students (Intercept)	−0.037*	0.013	−0.051*	0.014	−0.051*	0.014	−0.027	0.015	−0.053*	0.012	−0.028*	0.013
2nd Generation Immigrants	0.163*	0.029	0.162*	0.028	0.163*	0.028	0.015	0.033	0.165*	0.027	0.018	0.033
1st Generation Immigrants	0.209*	0.030	0.220*	0.028	0.220*	0.028	0.083*	0.033	0.220*	0.028	0.084*	0.033
Math Achievement	–	–	0.450*	0.011	0.450*	0.011	0.453*	0.011	0.474*	0.012	0.476*	0.011
Absolute Parental Edu Lvl	–	–		–	0.007	0.010	0.009	0.010	0.012*	0.010	0.014	0.010
Relative SES (Mean Yrs of Edu in Origin Cntry)	–	–		–	–	–	−0.091*	0.011	–	–	−0.089*	0.011
School-Avg Achievement	–	–		–	–	–	–	–	−0.281*	0.027	−0.280*	0.028
Covariates:												
Gender	0.180*	0.009	0.165*	0.009	0.164*	0.009	0.164*	0.009	0.162*	0.009	0.162*	0.009
Parental Occupation Status	0.046*	0.010	−0.031*	0.009	−0.033*	0.010	−0.028*	0.010	−0.023*	0.010	−0.018*	0.010
Home Possessions	0.134*	0.010	0.036*	0.010	0.036*	0.010	0.037*	0.010	0.045*	0.010	0.046*	0.010

Note. The estimates provided for 1st and 2nd generation immigrants represent the estimated differences between that immigrant category and native students. Parameter estimates that differ from zero by more than two standard errors (*SE*) are statistically significant ($p < .05$), indicated by *.

Table 3
Results from survey-weighted multilevel models predicting math self-concept in PISA 2012 – Australia, comparing immigrant groups.

	Model 8A		Model 8B		Model 8C		Model 8D		Model 8E		Model 8F	
	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*
Reference Group: Native Students (Intercept)	−0.049*	0.012	−0.071*	0.012	−0.071*	0.012	−0.051*	0.013	−0.068*	0.011	−0.046*	0.012
2nd Generation Immigrants	0.181*	0.032	0.096*	0.031	0.096*	0.031	−0.006	0.038	0.122*	0.030	0.011	0.038
1st Generation Immigrants	0.226*	0.030	0.204*	0.031	0.202*	0.031	0.095*	0.036	0.215*	0.031	0.099*	0.036
Math Achievement	–	–	0.354*	0.012	0.352*	0.013	0.353*	0.013	0.393*	0.013	0.395*	0.013
Absolute Parental Edu Lvl		–		–	0.017	0.013	0.018	0.013	0.024*	0.013	0.025	0.013
Relative SES (Mean Yrs of Edu in Origin Cntry)		–		–	–	–	−0.065*	0.012	–	–	−0.071*	0.012
School-Avg Achievement		–		–	–	–	–	–	−0.223*	0.022	−0.231*	0.022
Covariates:												
Gender	0.200*	0.011	0.177*	0.010	0.178*	0.010	0.177*	0.010	0.175*	0.010	0.174*	0.010
Parental Occupation Status	0.063*	0.011	−0.012	0.011	−0.018	0.010	−0.017	0.011	−0.010	0.011	−0.008	0.011
Home Possessions	0.082*	0.013	0.037*	0.012	0.034*	0.012	0.038*	0.012	0.046*	0.012	0.051*	0.013

Note. The estimates provided for 1st and 2nd generation immigrants represent the estimated differences between that immigrant category and native students. Parameter estimates that differ from zero by more than two standard errors (*SE*) are statistically significant ($p < .05$), indicated by *.

Table 4
Results from survey-weighted multilevel models predicting education expectations, in PISA 2003 – Australia, comparing immigrant groups.

	Model 9A		Model 9B		Model 9C		Model 9D		Model 9E		Model 9F	
	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*
Reference Group: Native Students (Intercept)	−0.042*	0.015	−0.053*	0.014	−0.051*	0.014	−0.028*	0.014	−0.051*	0.014	−0.027*	0.014
2nd Generation Immigrants	0.262*	0.027	0.269*	0.026	0.275*	0.026	0.139*	0.030	0.275*	0.026	0.139*	0.030
1st Generation Immigrants	0.271*	0.027	0.284*	0.026	0.266*	0.026	0.152*	0.030	0.265*	0.026	0.151*	0.030
Math Achievement	–	–	0.321*	0.010	0.318*	0.010	0.319*	0.010	0.315*	0.010	0.316*	0.010
Absolute Parental Edu Lvl		–			0.086*	0.010	0.090*	0.010	0.085*	0.010	0.089*	0.010
Relative SES (Mean Yrs of Edu in Origin Cntry)		–			–	–	−0.090*	0.010	–	–	−0.090*	0.010
School Avg Achievement		–			–	–	–	–	0.036	0.030	0.039	0.029
Covariates:												
Gender	−0.172*	0.009	−0.184*	0.008	−0.188*	0.008	−0.188*	0.008	−0.188*	0.008	−0.188*	0.008
Parental Occupation Status	0.124*	0.009	0.073*	0.009	0.044*	0.010	0.046*	0.010	0.043*	0.010	0.045*	0.010
Home Possessions	0.241*	0.009	0.175*	0.009	0.164*	0.009	0.168*	0.009	0.163*	0.009	0.167*	0.009

Note. The estimates provided for 1st and 2nd generation immigrants represent the estimated differences between that immigrant category and native students. Parameter estimates that differ from zero by more than two standard errors (*SE*) are statistically significant ($p < .05$), indicated by *.

Table 5
Results from survey-weighted multilevel models predicting education expectations in PISA 2012 – Australia, comparing immigrant groups.

	Model 10A		Model 10B		Model 10C		Model 10D		Model 10E		Model 10F	
	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*
Reference Group: Native Students (Intercept)	0.002	0.014	−0.021	0.012	−0.021	0.012	−0.008	0.012	−0.022	0.012	−0.009	0.012
2nd Generation Immigrants	0.245*	0.024	0.183*	0.023	0.185*	0.023	0.120*	0.027	0.183*	0.023	0.120*	0.027
1st Generation Immigrants	0.177*	0.025	0.166*	0.024	0.158*	0.024	0.092*	0.028	0.158*	0.024	0.091*	0.028
Math Achievement	–	–	0.353*	0.009	0.345*	0.009	0.344*	0.009	0.343*	0.010	0.344*	0.010
Absolute Parental Edu Lvl	–	–	–	–	0.065*	0.008	0.065*	0.008	0.065*	0.008	0.065*	0.008
Relative SES (Mean Yrs of Edu in Origin Cntry)	–	–	–	–	–	–	−0.043*	0.009	–	–	−0.043*	0.009
School-Avg Achievement	–	–	–	–	–	–	–	–	0.012	0.023	0.004	0.023
Covariates:												
Gender	−0.143*	0.008	−0.167*	0.008	−0.166*	0.008	0.167*	0.008	−0.166*	0.008	−0.167*	0.008
Parental Occupation Status	0.115*	0.008	0.050*	0.008	0.029*	0.008	0.031*	0.008	0.029*	0.008	0.031*	0.008
Home Possessions	0.132*	0.008	0.094*	0.008	0.085*	0.008	0.087*	0.008	0.085*	0.008	0.087*	0.008

Note. The estimates provided for 1st and 2nd generation immigrants represent the estimated differences between that immigrant category and native students. Parameter estimates that differ from zero by more than two standard errors (*SE*) are statistically significant ($p < .05$), indicated by *.

Table 6
Results from survey-weighted multilevel models predicting math self-concept and educational expectations, combining relative SES and immigrant status.

	Self-Concept				Education Expectations			
	2003: Model 11		2012: Model 12		2003: Model 13		2012: Model 14	
	β	*SE*	β	*SE*	β	*SE*	β	*SE*
Reference Group: Native Students (Intercept)	−0.053*	0.014	−0.072*	0.012	−0.054*	0.014	−0.022	0.012
2nd Generation Immigrants From High SES Countries	−0.038	0.057	0.060	0.060	0.104	0.054	0.085	0.053
2nd Generation Immigrants From Low SES Countries	0.218*	0.031	0.105*	0.034	0.333*	0.029	0.205*	0.025
1st Generation Immigrants From High SES Countries	−0.153*	0.066	0.040	0.078	0.009	0.060	0.074	0.050
1st Generation Immigrants From Low SES Countries	0.279*	0.032	0.230*	0.029	0.325*	0.029	0.176*	0.026
Math Achievement	0.451*	0.011	0.354*	0.012	0.318*	0.010	0.345*	0.009
Absolute Parental Education Level	0.006	0.010	0.017	0.013	0.087*	0.010	0.065*	0.008
Covariates:								
Gender	0.165*	0.009	0.177*	0.010	−0.187*	0.008	−0.167*	0.008
Parental Occupation Status	−0.028*	0.010	−0.019	0.011	0.046*	0.010	−0.030*	0.008
Home Possessions	0.037*	0.010	0.037*	0.012	0.168*	0.009	0.086*	0.008

Note. The estimates provided for 1st and 2nd generation immigrants from High/Low SES countries represent the estimated differences between that category and native students.
Parameter estimates that differ from zero by more than two standard errors (*SE*) are statistically significant ($p < .05$), indicated by *.