

***Does Tracking Culture Encourage Fixed Mindsets in Its Students?
An Interdisciplinary Analysis Using International Datasets***

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Abstract

This study serves as the first of its kind to quantitatively juxtapose students' mindsets from between-school tracking (BST) and comprehensive educational policies. Results indicated that students educated in a BST country were significantly more fixed minded than students educated in a comprehensive policy ($p \leq .0001$). Results also replicated the past finding that being less fixed minded served as a buffer against the negative impact coming from a low socioeconomic status (SES) had on performance in math and reading ($p \leq .0001$). Further results revealed the novel finding that being less fixed minded served as a buffer against the negative impact coming from a low SES had on future job expectation ($p \leq .0001$). A theoretical framework rooted in classical conditioning is used to offer an explanation as to why students educated in a tracking policy are so fixed minded. Results of this research warrant the demand that sociologists, psychologists, and educators better work together on ensuring what scales PISA, TIMMS, and PIRLS measure. An argument for the abolishment of tracking is provided.

Keywords: Mindset, Between-School Tracking, Early-Tracking, Educational Policy, Educational Inequalities

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Introduction

Sociological research has emphasized that the education system is the paramount societal structure in fostering social reproduction: It is the primary agent of socialization for younger students, and it performs the main allocative functions associated with placing older students into a proper societal working role (Parsons, 1959). Because of this, design flaws of the education system and educational inequalities have long since been a focal point of sociological research (Coleman, 1966). The current research was directly inspired by a cornerstone sociological study conducted by Hanushek and Wößmann (2006). Their research separated countries into BST countries and comprehensive countries. As defined in their research, BST countries separate students into university and non-university schools at the young ages of 10-15 based on prior academic performance. Higher achieving students attend a school designed to prepare them for university, whereas lower achieving students attend technical and vocational schools designed to teach them skills so they can enter the workforce after high school. Comprehensive countries were defined as countries that keep students together in the same school for the entirety or at least most of high school. Results of their differences in differences analysis revealed that educational inequalities increased over time in almost all BST countries, whereas educational inequalities decreased over time in almost all comprehensive countries. Researchers have hypothesized four key reasons as to why this finding occurred. The first is peer-group effects (Ryan, 2001; Hanushek et al., 2003). BST consists of placing higher achieving students in a university school and lower achieving students in technical or vocational schools. When highly motivated and high achieving students are placed in a separate school, lower achieving students are unable to benefit from studying with them. Because lower achieving students are no longer working alongside and learning from their higher achieving counterparts, they perform worse over time. On the contrary, lower achieving students from comprehensive countries spend more time with higher achieving students in the classroom, which causes them to improve over time. The second explanation is teacher sorting (Bonesrønning et al., 2005). The most able and motivated teachers prefer to teach higher achieving students. Thus, in BST countries, the students tracked into the university school have access to the best teachers and the technical and vocational schools have less capable teachers. The third explanation is differences in educational standards, curricula, and teachers' expectations (Betts & Grogger, 2003). A key factor of the educational policy of BST is that it sends a message to students that their educational future is likely determined by that young age of x years old (10-15 years old depending on which BST countries is being observed). Betts and Grogger (2003) argued that when students are tracked into non-university schools, students are not only offered a less challenging curricula, but teachers and society also expect less from them. This negative stigma and lack of challenging material causes students' performance to drop. The fourth explanation refers to resources provided to the different types of schools in BST countries: Research has found that non-university schools receive less funding in terms of teacher-per-student ratio than university schools (Brunello & Checchi, 2007).

What is Mindset? A growth mindset is the personal belief that individuals can improve ability through learning and effort; on the contrary, a fixed mindset is the personal belief that ability is an immutable entity that individuals either possess or do not (Dweck, 2000). Research on mindset has shown that environmental stimuli, such as teacher praise (Mueller & Dweck, 1998; Kamins & Dweck, 1999) or reading information on a card (Hong et al., 1999; Schroder, 2014), can affect what type of mindset students go on to display. Because the process of BST consists of the school system telling their students that their educational future is determined by the young ages of 10-15 years old, keeping in mind Bronfenbrenner's

theory of social ecology (Bronfenbrenner, 1979), such a message begs the question of whether the macrosystem of BST countries encourages fixed mindsets within its students. This is the exact question this research is designed to provide insight into: Are students from countries that practice BST significantly more fixed minded than students from comprehensive countries? Although (Hölscher, 2018) conducted a qualitative comparative study using interviews with teachers from the Netherlands and Sweden about the effect of BST on student mindset, no prior study has quantitatively juxtaposed students' mindsets from BST and comprehensive countries. Thus, the current study serves as the first to do so. The current research was also designed to establish whether a decrease in fixed mindset serves as a significant buffer against the negative impact low SES has on student future job expectation, performance in math, and performance in reading.

Participants

There were 104,533 total observations in this study, including students from ten BST countries (Czech Republic, Estonia, France, Germany, Greece, Hungary, Italy, Netherlands, Slovak Republic, and Switzerland - 42,494 observations) and eleven comprehensive countries (Australia, Canada, Denmark, Finland, Iceland, Ireland, Latvia, New Zealand, Sweden, United Kingdom, and United States - 62,039 observations). All variables were obtained from the PISA 2018 dataset. Only countries recognized as developed nations were included in the analysis to help control for what is meant by a low SES student (OCED, 2023).

Study 1

The feature analysis of study 1 was the effect of Educational Policy on Student Mindset. Key independent variables were School Type (dichotomous - students in university school or non-university school), Student SES (continuous – Highest Parental Occupation Status was used to measure this), Educational Policy (dichotomous - students from comprehensive countries [“0”] or BST countries [“1”]), Immigration Status (categorical - natural born citizens, 1st generation immigrants, 2nd generation immigrants), and Sex (dichotomous - male or female). The dependent variable was mindset (continuous – higher levels of mindset indicate an increase in fixed mindset).

Dependent Variable	Coef. (Standard Error)
Mindset	
School Type (Non-Uni School)	0.05* (0.03)
Student SES	-0.003*** (0.0001)
Educational Policy (BST)	0.16*** (0.006)
School Type * HPOS	0.00005 (0.0005)

School Type * Educational Policy	0.04 (0.03)
2 nd gen (Immigration Status)	-0.07*** (0.01)
1 st gen (Immigration Status)	0.01 (0.01)
Sex (Male)	0.03*** (0.005)
Constant	-0.08 (0.005)
Adjusted r Square	1.90%

* $p \leq 0.1$; ** $p \leq 0.001$; *** $p \leq 0.0001$

Table 1. Effect of Educational Policy on Student Mindset

Contrary to prior research (Glerum et al., 2019; Glerum et al., 2020), the current study found that students in non-university schools were significantly more fixed minded than students in the university school. The finding that an increase in HPOS led to a decrease in student fixed mindset is a replication of past research (Claro et al., 2016; Destin et al., 2019). The finding that 2nd-generation born immigrants were significantly less fixed minded than natural born citizens could help explain the “strong determination – weak performance” found in second generation non-European immigrants in past research (Jonsson & Rudolphi, 2011). Prior research on gender difference has shown that boys were significantly more likely to be tracked into non-university schools in BST countries because they mature more slowly than girls (Lehmann & Peek, 1997; Jürges & Schneider, 2011). Other research on gender difference has revealed that boys are significantly more likely to be tracked into non-university schools because school social norms for boys from low SES families tend to align with risky behavior, sports, and opposing authority (Legewie & DiPrete, 2012). This same research went on to state that school social norms for girls across all SES statuses as well as middle and upper-middle class boys tend to align with academic success. Collectively, these findings could help explain why male students were significantly more fixed minded than female students. The feature finding of study 1 was that, as hypothesized, BST students were significantly more fixed minded than students from comprehensive countries. The finding does come with three key limitations. The first is that the proper way to measure the effect of BST on student mindset would be to use the same difference in differences analysis as Hanushek and Wößmann did in 2006. It was not possible to run this analysis because the PIRLS and TIMSS datasets, the main datasets that measure student variables at age 9 (before tracking age in BST countries), do not measure student mindset. Thus, the difference in differences analysis could not be conducted. The next limitation is that the mindset survey that PISA uses is not the complete 6-question survey (Dweck, 2000), it is simply one question from that survey. Results would be more accurate if PISA uploaded the complete 6-question survey to the dataset. The last limitation of the research was that BST countries

submit more information on students from university schools to the dataset than they do for students from the non-university schools. The lack of having a proportional number of students from both university and non-university schools in BST countries, which better reflects their overall student population, confounds the results of accurately measuring the effect of BST on student mindset. This lack of proportional numbers of students from the university school and non-university schools in BST countries could also help explain why the adjusted r square is relatively low.

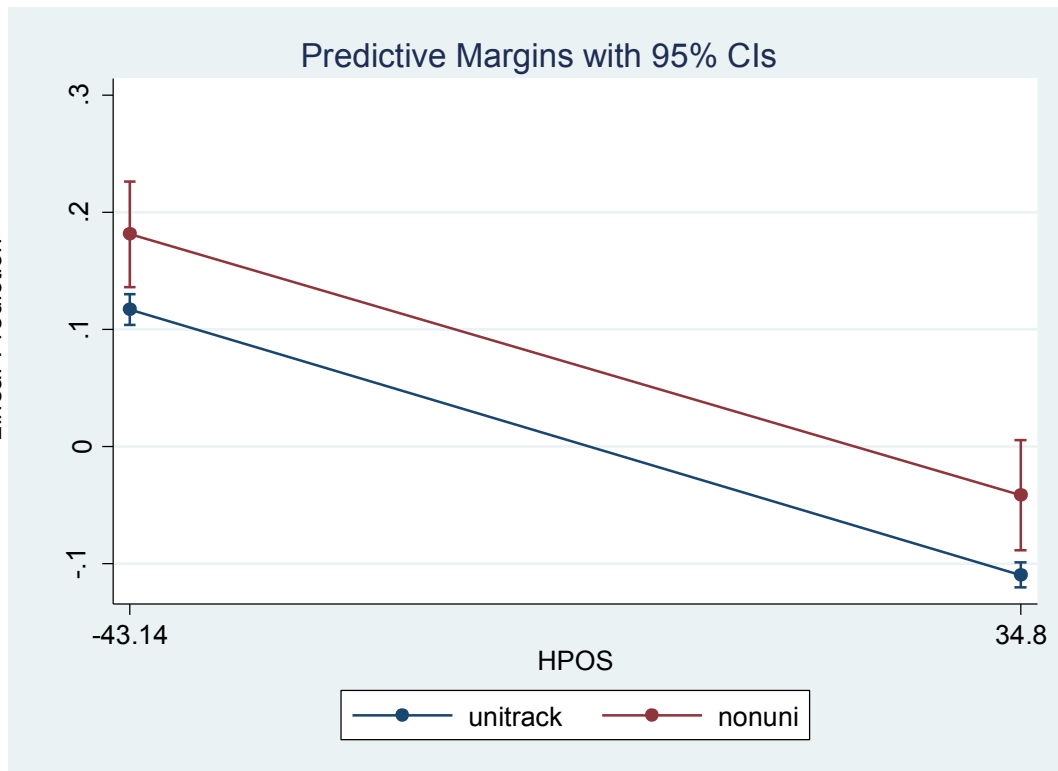


Figure 1: Effect of SES on Mindset Depending on School Type

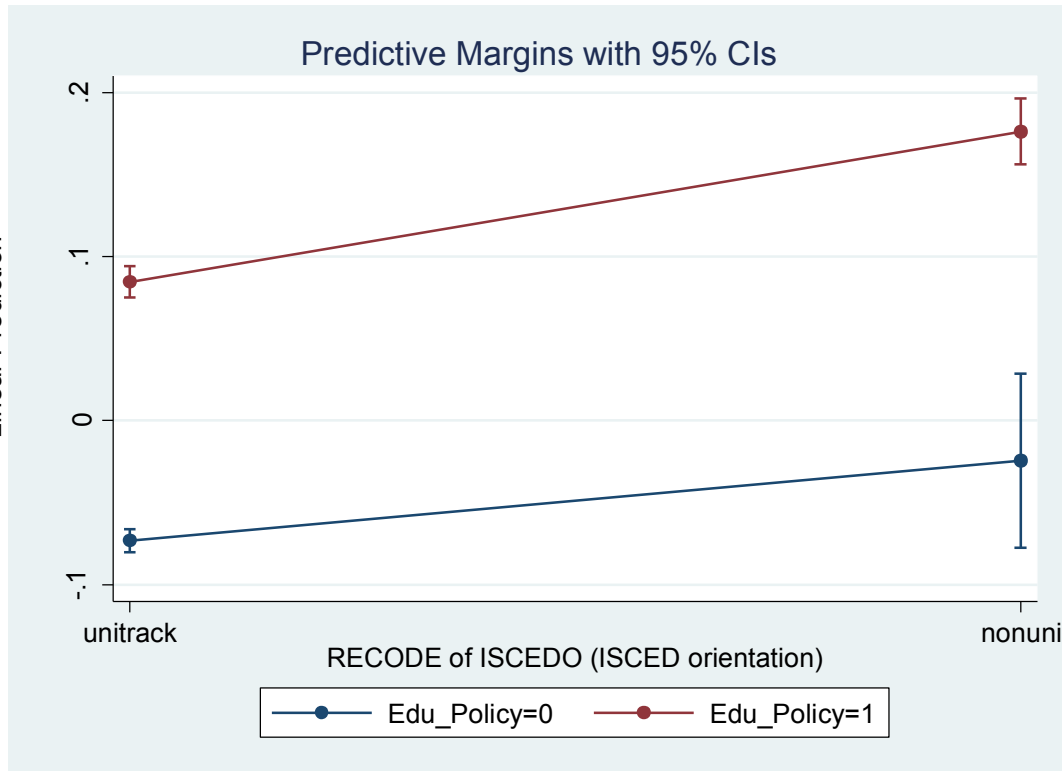


Figure 2: Effect of School Type on Mindset Depending on Educational Policy

Study 2

The feature observation of study 2 was measuring whether being less fixed minded would serve as a buffer against the negative impact low SES has on future job expectation. New independent variables included student mindset (continuous), and performance in math and reading (both continuous). All other independent variables used were the same as study 1. The dependent variable of study 2 was future job expectation (continuous).

Dependent Variable	Coef. (Standard Error)
Future Job Expectation	
Mindset	-0.79*** (0.07)
Track Placement (Non-Uni School)	-8.02*** (0.20)
Student SES	0.13*** (0.003)
Track Placement * Mindset	0.32 (0.21)

Fixed * HPOS	0.02*** (0.003)
2 nd Gen	6.59*** (0.20)
1 st Gen	7.21*** (0.23)
Sex (Male)	-6.63*** (0.12)
Educational Policy (BST)	-0.86*** (0.13)
Read	0.03*** (0.001)
Math	0.04*** (0.001)
Constant	3.48 (0.10)
Adjusted r Square	22.04%

* $p \leq 0.1$; ** $p \leq 0.001$; *** $p \leq 0.0001$

Table 2. Does Being Less Fixed Minded Serve as a Buffer against the Negative Effect Low SES has on Future Job Expectation?

Although mindset research has generally been applied to educational aspirations rather than future job expectation, results between the two variables have varied (Ahmavaara & Houston, 2007; Glerum et al., 2019; Glerum et al., 2020; Laurell et al., 2022). As seen in table 2, an increase in student fixed mindset predicted significantly lower future job expectation. As expected, students in non-university schools had significantly lower future job expectations than students in university schools. Similarly, students from BST countries had significantly lower future job expectations than students from comprehensive countries. The relationship between student SES status and future job expectation has been well documented, and results from the current research replicated the past finding that students from lower SES households had significantly lower future job expectation (Cook et al., 1996; Schoon & Parsons, 2002; Bigler et al., 2003; Howard et al., 2011). Research on the effect of gender on educational and career aspirations has been mixed (Marini, 1978; Mau & Bikos, 2000; Mendez & Crawford, 2002; Powers & Wojtkiewicz, 2004; Chang et al., 2006; Patton & Creed, 2007; Perry et al., 2009; Howard et al., 2011; Watt et al., 2012; Salmela-Aro & Upadyaya, 2017). Results of the current research revealed that females had significantly higher future job expectation than males. This finding is likely to at least be partially explained by the phenomena that boys are more likely to be tracked into non-university schools than girls in BST countries (Lehmann & Peek, 1997; Jürges & Schneider, 2011; Legewie & DiPrete, 2012). Past research has also

shown that academic performance predicts higher educational and career aspirations (Shapka, Domene, & Keating, 2006; Savolainen, Ahonen, Aro, Tolvanen, & Holopainen, 2008; Guo, Marsh, Morin, Parker, & Kaur, 2015; Korhonen et al., 2016; Widlund et al., 2020), and the current research replicated that finding. Regarding the significant interaction, - at least according to my literature review - this study serves as the first of its kind to show that a decrease in fixed mindset served as a buffer against the negative impact low SES had on future job expectation.

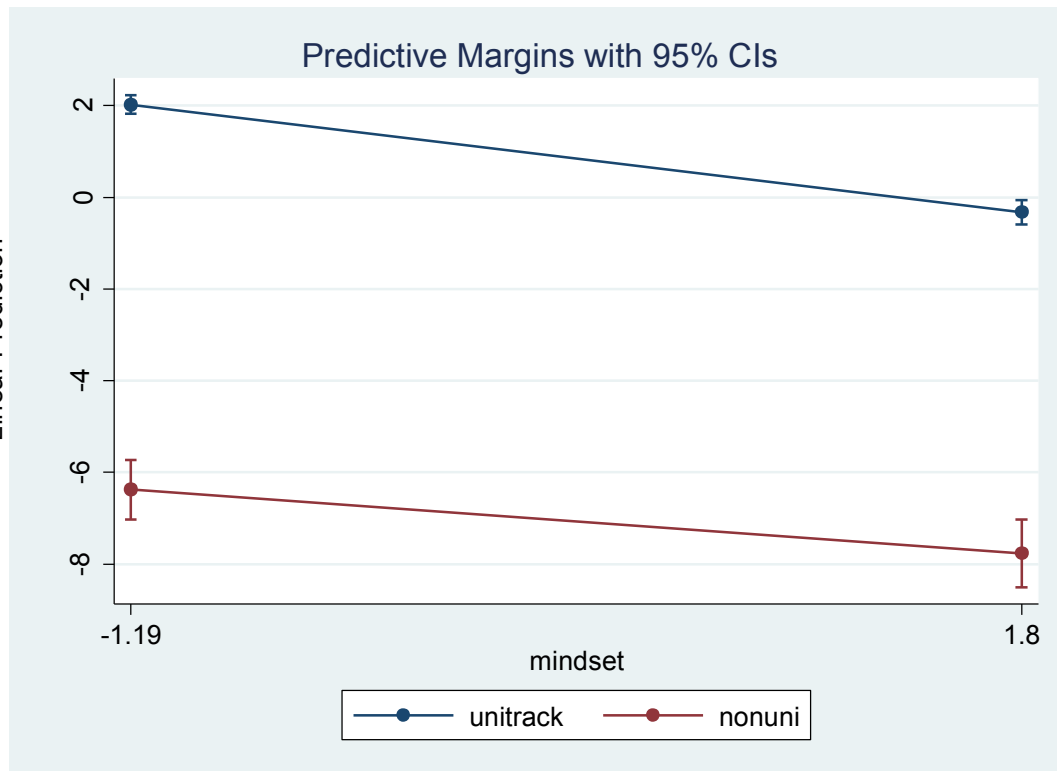


Figure 3: Effect of Mindset on Future Job Expectation Depending on School Type

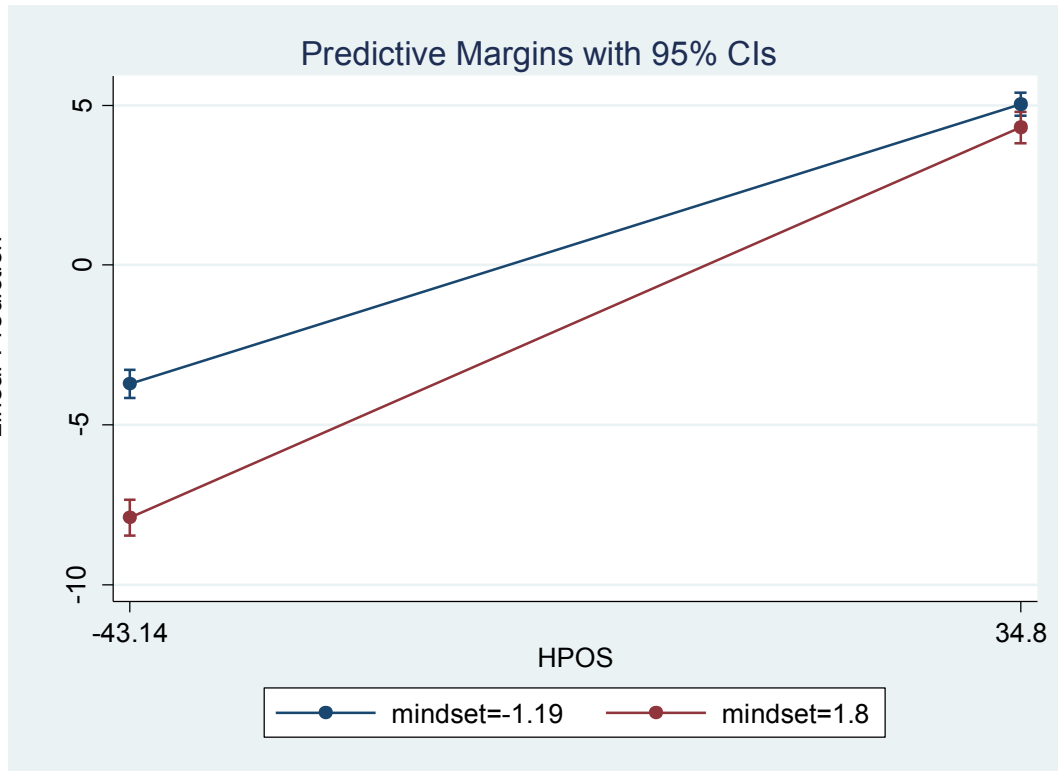


Figure 4: Effect of SES on Future Job Expectation Depending on Mindset

Studies 3 and 4

No new independent variables were added for studies 3 or 4. The dependent variables were performance in math and reading (both continuous), respectively.

Dependent Variable	Coef. (Standard Error)
Performance in Math	
Mindset	-14.16*** (0.28)
Track Placement (Non-Uni School)	-34.02*** (0.83)
Student SES	1.15*** (0.01)
Track Placement * Mindset	2.81** (0.88)
Mindset * HPOS	0.11*** (0.01)

2 nd Gen	-5.42*** (0.82)
1 st Gen	-5.49*** (0.94)
Sex (Male)	11.87*** (0.47)
BST	14.13*** (0.51)
Constant	-7.05 (0.39)
Adjusted r Square	15.28%

* $p \leq 0.1$; ** $p \leq 0.001$; *** $p \leq 0.0001$

Table 3. Does Being Less Fixed Minded Serve as a Buffer against the Negative Effect Low SES has on Performance in Math?

Dependent Variable	Coef.
Performance in Reading	(Standard error)
Mindset	-19.08*** (0.32)
Track Placement (Non-Uni School)	-42.43*** (0.96)
Student SES	1.16*** (0.01)
Track Placement * Mindset	4.61*** (1.002)
Mindset * HPOS	0.14*** (0.01)
2 nd Gen	-5.97*** (0.95)

1 st Gen	-13.63*** (1.07)
Sex (Male)	-23.55*** (0.53)
Educational Policy (BST)	-1.05* (0.58)
Constant	17.90 (0.45)
Adjusted r Square	16.55%

* $p \leq 0.1$; ** $p \leq 0.001$; *** $p \leq 0.0001$

Table 4. Does Being Less Fixed Minded Serve as a Buffer against the Negative Effect Low SES has on Performance in Reading?

Past research has shown that students with a growth mindset outperform students with a fixed mindset (Stipek & Gralinski, 1996; Blackwell et al., 2007; Romero et al., 2014; Alvarado et al., 2019); while other research has failed to replicate this finding (Li & Bates, 2019; Bahník & Vranka, 2017). Studies 3 and 4 support the finding that a decrease in fixed mindset significantly predicted higher academic performance in both math and reading. Non-university school students have a less challenging curriculum than university school students (Betts & Grogger, 2003), so it was expected to find that they performed significantly worse at math and reading than the university school students. Prior research has also found that low SES predicts significantly worse academic achievement (Coleman, 1966; White et al., 1993; Sirin, 2005; Reardon, 2011; Berkowitz et al., 2017;), and studies 3 and 4 replicated this finding. Studies 3 and 4 also replicated the finding that immigrants perform significantly worse than their natural born citizen counterparts (Warren, 1996; Rumberger & Thomas, 2000; Portes & Rumbaut, 2001; Riphahn, 2003; Fekjaer, 2007; Heath & Brinbaum, 2007; Lutz, 2007; Phalet et al., 2007; Rothon, 2007; Støren & Helland, 2010; Jonsson & Rudolphi, 2011; Dicks & Lancee, 2018) as well as the finding that female students tend to outperform males in reading and male students tend to outperform females in math (Spencer et al., 1999; Ma, 2008; Marks, 2008; Shafiq, 2013; Stoet & Geary., 2013; Schwabe et al., 2014; OCED, 2015; Cobb-Clark & Mosochion, 2017; Kim & Kwak, 2018). A literature review could not find any past studies indicating that BST countries were significantly better at math than comprehensive countries nor that comprehensive countries were significantly better at reading than BST countries; thus, this finding could be the result of chance rather than educational policy. Moreover, as previously stated, BST countries submit more information on students from university schools to the PISA dataset than they do for students from the non-university schools. The lack of having a proportional number of students from both university and non-university schools in BST countries could have confounded the results of this finding. Studies 3 and 4 also provided evidence that the least fixed minded students in non-university schools performed better at math and reading than the most fixed minded students in the university school. Prior research on this interaction could not be found. Past research has also found that having a growth mindset serves as a significant buffer against the negative impact low socioeconomic status had on academic performance (Claro et al., 2016).

Similarly, Destin et al., (2019) found that student fixed mindset predicted lower academic performance in both high and low SES students. Other research has shown that having a growth mindset only benefits students from higher SES families (Bernardo, 2020; King & Trinidad, 2021). Studies 3 and 4 from this research replicated the findings from Claro et al., (2016) and Destin et al., (2019) in that being less fixed minded served as a significant buffer against the negative impact coming from a low SES had on performance in math and reading.

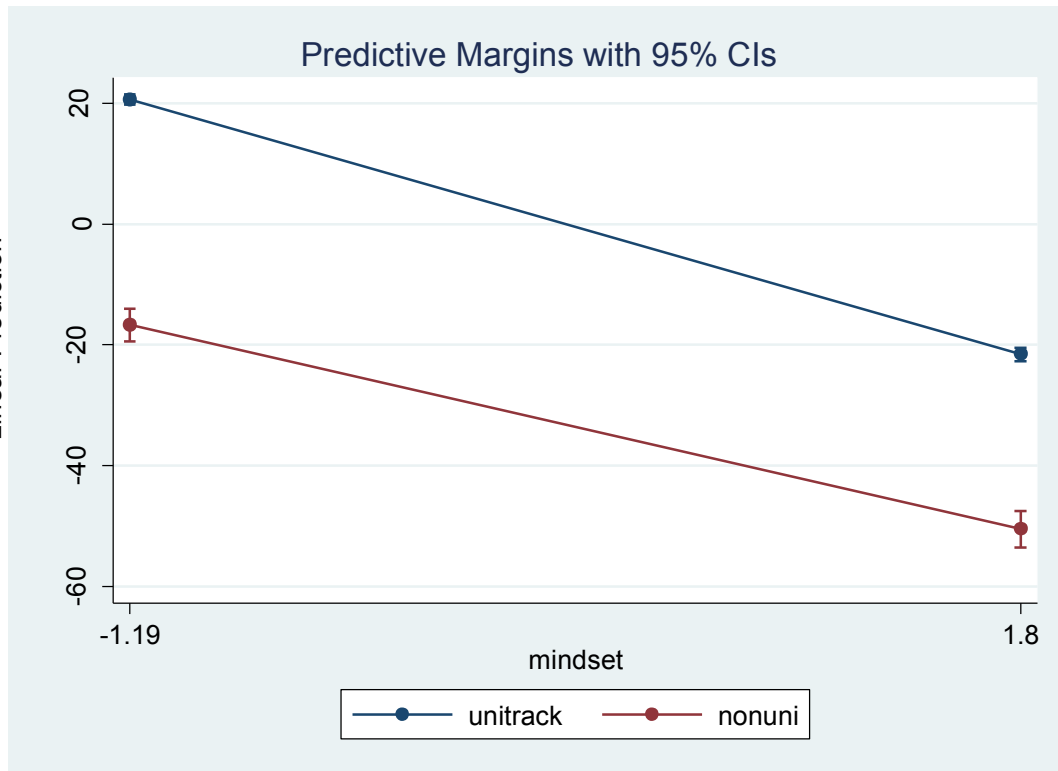


Figure 5: Effect of Mindset on Performance in Math Depending on School Type

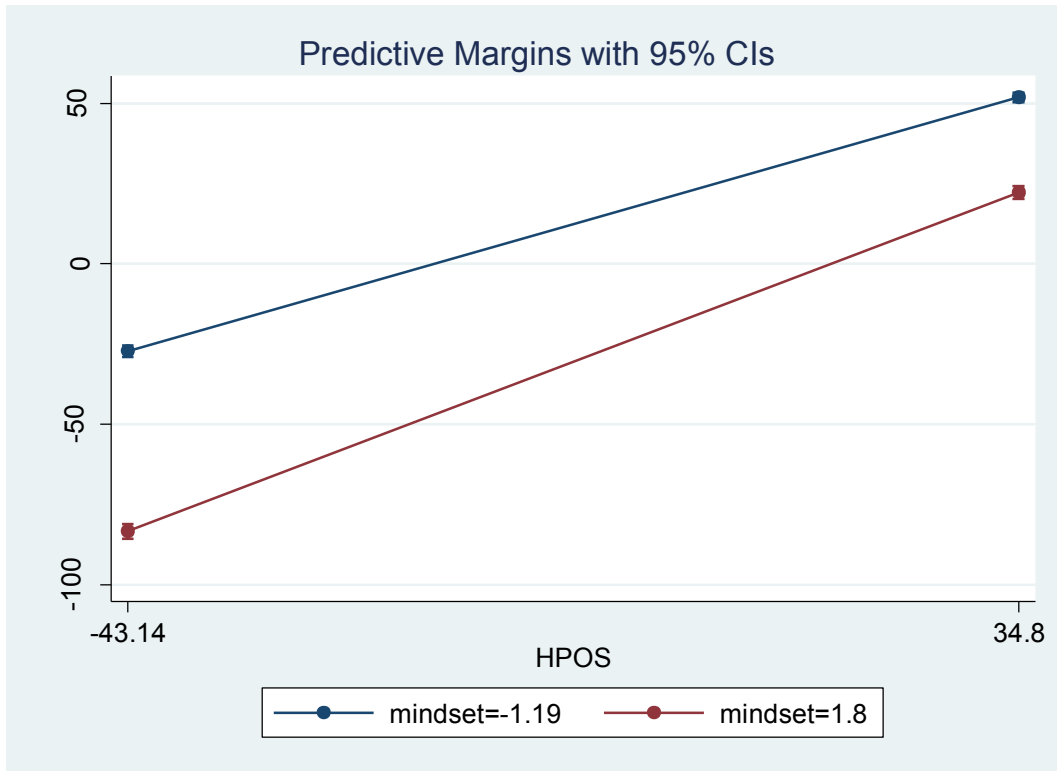


Figure 6: Effect of Mindset on Performance in Math Depending on SES

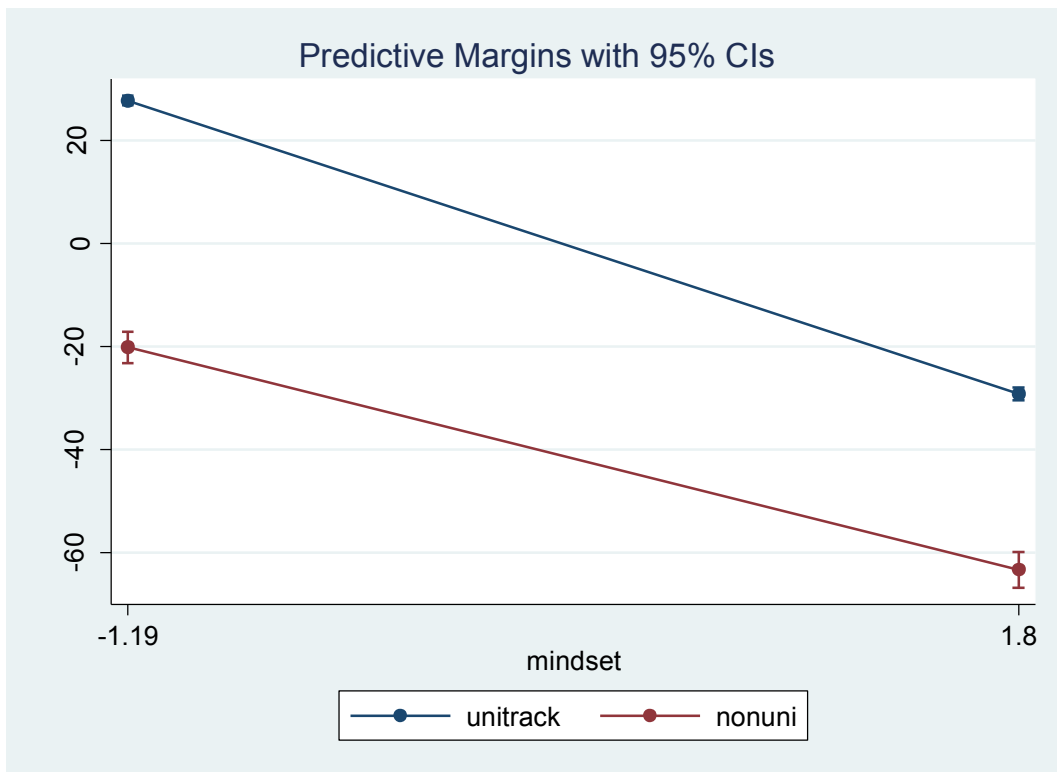


Figure 7: Effect of Mindset on Performance in Reading Depending on School Type

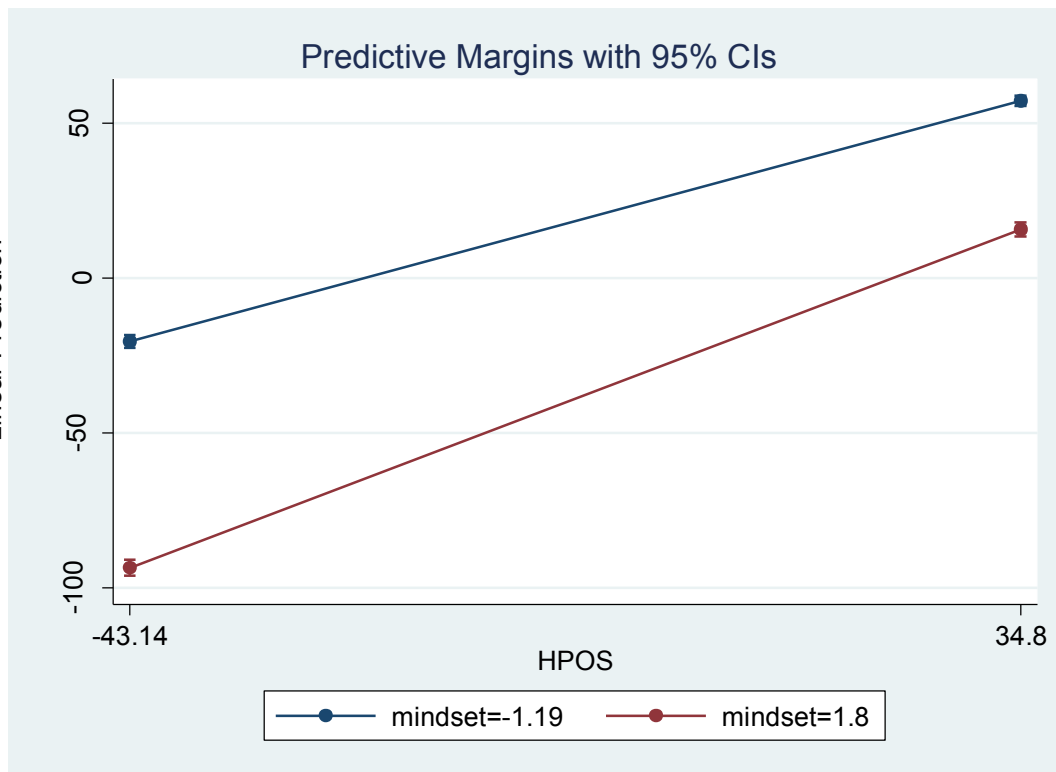


Figure 8: Effect of SES on Performance in Reading Depending on Mindset

Beginning at the turn of the 21st century, mindset interventions – interventions designed to make students more growth minded - received early success in the United States (Aronson et al., 2002; Good et al., 2003; Blackwell et al., 2007). Researchers eventually designed “scaled-up” versions of these mindset interventions to intervene with many students at once (Paunesku et al., 2015; Yeager et al., 2016). On the contrary, a meta-analysis using studies from all over the world found that mindset interventions were only effective in at risk or low SES students (Sisk et al., 2018). However, Sisk et al., (2018) failed to take educational policy into consideration. In 2017, Orosz et al., conducted a mindset intervention in Hungary (a BST country). Results revealed that students in the growth mindset intervention were significantly more growth minded than students in the control group post-intervention, but this significant difference disappeared by the end of semester follow up. Although one could criticize this research for only including higher performing students in their sample, it must be questioned whether mindset interventions can be effective in BST countries at all. After all, the results of their research do fit the model of classical conditioning (Pavlov, (1927/1960). The results of study 1 provided preliminary evidence that students from BST counties were significantly more fixed minded than students from comprehensive countries. I hypothesized that this is likely due to the macrosystem or educational culture of BST countries. For example, school serves as a neutral stimulus for a young student in a BST country who has not yet learned about the process of tracking. However, the student will eventually learn from their teachers or parents that “at the age of x years old, the process of tracking will determine your educational future”. This is a fixed unconditional stimulus paired alongside what was previously a neutral stimulus, which theoretically should cause the unconditioned response of “my educational future is determined at x years old”. Henceforth, whenever the student thinks about or goes to school (CS), the concept that they will be tracked at age x will be on their mind (CR).

(NS) School + (US) “you will be tracked at age x” (UR) “my educational future is determined at age x”
(CS) Going to or thinking about school (CR) “my educational future is determined at age x”

Given the results of Orosz et al., (2017), this could be what is happening with BST students. The mindset intervention did make students more growth minded post-intervention, this could be viewed as the process of extinction (Pavlov, 1927/1960). In other words, the mindset intervention caused the fixed beliefs of intelligence to become extinct within participants. However, after the intervention students returned to their normal educational culture, and their mindset levels returned to base level. This could be viewed as spontaneous recovery (Pavlov, 1927/1960). Although I am not an expert in classical conditioning, given the findings of study 1, experts on the matter should consider if mindset interventions have the potential to be successful in countries that practice the educational policy of BST. Perhaps the effect of BST on the psychology of students is too powerful for mindset interventions to have any long-term success in these countries.

Conclusion

Researchers have also found that the process of BST puts students from lower SES (Bouon, 1974; Contini & Scagni, 2011; Ichou & Vallet 2011; Schneider & Tieben, 2011; Panichella & Triventi, 2014), male students (Lehmann & Peek, 1997; Jürges & Schneider, 2011), and students from younger birth months (Jürges & Schneider, 2011; Schneeweis & Zweimüller, 2014) at a significant disadvantage. Based on my literature review, there were no studies that justify any of these disadvantages associated with the process of BST. Moreover, my research provided preliminary evidence that students from BST countries were significantly more fixed minded than students from comprehensive countries, and that being less fixed minded served as a significant buffer against the negative impact low SES had on future job expectation, performance in math, and performance in reading. These findings collectively argue that the process of BST should be abolished, and researchers should establish new ways to modernize this outdated practice.

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