

An Effort-Centered Model of Learning: Academic Achievement Among East Asian Immigrant Families in Canada

Hongyi Sun
kevin09.sun@gmail.com

ABSTRACT

East Asian immigrant families in Western countries are commonly measured to outperform their non-immigrant peers in school, yet researchers disagree about why. This paper aims to answer a narrower version of that question, specifically, whether the effort-centered model of learning that was characterized in cross-cultural scholarship can be identified in a contemporary Canadian sample. Here, an effort-centered model of learning means a model in which achievement is understood to follow from sustained, disciplined study rather than from fixed ability. Education scholars have widely associated this model with China's imperial examination system. Using paired student-parent survey data from 252 matched student-parent pairs drawn from a sample of 343 adolescents aged 13 to 17, the analysis tests three predictions the model would generate: first, that the achievement advantages should be independent of family capital and resources, second, it should track East Asian heritage rather than immigrant status generally, lastly, it should be subject-specific. All three of these predictions appeared in the data. Students from East Asian immigrant families show a substantial mathematics advantage with no corresponding gap in English. Importantly, this gap is decoupled from both household income and parental education levels. Parental education is statistically indistinguishable across the two groups, and the mathematics advantage appears despite immigrant families in this sample reporting lower household incomes than non-immigrant families. These patterns are consistent with a transmitted, effort-centered orientation operating through family practice, and are difficult to reconcile with accounts resting on parental educational selectivity or economic status. The sample is self-selected and academically high-achieving, so the findings establish the model's presence rather than its prevalence or historical causations or origins.

INTRODUCTION

Keju, a collection of examinations in ancient China, was for over a thousand years the main path to political power in China from its origins in the Sui dynasty to its eventual abolition in 1905. In China, passing the exam would mean a direct route into the scholar-official class which then staffed the country's bureaucracy. This route was open, at least in theory, to any family willing to invest heavily into their son's

education regardless of their existing socioeconomic status. That openness was heavily qualified in practice as women were excluded outright, and the cost of years of preparation placed the examination beyond many households. The principle itself, however, was consequential. Because of this qualified openness, and because the rewards of passing were so large, keju sustained a broad social attraction towards study and scholarly attainment that extended well beyond the small population that ever held a degree.

This paper focuses on the present because the weight keju placed on scholarly achievement appears not to have disappeared when families left China. East Asian immigrant families in Western countries are widely observed to outperform their non-immigrant peers on measured indicators of school achievement such as grades and standardized assessments where non-immigrant refers to families in which both parents were born in the host country. This paper's guiding intuition is that an orientation toward learning this old and this deeply institutionalized can persist as a family habit long after the specific institution that produced it, and the specific rewards it once connected with examination success, have disappeared. Now, whether such persistence can be demonstrated across centuries is beyond what any available data could establish. However, what can be tested is whether the orientation itself is still present and in effect within diaspora families today.

This paper asks why the difference in academic performance that separates East Asian immigrant families from their non-immigrant peers exists in the first place. The central question is whether a distinctive model of learning, one that scholarship has characterized in East Asian and other Confucian-heritage cultures and traced historically through the examination system, can be identified in this diaspora setting, where keju's original incentives are entirely absent. The hypothesis is that an effort-centered model of learning in which academic achievement is understood to follow from sustained, disciplined study rather than from fixed ability persists in the East-Asian diaspora as a transmitted family norm rather than as a response to any present-day reward. Moreover, because such a norm operates through how families approach study rather than through resources they must purchase, the gap it produces should appear across the income distribution rather than concentrating among the families with the most resources. This prediction also distinguishes the cultural account from any explanation based on biological differences as a transmitted norm is a property of family practice, not of persons. As evidence from within China discussed below shows, results vary across regions with different historical exposure to the examination system and decay when transmission is disrupted, a trend that no biological explanation could predict. In this paper, the non-immigrant group serves as a baseline against which this pattern can be measured.

LITERATURE REVIEW

The keju examination system whose cultural residue this paper looks for was, in institutional terms, remarkably specific. It existed from its creation in 605 CE until its abolition in 1905, the keju operated as a sequence of examinations at county, provincial, metropolitan, and palace levels, with each successive level offering greater status and, at the highest levels, eligibility for positions in the imperial office. Due to

the great difference in population and number of government employees, the pass rates for the exam were very low. By the mid-nineteenth century, roughly 1.5 percent of candidates passed at the county level, and of an estimated 2.5 million county level candidates in the late Qing period, only 240 reached the highest degree of jinshi. Although some studies, such as Ho's classic mobility study, estimated that in the Qing dynasty as much as 45 percent of provincial degree-holders and 38 percent of jinshi came from families with no prior degree-holding ancestors¹, and access to the exam, as noted above, was formally restricted to males who also had to pass a family background and occupation check. However, what matters for the present and this paper is less the system's contested fairness than the social effects. In ancient China, examination results were proclaimed and celebrated publicly, and villages often collectively funded schools and academies to support local candidates. Government schooling itself even became organized around examination preparation. As a result, the educational practice of a population much larger than those gaining degrees was formed, and this exam-centered orientation can be seen in the testing environments of China today².

Within China, the durability of this exam-centered orientation and model of learning is not merely asserted but measured. Chen, Kung, and Ma (2020) explored variation in the density of jinshi (holders of keju's highest qualification) across the 278 Chinese prefectures during the Ming/Qing dynasty and found that a doubling of jinshi density raises years of schooling in 2010 by 8.5 percent³. That is, regions that historically produced twice as many holders of keju's highest degree show, a century after the system's abolition, measurably higher educational achievement among their present-day locals. Importantly, they attribute this effect to multiple channels, with cultural transmission and educational infrastructure doing most of the work. This means that the effect of keju survives even in regions where the old scholar-official class's power has diminished significantly. Their study provides the causal relationship for the cultural-historical argument. It shows that keju produced an effect on educational behavior that operates independently from wealth, infrastructure, and elite political continuity. Moreover, it demonstrates that the effect is durable and can still be measured a century after the exams were abolished.

Li (2012) provides the characterization of the learning model that this paper tests for. After reviewing several decades of cross-cultural research and data, she distinguishes a western mind model of learning centered around curiosity and understanding the world from an East Asian model of learning oriented

¹ Ping-ti Ho, *The Ladder of Success in Imperial China: Aspects of Social Mobility, 1368–1911* (New York: Columbia University Press, 1962), cited in Barry O'Sullivan and Liying Cheng, "Lessons from the Chinese Imperial Examination System," *Language Testing in Asia* 12 (2022), <https://doi.org/10.1186/s40468-022-00201-5>.

² Barry O'Sullivan and Liying Cheng, "Lessons from the Chinese Imperial Examination System," *Language Testing in Asia* 12 (2022): article 52, <https://doi.org/10.1186/s40468-022-00201-5>.

³ Ting Chen, James Kai-sing Kung, and Chicheng Ma, "Long Live Keju! The Persistent Effects of China's Civil Examination System," *The Economic Journal* 130, no. 631 (2020), <https://doi.org/10.1093/ej/ueaa043>.

around moral self-perfection through diligent study⁴. She also traces the latter to the Confucian philosophy. The model is very specific in what it states: achievement is understood to come from diligence, persistence from difficulty, and self-improvement from study rather than from fixed ability. Importantly, in this model, effort itself carries moral weight since diligence and perseverance are counted among the learning virtues. Crucially for this paper, she documents that these orientations are not confined to their countries of origin. For instance, the virtue model persists among Chinese immigrant families in the US, shaping how parents frame achievement and how children interpret success and failure. This is also precisely the observable form of the transmission in which the model is carried not as an abstract commitment to an extinct institution but a form of everyday parental practice, in which, for instance, failure is diagnosed as a result of insufficient effort rather than insufficient ability. Whether and how quickly such practices dissipate across generations in the diaspora is an empirical question this paper returns to in its conclusion. A complementary literature on Confucian heritage learning cultures reaches a similar conclusion but from the classroom side. Collecting and synthesizing studies from Hong Kong, Taiwan, Singapore, and the diaspora, Watkins and Biggs (1996) find that learners from these cultures consistently treat sustained effort as the decisive determinant of academic success⁵. This belief is exactly what sustains persistence and determination on difficult material and it is the belief whose presence the analysis later tests for. Critically, when taken together, these literatures establish two things that this paper relies on: that a distinctive, describable model of learning exists and has been characterized constantly across decades of cross-cultural research, and that it has been documented operating in immigrant families outside of East Asia. However, these literatures do not establish a linked causal chain from keju to the contemporary diaspora. What they do argue is narrower: that the model is real, portable, and identifiable, and its historical association with China's examination culture explains why scholars today describe it as an inheritance rather than an invention of migration. Furthermore, the account also doesn't require that modern rewards for achievement be absent. Immigrant families face strong present-day incentives to succeed academically. A transmitted norm and contemporary incentives can operate collaboratively at the same time. The analysis below separates them not by denying the incentives, but by testing a prediction that incentives alone do not generate: if the norm operates through family practice, the achievement it produces should not depend on household resources.

A collection of other empirical studies also document this model's footprint in the diaspora directly. Hsin and Xie (2014) find an Asian-white academic achievement gap of around 0.3 standard deviation by tenth grade in two nationally representative US longitudinal datasets⁶. They then traced this to the difference in

⁴ Jin Li, *Cultural Foundations of Learning: East and West* (Cambridge: Cambridge University Press, 2012).

⁵ David A. Watkins and John B. Biggs, eds., *The Chinese Learner: Cultural, Psychological and Contextual Influences* (Hong Kong: Comparative Education Research Centre; Melbourne: Australian Council for Educational Research, 1996).

⁶ Amy Hsin and Yu Xie, "Explaining Asian Americans' Academic Advantage over Whites," *Proceedings of the National Academy of Sciences* 111, no. 23 (2014), <https://doi.org/10.1073/pnas.1406402111>

academic effort rather than cognitive abilities. The two were measured separately: cognitive abilities by standardized test scores in reading and mathematics, and academic effort by teachers' ratings of students' attentiveness, task persistence, and eagerness/initiative to learn. Decomposition models testing the two against each other, alongside socio-demographic characteristics, attributed the achievement gap mainly to effort rather than to tested abilities, and traced the effort difference in turn mainly to beliefs about the connection between effort and achievement although also, in part, to immigration status itself. The effort measure is a proximate one, resting on teacher judgment, which the authors acknowledge. This finding operationalizes exactly the effort-centered learning belief documented by Li and Watkins and Biggs⁷. Jerrim (2015) finds that second-generation East Asian immigrants in Australia outperform their native-born peers by roughly 100 PISA points, equivalent to about two and a half years of schooling⁸. This is a gap that persists even after controlling for parental education, social class, and other demographic characteristics. For present purposes, the relevance is not that Jerrim identifies a cause, matter of fact, he declines to. However, the pattern that he documents is what an operative effort-centered model would produce: an advantage that survives controls for parental class and education, in a second generation raised entirely within the host country's schools. However, Jerrim himself is notably cautious about attributing this fully to any single cause, concluding that no "silver bullet" explanation accounts for it and that it is probably a result of a combination of several factors. Liu and Xie (2016) add an important refinement: rather than finding a flat cultural advantage, they show that family socioeconomic status predicts achievement-related behavior and attitudes much more weakly among Asian American families than among white families, which is why the Asian advantage is largest precisely among poorer families, where a purely structural account would predict the smallest gap⁹. Lastly, Feniger and Lefstein (2014) eliminates the school environment as an explanation entirely. They show that Chinese immigrant students in Australia and New Zealand score much closer to their peers in Shanghai than to their non-immigrant classmates attending the same schools, which eliminates any explanation attributed to the school system itself¹⁰.

The principal alternative reading of this diaspora evidence locates the source of the gap not in inherited values but in the structure of modern immigration. Its most influential statement is Lee and Zhou's (2015) study of Chinese and Vietnamese second-generation youth in Los Angeles¹¹. Their starting observation is

⁷ Li, *Cultural Foundations*; Watkins and Biggs, *Chinese Learner*.

⁸ John Jerrim, "Why Do East Asian Children Perform So Well in PISA? An Investigation of Western-Born Children of East Asian Descent," *Oxford Review of Education* 41, no. 3 (2015), <https://doi.org/10.1080/03054985.2015.1028525>.

⁹ Airan Liu and Yu Xie, "Why Do Asian Americans Academically Outperform Whites? The Cultural Explanation Revisited," *Social Science Research* 58 (2016), <https://doi.org/10.1016/j.ssresearch.2016.03.004>.

¹⁰ Yariv Feniger and Adam Lefstein, "How Not to Reason with PISA Data: An Ironic Investigation," *Journal of Education Policy* 29, no. 6 (2014), <https://doi.org/10.1080/02680939.2014.892156>.

¹¹ Jennifer Lee and Min Zhou, *The Asian American Achievement Paradox* (New York: Russell Sage Foundation, 2015).

that because United States immigration policy since 1965 has favoured applicants with high levels of education and professional skill, many Asian immigrants arrive far more educated than the typical person in either their origin society or the host society, a pattern Zhou and Lee (2017) later term hyper-selectivity¹². On this account the diaspora advantage need not reflect a thousand-year cultural inheritance at all; it can instead follow from the unusually elite character of the migrant stream and from what that selectivity makes possible in the host country.

Lee and Zhou argue that this selectivity produces achievement through mechanisms operating beyond the individual family. Selected immigrant communities converge on a demanding "success frame" that equates a good outcome with admission to an elite university and entry into a high-status profession, and they build community resources (College prep classes, tutoring resources, etc.) that even lower-income coethnic families can draw upon. Public institutions reinforce the cycle: teachers and counselors who assume Asian American students are diligent and capable give them extra help and channel them into competitive programs, a dynamic of favourable stereotyping that lifts performance. Interestingly, Lee and Zhou find that the second-generation Chinese and Vietnamese in their study reach strikingly similar levels of attainment despite the very different socioeconomic profiles of their immigrant parents. Which to them, is evidence, on their reading, that the advantage rests on group-level frames and resources rather than on individual family wealth. They advance this explicitly as a corrective to accounts attributing Asian American success to intrinsic "Tiger Mom" or Confucian values; in their formulation culture matters, but it is remade by the conditions of selective immigration rather than carried intact from a national past¹³.

For this paper the hyper-selectivity account matters because it offers a rival explanation for the same observable patterns: where a cultural account treats the emphasis on education as a transmitted family norm, Lee and Zhou treat it as a contemporary product of who is admitted and how they are received. The two accounts do not disagree about whether the advantage exists, instead, they disagree about what sustains it and they make different predictions about its relationship to family resources. Note that the account has not gone unchallenged. Sakamoto and Wang (2021), for example, argue that hyper-selectivity is inadequately conceptualized and is not clearly supported by data on immigration or income mobility, and that cultural factors shape attainment for most second-generation Asian Americans regardless of parental socioeconomic status. This is a position close to the one this paper's data speak to¹⁴. Zhou and Lee have defended the concept in subsequent exchanges, and the debate remains unresolved. What matters here is not judging it but noting that its central point of contention - whether the advantage depends on parental class and resources - is precisely what the present data can address.

¹² Min Zhou and Jennifer Lee, "Hyper-Selectivity and the Remaking of Culture: Understanding the Asian American Achievement Paradox," *Asian American Journal of Psychology* 8, no. 1 (2017), <https://doi.org/10.1037/aap0000069>.

¹³ Lee and Zhou, *Asian American Achievement Paradox*.

¹⁴ Arthur Sakamoto and Sharron Xuanren Wang, "Deconstructing Hyper-selectivity: Are the Socioeconomic Attainments of Second-Generation Asian Americans Only Due to Their Class Background?," *Chinese Journal of Sociology* 7, no. 1 (2021), <https://doi.org/10.1177/2057150X20973802>.

Two features of this literature motivate the present study. The first is that almost all of the diaspora evidence, on both sides of the debate, comes from the United States, Australia, or New Zealand. Direct Canadian evidence is comparatively thin, even though Canada's points-based immigration system makes it an especially clean setting in which to observe these patterns. What Canadian evidence exists is consistent with the broader picture. Abada, Hou, and Ram (2009) document large differences in second-generation educational attainment across ethnic groups in Canada, with the children of Chinese and other East Asian immigrants completing university at notably high rates¹⁵, and Boyd and Tian (2016) likewise reports high attainment among the East Asian second generation in Canada¹⁶.

This literature, taken together, licenses a specific empirical strategy. If the effort-centered model characterized by Li and by Watkins and Biggs is present and operative in a diaspora population, it should leave three identifiable pieces of evidence. First, because the model works through how families approach study rather than through resources families purchase, the achievement it produces should appear across the income distribution rather than concentrating where resources are greatest, which is a pattern that Liu and Xie (2016) documents in the US. Second, because the model of learning is a feature of Confucian-heritage cultures rather than a general consequence of migration, its effects should track East Asian background at least as closely as immigrant status itself. Third, the advantage should be strongest where family-directed effort yields the most self-contained returns. A selection-based account predicts differently on the first signature in particular: if the advantage rests on the educational and material capital of selected parents, it should strengthen with family resources rather than operate independently of them. The present study examines a Canadian sample against these predictions. Canada's points-based immigration system makes it a setting where selection pressures are, if anything, especially strong, which makes any observed decoupling of achievement from family resources more informative rather than less.

METHODOLOGY

This paper aims to reanalyze the data originally collected in 2024 for a study of East-Asian immigrant and non-immigrant teenagers in Canada, conducted in collaboration with a professor at the University of Toronto and examining mental-health status, academic performance, family composition, and parenting styles. While that study's analysis was about mental-health trends, the present study redirects that same dataset toward academic achievement and its familial relations. Because this paper asks whether an effort-centered model of learning can be identified in diaspora families, the dataset is well suited as a test case as it contains mainly East Asian immigrants with a non-immigrant comparison group in Canada.

¹⁵ Teresa Abada, Feng Hou, and Bali Ram, "Ethnic Differences in Educational Attainment among the Children of Canadian Immigrants," *Canadian Journal of Sociology* 34, no. 1 (2009).

¹⁶ Monica Boyd and Siyue Tian, "Educational and Labor Market Attainments of the 1.5- and Second-Generation Children of East Asian Immigrants in Canada," *American Behavioral Scientist* 60, no. 5–6 (2016), <https://doi.org/10.1177/0002764216632830>.

The original study used a cross-sectional, paired-respondent design in which each teenager and one parent completed parallel questionnaires, allowing student outcomes to be linked to parent-reported family characteristics.

The dataset contains 343 teenagers aged 13 to 17. Of these, 252 were linked to a participating parent and the remaining 91 parents did not complete the provided survey. Because family immigration status, ethnic background, household income, and parental education are all drawn from the parent questionnaire, every comparison reported below in this paper is restricted to the 252 families with matched parent records. The figure of 343 describes the recruited sample only and no analysis uses it. The recruitment process was an invitation-based referral system, in which participants entered an access code supplied by the person who referred them. The sample is therefore self-selected rather than random, and is concentrated among East Asian and immigrant families with smaller groups of non-immigrants serving as comparison. Families were classified as non-immigrant if and only if both parents were born in Canada and they were classified as immigrant otherwise, yielding 207 immigrant and 45 non-immigrant families. It is also important to note that the sample is academically high-achieving, with most reporting grades above 90%, and is likely not representative of the broader adolescent population.

These sample characteristics constrain what the analysis can claim, and the design reflects the constraint. A self-selected, high-achieving sample cannot support causal inference about the origins of the achievement gap. Moreover, the absence of country-of-origin data makes it impossible to isolate ethnically Chinese families or differentiate among immigration pathways. However, what such a sample can support is an existence test. Specifically, whether the patterns of achievement that an effort-centered model predicts is present in these families. The analysis is accordingly descriptive, and its comparisons are internal to the sample.

The questionnaire collected data across a wide range of domains. The analysis below draws on four measures: academic achievement, household income, parental education, and ethnic background. Academic achievement was recorded through questions asking students to select their most recent grade band in Mathematics and English from six ordered options ranging from below 60 to 96 and above. Household income was recorded by asking the participant which segment the family's annual income falls into with eight ordered options: below \$50,000; \$50,000~\$74,999; \$75,000~\$99,999; \$100,000~\$144,999; \$150,000~\$199,999; \$200,000~\$249,999; \$250,000~\$299,999; and \$300,000 and above, all in Canadian dollars. Parental education was recorded as the responding parent's highest completed level of education, with five ordered options: graduated from primary school; graduated from high school; graduated from college; some graduate school; and completed graduate school. Ethnic background was recorded as a single closed-response item asking the responding parent to select the option best describing their main ethnic group, with five options offered: East Asian; European; South Asian; Middle Eastern and North African; and African and Caribbean. Within the 252 matched families, 177 selected East Asian, 43 European, 13 South Asian, 4 Middle Eastern and North African, and 3 African and Caribbean and one gave a write-in response and 11 left the item blank. The heritage comparison reported below only considers the 177 East Asian families with the 43 European families and excludes the remaining ones whose cell sizes are too small to support separate comparisons. Because the

item offers only broad regional categories and the survey contains no country-of-origin field, “East Asian” is the smallest available proxy for Confucian-heritage background. All four measures are ordinal or categorical and were analyzed with rank-based or frequency-based methods. The parent questionnaire was administered in both English and Chinese, and equivalent response options in the two versions were translated and mapped to common codes before analysis.

The questionnaires were completed online and time-stamped. Each student response was paired with the corresponding parent response to form family level records and trends. Family immigration status was assigned based on whether both parents were born in Canada or not.

Because the achievement outcomes are largely ordinal and several group cells are small, comparisons between immigrant and non-immigrant families use nonparametric tests. The analysis first establishes whether an achievement gap is present in this Canadian sample, then tests the three predictions derived above: whether the gap is independent of household income and parental education, whether it tracks East Asian heritage rather than immigrant status itself, and whether it is subject-specific.

Note that these comparisons are reported one variable at a time rather than estimated jointly in a single model. This was chosen because the design is descriptive and aims at an existence test rather than at partitioning independent effects, and the two grouping variables of interest cannot in any case be separated within a common model as 168 of the 207 immigrant families are East Asian, so immigrant status and heritage are too closely confounded here to enter as distinct predictors.

RESULTS

This section of the paper aims to address the three predictions listed above in turn, beginning by addressing whether a gap exists at all. A secondary analysis of the data reveals a substantial achievement gap in math but not in English. Immigrant-family students reported a median grade band of 91–95, compared with 81–90 among non-immigrant students. Importantly, 75 percent of immigrant students reported grades of 91 or above in Mathematics, against 40 percent of non-immigrant students (Table 1). A Mann-Whitney U test confirmed the difference as statistically significant with a moderate effect ($U = 6473$, $p < 0.001$, rank-biserial $r = 0.41$), as did the full grade distribution ($X^2(5) = 25.29$, $p < 0.001$). The English comparison showed no such gap as the two groups were nearly indistinguishable (54% versus 51% scoring 91 or above, Table 2). The immigrant advantage in this sample is therefore subject-specific rather than a uniform academic superiority.

Table 1. Distribution of self-reported Mathematics grade bands by group.

Grade band	Immigrant (n = 204)	Non-immigrant (n = 45)	East Asian immigrant (n = 167)
Below 60	5 (2.5%)	3 (6.7%)	3 (1.8%)
61 to 70	3 (1.5%)	4 (8.9%)	1 (0.6%)
71 to 80	13 (6.4%)	5 (11.1%)	6 (3.6%)
81 to 90	30 (14.7%)	15 (33.3%)	25 (15.0%)
91 to 95	59 (28.9%)	10 (22.2%)	50 (29.9%)
96 and above	94 (46.1%)	8 (17.8%)	82 (49.1%)

Note: Counts with column percentages in parentheses. Percentages are computed over students reporting a grade in the subject; 3 of 207 immigrant-family students did not report a Mathematics grade. The East Asian immigrant column is a subset of the immigrant column.

Table 2. Distribution of self-reported English grade bands by group.

Grade band	Immigrant (n = 204)	Non-immigrant (n = 45)	East Asian immigrant (n = 167)
Below 60	1 (0.5%)	0 (0.0%)	1 (0.6%)
61 to 70	4 (2.0%)	1 (2.2%)	2 (1.2%)
71 to 80	14 (6.9%)	9 (20.0%)	11 (6.6%)
81 to 90	75 (36.8%)	12 (26.7%)	60 (35.9%)
91 to 95	67 (32.8%)	15 (33.3%)	57 (34.1%)
96 and above	43 (21.1%)	8 (17.8%)	36 (21.6%)

Note: Counts with column percentages in parentheses. Percentages are computed over students reporting a grade in the subject. The East Asian immigrant column is a subset of the immigrant column.

This subject-specificity is open to a reading consistent with the effort-centered model, though the reading is interpretive rather than demonstrated. It is unlikely to reflect anything inherited from keju's content, whose curriculum was classical and literary rather than mathematical. However, what the model proposes is the transmission of an orientation toward effortful study, not of any subject matter. Such an orientation, if operative, should surface most visibly where sustained and directed effort yields the largest and most self-contained returns. Mathematics is a strong candidate: it is the school subject most commonly targeted by supplementary practice and tutoring, and the one least mediated by the ambient language of the host society. English achievement, by contrast, is bound up with home-language exposure and immersion in the majority language. The observed pattern of a large mathematics gap with English parity is consistent with an effort advantage expressing itself fully in mathematics while being offset in English by language-related disadvantages. However, the data cannot separate those two forces, and exact parity is not something the model predicts. Instead, an English deficit or even a smaller English advantage would be consistent with it. The mathematics result is therefore the informative one, and the English result is best read as neutral rather than confirming.

This pattern still holds when the comparison is drawn in ethnic-heritage terms. Comparing East Asian to European-heritage families regardless of immigrant status produced a similar result. A significant math gap was shown with no significant English gap. The mathematics difference was again moderate-to-large (Mann-Whitney $U = 5542$, $p < 0.001$, rank-biserial $r = 0.46$), with 78 percent of East Asian students

scoring 91 or above against 35 percent of European-heritage students, while the English comparison remained non-significant ($p = 0.2$).

A further check addresses whether the immigrant advantage reported earlier depends on pooling non-East-Asian families into the immigrant group. Restricting that group to East-Asian families only by dropping the South Asian, European, and other non-East-Asian immigrant families does not weaken the mathematics gap but sharpens it slightly. East-Asian immigrant students outperformed non-immigrant students with a rank-biserial correlation of .47, compared with .41 for the full immigrant group, and 79 percent scored 91 or above against 40 percent of non-immigrant students. As reported below, the income-decoupling pattern survives the same restriction unchanged, with income remaining unrelated to mathematics achievement among East-Asian immigrant families (Spearman $\rho = .04$, non-significant) while continuing to predict it among non-immigrant families ($\rho = .53$, $p < .001$). The advantage is therefore specifically an East-Asian pattern rather than a generic immigrant effect, which is what a cultural-transmission account predicts and a general account of immigration does not.

Immigrant status and East Asian heritage are heavily confounded in this sample as 168 of the 207 immigrant families are East Asian and the two cannot be statistically separated. This overlap limits what the comparison can establish, but it is also the pattern a cultural-transmission account would expect. The achievement difference shows cultural background as closely as it shows time of immigration, which is difficult to support with an explanation centered on the disruptions of immigration itself.

However, it is important to note that one limitation constrains how far this can be pushed. The survey records ethnic background only in broad regional categories and has no country-of-origin field, so the analysis cannot isolate ethnically Chinese families specifically; "East Asian," which also includes Japanese, Korean, Filipino, and Vietnamese heritage, is the narrowest available proxy. The results should therefore be read as pertaining to East-Asian rather than narrowly Chinese families. This restriction is less damaging to the present design than it would be to a keju-specific causal claim: the effort-centered model is documented across Confucian-heritage cultures rather than in China alone, so an East Asian sample remains a valid sample for testing of the model's presence, even though it cannot speak to the model's specifically Chinese origins.

The strongest evidence that the model is operative comes from the relationship between household income and academic achievement, which follows the decoupling pattern identified by Liu and Xie (2016)¹⁷. However, before we get there, it is worth noting the income distributions themselves. Immigrant families in this sample report lower household incomes than non-immigrant families (Mann-Whitney $U = 1952$, $p < 0.001$, rank-biserial $r = -0.44$), with a median band of \$100,000 ~ \$144,999 against \$200,000 ~ \$249,999. The mathematics advantage therefore appears in the lower-income group, not the higher-income one. Among non-immigrant families, income was a strong predictor of mathematics achievement (Spearman $\rho = .53$, $p < .001$), the expected pattern under a conventional socioeconomic account in which resources buy outcomes. Among immigrant families, that relationship effectively

¹⁷ Liu and Xie, "Why Do Asian Americans,".

disappeared and became non-significant ($p = .05$), and it remained absent when the immigrant group was restricted to East-Asian families ($p = .04$). High achievement appeared across the income distribution rather than concentrating as income rose. The gap in achievement is therefore not explained by material resources.

Parental education shows the same decoupling as income. The two groups are statistically indistinguishable on this measure. 95 percent of immigrant parents and 97 percent of non-immigrant parents had completed college or more, and roughly half of each group had at least some graduate education (51 percent and 58 percent respectively). A Mann-Whitney test finds no difference between the distributions ($U = 3589$, $p = 0.67$). Within groups, parental education does not predict mathematics achievement (Spearman $p = 0.08$, non-significant). The mathematics gap also persists when the comparison is restricted to education level. Among families where the parent completed college, immigrant students still outperformed non-immigrant students (rank-biserial $r = 0.37$, $p = 0.017$, with 71 percent vs 47 percent scoring 91 or above). Among families where parents had graduate education, the gap was still larger ($r = 0.49$, $p < 0.001$, 81 percent vs 36 percent). However, it is important to note that the sample's uniformly high parental education means the analysis compares educated families with educated families so it cannot speak to how the gap behaves where parental education is genuinely at a lower level. Table 3 summarizes all statistical comparisons reported in this section.

Table 3. Summary of statistical comparisons.

Comparison	Test statistic	p	Effect size	n
Mathematics: immigrant vs. non-immigrant	$U = 6473$	$< .001$	$r = .41$	204/45
English: immigrant vs. non-immigrant	—	n.s.	—	204/45
Mathematics: East Asian vs. European heritage	$U = 5542$	$< .001$	$r = .46$	177/43
Mathematics: East Asian immigrant vs. non-immigrant	—	$< .001$	$r = .47$	167/45
Parental education: immigrant vs. non-immigrant	$U = 3589$	.67	—	197/38
Income → math, non-immigrant families	$\rho = .53$	$< .001$	—	36
Income → math, immigrant families	$\rho = .05$	.46	—	191
Income → math, East Asian immigrant families	$\rho = .04$	n.s.	—	—
Parental education → math, immigrant families	$\rho = .08$	.27	—	195
Parental education → math, non-immigrant families	$\rho = .07$	.67	—	38
Mathematics gap, college-educated stratum	—	.017	$r = .37$	86/15
Mathematics gap, graduate-educated stratum	—	$< .001$	$r = .49$	100/22

Note: U denotes Mann-Whitney U (two-sided); p denotes Spearman rank correlation; r denotes the rank-biserial correlation. n gives group sizes for two-group comparisons (group 1/group 2) or the number of paired observations for correlations. Rows with missing entries report tests where the corresponding statistic was not computed or not applicable. Parental education and income analyses exclude records with missing or unusable parent responses.

A final comparison addresses whether the advantage tracks proximity to migration. Within immigrant families, students born outside Canada did not differ significantly in math achievement from those born in Canada ($U = 5318$, $p = 0.16$, rank-biserial $r = 0.11$), and the difference was still smaller within East-Asian immigrant families ($p = 0.49$). It is however important to note that student birthplace is a crude proxy for generational distance, since the survey records no arrival date, but the absence of any gradient is what a

transmitted-norm account predicts and what an account centred on the process of immigration itself does not.

Because several comparisons are reported, a Holm-Bonferroni correction was applied across the 15 tests in this section. All principal results survive correction, including the mathematics gap by immigrant status and by heritage, the full grade-distribution comparison, the income-achievement association among non-immigrant families, and the mathematics gap within the graduate-educated level all remain significant at $\alpha = 0.05$. Note that the one exception is the mathematics gap within the college-educated level, which is statistically significant uncorrected ($p=0.017$) but not after correction ($p=0.139$). This comparison comes from the smallest cell in the analysis (15 non-immigrant families to be exact) and should be read as suggestive. The comparisons that returned no difference, including the English comparison, the parental education comparison, and the income and education correlations within immigrant families, are unaffected by the correction, which can only make a test more conservative.

DISCUSSION

The findings can be summarized against the three predictions listed before. The achievement gap in this sample is real but subject-specific, appearing only in mathematics and not in English. Moreover, it also tracks East Asian heritage at least as closely as immigrant status, and sharpens rather than weakens when the immigrant group is restricted to East Asian families. It is also decoupled from household income, appearing across the income distribution rather than concentrating at the top where resources are greatest. This is the signature that the effort-centered model predicts, and the central claim of this paper is that the model is therefore present and operative in these families.

One alternative reading attributes immigrant achievement differences to the migration experience itself, specifically, to the pressures, disruptions, and compensating drives that accompany resettlement. Such an account would attribute the gap to the condition of being an immigrant. This would mean that a rise in performance in both math and English would be expected, which does not line up with the data in which only the math performance was significantly higher than non-immigrants. Secondly, a psychological hypothesis focused on the experience of immigration itself would suggest that the gaps in achievement will be correlated with immigrant status and recency. However, in the data, the achievement is instead correlated equally to all participants of East Asian background instead of migration recency, pointing towards something carried with cultural heritage rather than generated by the experience of migrating itself.

The more demanding challenge comes from the selection argument from Lee and Zhou (2015): that the immigrant advantage reflects the educational selectivity of immigrant parents and the community resources that selectivity generates¹⁸. Two features of the data bear on this. The first deals with the account's premise that hyper-selectivity requires that immigrant parents be substantially more educated

¹⁸ Lee and Zhou, *Asian American Achievement Paradox*.

than their non-immigrant counterparts. However, immigrant and non-immigrant parents in this sample are equally educated, parental education does not predict achievement within either group, and the Mathematics gap persists among college-educated families and, more tentatively, among graduate-educated families as well. The selectivity gap that the account runs on is absent here, yet the achievement gap still remains. The second feature is a limit on what this establishes. Lee and Zhou's fuller argument holds that community-level resources can decouple achievement from individual family resources, so the income-decoupling reported above does not by itself count against their account. This sample contains no measures of coethnic community resources, and the analysis simply cannot rule out community-level mechanisms. However, what it can say is that whatever sustains the advantage in these families, it is not the parental education level that hyper-selectivity treats as the fuel.

It is still worth stating what the identified model amounts to, since the paper infers it from its statistical signature rather than observing it directly. As characterized in the cross-cultural literature and consistent with the patterns here, the model is a set of family practices organized around a shared belief: that achievement follows from sustained effort rather than fixed ability. In practice this looks like a routine in which failure is diagnosed as insufficient effort rather than insufficient talent, study time is treated as a protected family value, supplementary practice directed at subjects where it pays off, and effort itself treated as creditable independent of immediate results. None of these require wealth, which is why the model's signature is resource-independency. All of these mechanisms require sustained parental attention, which is why the model travels through families rather than through institutions. What this paper has shown is not the interior working of these practices as no observational or attitudinal data was collected. However, what this paper does show is simply the statistical shadow: an achievement pattern that appears where the model is culturally expected, tracks the heritage that carries it, and operates independently of the resources that other accounts require.

CONCLUSION

In conclusion, this study set out to ask whether an effort-centered model of learning, characterized in cross-cultural research and historically associated with China's examination culture, can be identified in East Asian immigrant families in Canada. Three findings bear on that question. First, the gap is real but subject-specific: substantial in mathematics and absent in English. It tracks East-Asian heritage at least as closely as it tracks immigration itself. And it is decoupled from household income and parental education, appearing across the income distribution rather than concentrating among the families best able to purchase advantage. Taken together, these results are the signatures the model predicts. A migration-experience account cannot easily accommodate a gap confined to one subject and tied more to heritage than to recency of arrival. A selection account grounded in parental educational capital is weakened by the finding that immigrant and non-immigrant parents in this sample are more or less equally educated, and that the gap persists across income and education levels alike. What remains most consistent with the data is the account this paper has advanced: a transmitted, effort-centered orientation

toward study and learning in general that operates through family practice rather than through material means.

For education research the contribution here is less a discovery than a refinement of how cultural effects on achievement should be modelled. The pattern here is not a blanket cultural superiority but a narrow one, and its narrowness is informative. An advantage that appears in mathematics and not in English, and that survives the removal of material resources, points to a mechanism operating at the level of how families approach effortful study rather than at the level of general ability, school quality, or wealth. It also adds Canadian evidence to a literature drawn almost entirely from the United States and Oceania and does so in a points-based immigration setting where the income-achievement decoupling identified by Liu and Xie (2016) is replicated¹⁹. The historical claim this paper has deliberately not made should be named: that the orientation descends from keju specifically. Keju here acts as the background, the institutional setting in which scholars locate the model's origins. It is not a tested variable. Establishing that lineage would require country-of-origin data and generational measures this study lacks, and it remains the clearest path for further work and research.

The policy reading of these findings should be handled with care, because the most tempting version of it is also the least defensible. It does not follow from this study that interventions aimed at closing achievement gaps are futile, or that gaps reflect fixed differences in cultural worth. What the data suggest is narrower: that a gap with a culturally transmitted, resource-independent component will not be fully closed by interventions that manipulate only material resources or school factors. Accountability-driven regimes in the mould of the United States' No Child Left Behind, which sought to raise outcomes largely through testing, standards, and school accountability, would on this account be expected to leave such a component untouched not because the families involved are beyond reach, but because the lever being pulled is not the one linked to the effect. The constructive implication runs the other way. If an orientation toward effortful study is transmitted rather than innate, it is also, in principle, cultivable. The community "success frames" and coethnic resources that Lee and Zhou (2015) documented are themselves evidence that such orientations can be built rather than merely inherited²⁰. A practitioner takeaway in line with this study is therefore that interventions addressing how students and families understand the relationship between effort and achievement may reach gaps that resource-based interventions alone do not. The finding cautions against expecting resource equalization to do all the work.

Several questions remain open, and most turn on data the present study did not have. The most consequential is direct evidence for the transmission mechanism itself. This study infers an effort-centered orientation from the shape of the achievement gap, however it does not measure that orientation. A stronger design would assess families' beliefs about learning directly, using instruments of the kind Li (2012) develops²¹, and test whether those beliefs mediate the achievement difference rather

¹⁹ Liu and Xie, "Why Do Asian Americans,".

²⁰ Lee and Zhou, *Asian American Achievement Paradox*.

²¹ Li, *Cultural Foundations*.

than inferring them from outcomes. Three further constraints also exist. For starters, the sample is self-selected and academically high-achieving, so the patterns need confirmation in a representative one. Moreover, the data record ethnicity only in broad regional terms, so any claim specific to Chinese families requires country-of-origin information that the current survey did not collect. Lastly, because cultural transmission should weaken across generations in the absence of the original institution as Chen, Kung, and Ma (2020) find it did within China after the Cultural Revolution²², a generational measure of orientation and achievement in the diaspora would offer a particularly direct test: a transmitted norm should decay with distance from the migrating generation, in a way that selection-based or purely structural accounts would not predict.

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²² Chen, Kung, and Ma, "Long Live Keju!,".

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