Research Proposal

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Cross-national Analysis of Adolescents’ Mathematics, Reading, and Science Abilities

The stereotypical belief that Asian students generally do better in mathematics has been prevalent in the United States for decades. The positive and negative influence of this stereotype on students’ performances and mental conditions have been explored thoroughly by previous literature (Trytten, Lowe, & Walden, 2012; Tsui, Xu, Venator, & Wang, 2016; McGee, Thakore, & LaBlance, 2017), and different hypotheses have also been proposed to emphasize the role of parenting and schooling styles (Gibbs et al., 2017) and social media (Sun et al., 2015) in forming such racial stereotype. However, the majority of studies examining this stereotype used participants who were students with different ethnic identities (e.g., Cvencek et al., 2015). It is no doubt that comparing Asian and non-Asian American students’ performances on mathematics would better our understanding of the effect of stereotype threat in a more controlled environment (Cvencek et al., 2015). Nevertheless, it is equally important to examine such stereotypical belief in a larger perspective by looking at student performances and educational styles outside of the U.S. On the one hand, making such cross-national comparison would offer some insights to the origin of this stereotype. Do students in Asian countries truly outperform their U.S. counterparts in mathematics? Only cross-national studies could help to answer this question. On the other hand, looking at the education system, the teaching and parenting style, and other factors related to education in other countries would allow educationalists and policy makers to re-examine the American education system more thoroughly. It does not only permit us to test the authenticity of such stereotypical belief on an international scale but would also help us to find possible ways to improve education outcomes.

However, cross-national analysis can be challenging for any individual researcher or research group. First, it is difficult to test the math abilities of students from different countries with similar standards because they use different textbooks and study in different languages. Second, it can be costly to conduct research in different areas of Asia as education levels could vary dramatically from country to country, and school to school. Therefore, the proposed study will utilize the open-sourced data provided by the Program for International Student Assessment (PISA; 2015) under the National Center for Education Statistics (NCES). The main research questions of this proposed study include: 1) are 15-year-old students in Asian countries significantly differ in their mathematical abilities from their U.S. counterparts, and 2) if the difference is significant, what factors might have led to it.

The PISA is a program that gives surveys to 15- year-old students across 80 countries every three years. The PISA data includes student performance in reading, mathematics, and science across 80 countries as well as other measures such as the basic demographic questions regarding the student and his or her family, the student’s perception of school climate, the type of the school, and the attitudes of the student about mathematics, reading, and science. I have selected 74 variables that are potentially relevant to students’ PISA scores in reading and mathematics. Table 1 shows the full list of variables. I selected Japan, Korea, China (four major provinces including Beijing, Shanghai, Jiangsu, and Guangdong), and Singapore as representatives of Asian countries. During analysis, I would first compare mathematics and reading scores across countries to see if there exist significant differences in PISA scores and whether such differences are more salient for mathematics. Second, I would use feature importance and dimension reduction methods to narrow down the most influential factors that would affect students’ performances in mathematics.

Through this analysis, I would draw conclusions on whether U.S. students do perform worse in mathematics than their Asian counterparts, and what are the possible causes for the cross-national discrepancies. This proposed study would provide an analysis of the most recent PISA data. The results would offer educationalists with more insights about ways to improve the current education system in the U.S. and possible solutions to the prevalent stereotype of “Asian students are better at math”.

References

Sun, C., Liberman, R., Butler, A., Lee, S. Y., & Webb, R. (2015). Shifting Receptions: Asian American Stereotypes and the Exploration of Comprehensive Media Literacy. *Communication Review*, *18*, 294–314. doi: 10.1080/10714421.2015.1085778

Trytten, D. A., Lowe, A. W., & Walden, S. E. (2012). “Asians are Good at Math. What an Awful Stereotype”: The Model Minority Stereotype’s Impact on Asian American Engineering Students. *Journal of Engineering Education*, *101*, 439–468. doi: 10.1002/j.2168-9830.2012.tb00057.x

Tsui, M., Xu, X., Venator, E., & Wang, Y. (2016). Stereotype Threat and Gender: Math Performance in Chinese College Students. *Chinese Sociological Review, 48*, 297–316. doi: 10.1080/21620555.2016.1166339

McGee, E. O., Thakore, B. K., & LaBlance, S. S. (2017). The burden of being “model”: Racialized experiences of Asian STEM college students. *Journal of Diversity in Higher Education, 10,* 253–270. [doi: 10.1037/dhe0000022](https://doi.org/10.1037/dhe0000022)

Fields, C. (2016). Stereotypes and Stereotyping : Misperceptions, Perspectives and Role of Social Media. Hauppauge, New York: Nova Science Publishers, Inc.

Gibbs, B. G., Shah, P. G., Downey, D. B., & Jarvis, J. A. (2017). The Asian American Advantage in Math among Young Children: The Complex Role of Parenting. *Sociological Perspectives, (2)*, 315.

Cvencek, D., Nasir, N. S. ., O’Connor, K., Wischnia, S., & Meltzoff, A. N. (2015). The Development of Math-Race Stereotypes: “They Say Chinese People Are the Best at Math.” *Journal of Research on Adolescence (Wiley-Blackwell), 25*, 630–637. doi: 10.1111/jora.12151

Program of International Student Assessment (2015). Retrieved from http://www.oecd.org/pisa/data/

Table 1. The list of independent variables.

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| Independent Variables for Analysis |
| *Student Demographics*  Sex  Race/ethnicity (U.S. only)  What grade are you in?  *Parents’ Education*  Index educational level of mother  Index educational level of father  Index highest parental education in years of schooling  *Home Posessions*  Own room  Educational software  Internet link  How many televisions  How many bathrooms  How many cars  Dictionary  Quiet place to study, Desk  Textbooks  Computer for school work  How many books at home  *Usage and Availability of Computers*  First use of computers  First access to internet  Internet at school  *Parent Participations and Expectations*  Parent pressure academic standards  *School Climate*  Feel an outsider  Make friends  Feel I belong  Feel awkward  Seem to like me  Feel lonely  Skip whole school day  *School Type and Community*  School type  Public or private  School location  *Language and Immigration*  Country of birth: Self  Language at home  Index immigration status  Index highest educational level of parents  School type |