



Motivation and Achievement in Confucian Heritage Cultures

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Motivation and Achievement in Confucian Heritage Cultures

A Dissertation

presented by

Kaity Kao

to

The Committee on Higher Degrees in Education

in partial fulfillment of the
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Motivation and Achievement in Confucian Heritage Cultures

Abstract

Growth mindset (belief in the malleability of intelligence), mastery goal orientation (pursuing a task for its own sake), and intrinsic motivation (engaging in an activity due to interest) are three main motivation constructs that tend to positively predict achievement. However, a growing number of studies have found conflicting results in the Confucian Heritage Cultures (CHCs). This dissertation examines the relations between these motivation constructs and achievement by comparing students in the CHCs to those in other countries.

Study 1 examines the relations between these motivation constructs and achievement. Study 2 examines how the value of effort in school mediates the relations between these motivation constructs and achievement. Study 3 focuses on how SES and gender moderate the relation between growth mindset and achievement. These studies find that although growth mindset tends not to predict achievement in CHCs, value of effort in school positively predicts achievement in these contexts, suggesting that growth mindset and value of effort in school are distinct constructs. In addition, SES moderates the association between growth mindset and achievement in some CHCs, with particularly interesting results in China, where this association is positive for low SES students and negative for high SES students. Lastly, unlike growth mindset and mastery goal orientation, intrinsic motivation positively predicts achievement across CHCs and other countries. Ultimately, these findings suggest that the relations between growth mindset/mastery goal orientation and achievement vary across different contexts, while intrinsic motivation may be the most generalizable of the three motivation constructs.

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Introduction

In the field of motivation, research predominantly shows that the constructs of growth mindset, mastery goal orientation, and intrinsic motivation have a positive association with achievement. Growth mindset is the belief in the malleability of intelligence; mastery goal orientation involves pursuing a task for its own sake or for the purpose of becoming a more competent learner; and intrinsic motivation is pursuing an activity out of pure interest or enjoyment (Dweck, 1986; Dweck & Leggett, 1988; Deci & Ryan, 1985). Moreover, these findings have not only influenced thinking within academia, but have also reached practitioners around the world, who encourage their students to develop growth mindsets and mastery goal orientations, and to nurture their intrinsic motivation toward academic pursuits (Blad, 2016; Cooper, 2018; OECD, 2019; Hennessey, 2015).

However, the majority of studies in the literature have been conducted on middle-class individuals in Western societies, otherwise known as WEIRD people (Western, Educated, Industrialized, Rich and Democratic), and a growing body of evidence that suggests that these motivation constructs may not have a positive association with achievement for students across all contexts (Henrich et al., 2010). In particular, students in Confucian Heritage Cultures (CHCs) appear to have a different relation between motivation and achievement when compared to those in the majority of the literature. The CHCs, which include the countries and territories China, Hong Kong, Japan, Korea, Macau, Singapore, Taiwan, and Vietnam, share a common Confucian heritage, a reverence for education, and a greater emphasis on adhering to the expectations of one's parents, teachers, and greater society, often at the expense of one's personal interests (Guo, 2015; Sun et al., 2019). These aspects of Confucianism contrast with many of the WEIRD countries that emphasize the need to prioritize one's own interests over that of others (Qu et al.,

2016; Ma & Schoeneman, 1997; Markus & Kitayama, 1991). Because students are seen as extensions of their families rather than as lone individuals, there is a greater expectation for students to do what their families expect rather than what they would personally like to do (Watkins & Biggs, 1996; Chin, 1988). As a result, students may focus on tangible goals valued by families and society, such as attending a top university or finding a high paying job, rather than pursuing their personal interests (Salili et al., 2001; Salili, 1996; Winter, 1996; Llewellyn et al., 1982). Although these goals are also important in many other countries such as the US, there is still a greater emphasis on pursuing one's interests in those countries when compared to the CHCs (Qu et al., 2016; Wang & Pomerantz, 2009). Even if they do not have an intrinsic interest in a task, students in CHCs will often work hard at the task if it is deemed valuable by parents, teachers, or society (Lu, 2011; Cheng, 2019).

As a result, a small but growing number of studies have found that growth mindset and intrinsic motivation do not positively predict achievement in CHCs (Li & Bates, 2019; Wang et al., 2020; OECD, 2019; Lu, 2011; Cheng, 2019), while other studies still find that they do predict achievement (Li et al., 2020; Wang et al., 2020; Lim et al., 2020; Nakayama et al., 2007; You et al., 2016; Wang & Guthrie, 2004). Mastery goal orientation, while closely related to growth mindset, appears to still have a positive association with achievement in these studies (Zhou & Wang, 2019; Ho & Hau, 2008; Shimizu et al., 2016; Song et al., 2020; Lee et al., 2014).

The lack of association between achievement and growth mindset, in particular, may lead one to believe that students in CHCs do not believe in the value of effort. According to growth mindset theory, students with a growth mindset are more likely to believe that effort is important and useful, and thus are more likely to put in the needed amount of effort to succeed (Dweck, 1986; Dweck & Leggett, 1988; Dinger, et al., 2013). Similarly, those with mastery goal

orientation or intrinsic motivation also tend to believe that effort is important and put in the effort necessary for success (Elliot & Harackiewicz, 1996; Dweck & Leggett, 1988; Deci & Ryan, 1985; Deci & Ryan, 2002). As a result, belief in the value of effort positively predicts student achievement in the majority of the findings in the literature (Mrazek, 2018; Blackwell, 2002; Baldrige, 2010; Duco, 2017; Li et al., 2019).

Although growth mindset may not predict achievement for students in CHCs, studies show that CHC students do believe in the value of effort and see effort as essential to academic performance (Huang & O'Neil, 1993; Salili et al., 2011). Because parents in CHCs have high expectations for their children's academic success and consider effort to be the most important means to do well academically, their children are frequently encouraged to make an effort in their studies (Ho, 1986; Lin & Fu, 1990; Mau, 1997; Law, 2009). As a result, these parents and teachers tend to downplay students' successes and provide more negative emotional responses to failures, which encourages students to work even harder (Miller et al., 1997; Ng et al., 2007; Bao & Lam, 2008). Thus, many students in CHCs have a belief that effort leads to increased achievement or ability and therefore believe that effort is important (Huang & O'Neil, 1993; Salili et al., 2011). Chinese students are more likely than US students to attribute success in school to effort (Sun et al., 2021). Not only does belief in the value of effort positively predict achievement in CHCs, but growth mindset, mastery goal orientation, and intrinsic motivation also positively predict belief in the value of effort (Wang et al., 2018; Fryer et al., 2014; Wey, 1999; Hong et al., 2009).

If belief in the value of effort does not explain why growth mindset does not necessarily predict achievement in CHCs, then another possible topic for exploration is how moderators may influence this relation. The lack of association between growth mindset and achievement in

CHCs may lead to questions about whether growth mindset could still be predictive of achievement for particular groups of students in these contexts. Even if there is no relation between growth mindset and achievement for the students overall, perhaps there still could be a positive relation for a subgroup of students, which would complicate our understanding of growth mindset in these contexts.

Studies in the majority of the literature on adolescent motivation and achievement primarily focus on two moderators, SES and gender, and only examine the relation between growth mindset and achievement, whereas moderators have not been examined in the relations between mastery goal orientation and intrinsic motivation with achievement. Given that this topic is still relatively unexamined, there have been no studies conducted on moderators of the relation between growth mindset and achievement in CHCs. Studies examining how SES and gender moderate the association between growth mindset and achievement find varying results. Some studies show that growth mindset positively predicts achievement only among students from high SES families (King & Trinidad, 2021; Bernardo, 2020), while other studies find that growth mindset is positively associated with achievement only for low SES students (Claro et al., 2016; Destin et al., 2019). Still, other studies find that growth mindset does not predict achievement differently among high and low SES students (Destin et al., 2019; Hwang et al., 2016). In addition, the studies on gender as a moderator find that growth mindset positively predicts math achievement only for males (Zhao et al., 2021) or that growth mindset negatively correlates with math achievement only for male students (Heyder et al., 2021), while there is no association for females. Moreover, the majority of the studies do not find any differences between genders in the relation between growth mindset and achievement (Claro et al., 2016; Pierce, 2017; Hwang et al., 2016; Gandhi et al., 2020; Macnamara & Rupani, 2017). Although

there is no prior evidence to guide predictions for CHCs, given that there are differences in the association between growth mindset and achievement between CHCs and other countries, this evidence may suggest that the moderators could behave differently as well. However, it is also possible that these moderators behave the same across all contexts.

Thus, to explore the differences in motivation among CHCs and other countries, this dissertation examines the relations between growth mindset, mastery goal orientation, intrinsic motivation, and achievement in the PISA 2018 data set by comparing CHCs to non-CHCs, a term used to refer to all other countries excluding the CHCs. PISA, which stands for Programme for International Student Assessment, is administered by the Organisation for Economic Co-operation and Development (OECD) to assess the academic achievement of 15-year-old students in many countries around the world. The PISA 2018 data set is particularly appropriate for this study because the OECD released a report stating that they found growth mindset to be a negative or weak predictor of achievement for students in the CHCs, whereas growth mindset positively predicted achievement for all other non-CHCs (OECD, 2019). These intriguing differences between CHCs and non-CHCs call for a more in-depth examination of the relation between motivation and achievement. Besides growth mindset, other motivation constructs collected as part of PISA 2018, such as mastery goal orientation and intrinsic motivation, seem worth exploring. Therefore, Study 1 examines the relations between these motivation constructs and achievement, as well as the relations between the motivation constructs themselves through a serial multiple mediation model. Next, Study 2 examines how the value of effort in school mediates the relations between these motivation constructs and achievement. Lastly, Study 3 focuses on growth mindset exclusively and how SES and gender moderate the relation between

growth mindset and achievement. The results from these studies contribute to the growing body of evidence that motivation is not as generalizable across contexts as once assumed.

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] Motivation and Achievement in Confucian Heritage Cultures

1 Introduction

Growth mindset, the belief that intelligence is malleable, is one of the most widely studied constructs related to motivation because it has been shown to positively predict achievement in many studies (Dweck, 1986, Blackwell et al., 2007; Chen & Pajares, 2010; Henderson & Dweck, 1990; Mueller & Dweck, 1998). Given that growth mindset is such an important measure, it was included in the Programme for International Student Assessment (PISA) 2018 survey and assessment, which was administered by the Organisation for Economic Co-operation and Development (OECD) to assess the academic achievement of 15-year-old students in 79 countries around the world (OECD, 2019a). Growth mindset was also the only motivation construct analyzed and discussed in the PISA report, even though other motivation constructs were measured (OECD, 2019c). Although growth mindset positively predicted achievement for students in most countries in PISA 2018, the report (OECD, 2019c) notes a puzzling finding that growth mindset did not predict or only weakly predicted achievement for students in East Asian countries. However, the report does not provide any explanation for these findings, nor have there been many studies so far providing robust explanations for this finding because growth mindset has not been frequently examined in these countries.

Even still, the results from PISA 2018 and those of a small handful of studies based on other datasets (Li & Bates, 2019; Wang et al., 2020; Sun et al., 2021a) provide some evidence indicating that the students in these countries may experience the relation between growth mindset and achievement differently from the majority of students around the world. This difference is worth examining because the literature primarily suggests that growth mindset

positively predicts achievement, which has encouraged teachers and students around the world to embrace growth mindset without questioning its effectiveness or its applicability to their contexts, often resulting in misunderstanding and misapplication of growth mindset in classrooms (OECD, 2019c). Before it continues to spread into more classrooms, more research needs to be done in order to understand how it relates to achievement and other factors for individuals in different contexts. Because if the results from the PISA 2018 are any indication of the motivations of students in these countries, then they provide strong enough evidence to question the belief that growth mindset improves achievement for all students in all contexts. Other studies that consistently document these discrepant findings would suggest that growth mindset, and perhaps even other motivation constructs, are more context specific than once assumed. This may not come as much of a surprise given that the majority of research in educational psychology has been conducted on middle-class individuals in Western societies, otherwise known as “WEIRD” people - Western, Educated, Industrialized, Rich and Democratic, a body of research that has increasingly been shown to be insufficient in explaining phenomena among people who do not belong to this group (Henrich et al., 2010). Thus, this paper examines the relations between growth mindset and two other motivation constructs, mastery goal orientation and intrinsic motivation, with student achievement in the PISA 2018 data set.

1.1 Growth mindset, mastery goal orientation, and intrinsic motivation predicting achievement

The three motivation constructs examined in this study have emerged from two prominent theories, goal orientation theory and self-determination theory, that are examined in this study. First, goal orientation theory, which was developed by scholars such as Dweck, Elliot, and Harackiewicz, emphasizes the influence of an individual’s goals over his or her behavior

towards learning and suggests that successful learners tend to engage in tasks when concerned about mastering the content or task (Dweck & Leggett, 1988; Ames, 1992; Elliot & Harackiewicz, 1996). Within goal orientation theory, Dweck popularized the concept that one's growth mindset regarding the malleability of intelligence leads to the development of a mastery goal orientation, which involves acquiring knowledge and skills for the purpose of becoming a more competent learner. Next, self-determination theory identifies the factors that affect motivation to include feeling competent at the task or subject, having autonomy over one's actions and the desire to relate to others (Deci & Ryan, 1985; Deci & Ryan, 2002). According to self-determination theory, successful learners tend to have intrinsic motivation, which involves behavior that is driven by internal rewards such as genuine interest in the task or subject or one's personal development irrespective of external rewards (Deci & Ryan, 1985; Deci & Ryan, 2002).

Growth mindset refers to the implicit or incremental theory of intelligence, which is defined as individuals' personal conceptions about the nature of intelligence (Sternberg et al., 1981). According to this theory, individuals can have either a growth mindset, the belief that intelligence is malleable, or a fixed mindset, the belief that intelligence cannot be changed, but not both at once (Dweck, 1986; Dweck, 2000). Studies show that having a growth mindset positively predicts achievement in the majority of studies, while having a fixed mindset negatively predicts achievement (Blackwell et al., 2007; Chen & Pajares, 2010; Henderson & Dweck, 1990; Mueller & Dweck, 1998). Individuals with a growth mindset are more likely to think about their achievement in terms of possibilities to extend their capabilities, and thus tend to focus on increasing their knowledge through practice and persistence rather than thinking of themselves as limited by their abilities (Dweck & Leggett, 1988; Dinger, et al., 2013). On the other hand, individuals with a fixed mindset tend to focus on demonstrating their adequacy or

avoiding inadequacy when engaged in academic tasks (Dweck & Leggett, 1988; Dinger, et al., 2013). When individuals are successful at a task, those with growth and fixed mindset tend to behave similarly academically (Dweck, 2002; Grant & Dweck, 2003). However, when faced with a challenge, individuals with growth mindsets see the opportunity to expand their intelligence by learning new skills or knowledge (Blackwell et al., 2007; Hong et al., 1999), whereas individuals with fixed mindsets see challenge as an indication of their inadequacy, and thus withdraw from the task or activity to protect their egos (Hong et al., 1999).

The predecessor to growth mindset theory is goal orientation theory, which was first developed by Dweck and other scholars to highlight the influence of an individual's goals over his or her behavior towards learning (Dweck & Leggett, 1988; Ames, 1992; Elliot & Harackiewicz, 1996). According to this theory, there are two types of orientations that one can adopt towards learning which are not mutually exclusive: mastery or performance goal orientations. A mastery goal orientation leads to acquiring knowledge and skills for the purpose of becoming a more competent learner, whereas a performance goal orientation leads to seeking opportunities to demonstrate skills or knowledge in a competitive approach (Elliot & Harackiewicz, 1996; Dweck & Leggett, 1988). Mastery goal orientation tends to positively predict achievement because students with a mastery goal orientation engage in more effective learning strategies, such as learning from their mistakes, changing ineffective strategies, and seeking help (Elliot & Harackiewicz, 1996; Dweck & Leggett, 1988). The majority of studies in the field show that mastery goal orientation positively predicts achievement (Dweck & Elliott, 1983; Harackiewicz, et al., 1997; Harackiewicz et al., 2000; Harackiewicz, et al., 2002).

The third motivation construct examined in this study is intrinsic motivation, a type of motivation according to self-determination theory identifies the factors that affect motivation to

include feeling competent at the task or subject, having autonomy over one's actions and the desire to relate to others (Deci & Ryan, 1985; Deci & Ryan, 2002). According to self-determination theory, there are two types of motivation which are not mutually exclusive: intrinsic vs. extrinsic. Intrinsic motivation involves behavior that is driven by internal rewards such as genuine interest in the task or subject or one's personal development irrespective of external rewards (Deci & Ryan, 1985; Deci & Ryan, 2002). Intrinsic motivation tends to positively predict achievement because intrinsically motivated students engage in an activity purely for enjoyment and tend to persist in the activity even in the presence of negative feedback such as failure, or the absence of positive feedback such as external affirmation (Deci & Ryan, 1985; Deci & Ryan, 2002). Intrinsic motivation positively predicts achievement in the majority of studies (Guthrie et al., 2013; Froiland & Davison, 2016; Niehaus et al., 2012). Like performance goal orientation, extrinsic motivation is not examined in this study due to the limitations of the PISA survey which does not include a measure of this construct (PISA, 2018).

1.2 Relations between growth mindset, mastery goal orientation, and intrinsic motivation

In addition to studies that show that growth mindset, mastery goal orientation, and intrinsic motivation predict achievement, other studies also find associations between these motivation constructs. First, growth mindset is associated with mastery goal orientation. The connection between growth mindset has been well established primarily by Dweck who has published extensively about both constructs (Dweck, 1986; Dweck & Leggett, 1988; Dweck & Molden, 2017). Because students with a growth mindset believe that intelligence is malleable, they think of their achievement situations as possibilities to expand their abilities rather than as evaluations of their abilities (Dweck, 1986; Dweck & Leggett, 1988). As a result, students with a

growth mindset also tend to have a mastery goal orientation, which focuses on mastering a task for its own sake and not to compete with others or avoid failure (Dweck & Molden, 2017).

Next, studies have also found an association between mastery goal orientation and intrinsic motivation. Individuals wanting to master a task or skill for the sake of mastery tend to have an intrinsic interest that does not involve trying to please others or avoid failure. Thus, mastery goal orientation tends to lead to an increased desire to approach tasks, particularly challenging ones, and to support feelings that one has control over a situation, which are all factors that facilitate intrinsic motivation (Deci & Ryan, 1985; Dweck, 1986; Rawsthorne & Elliot, 1999). Mastery goals have been shown to predict intrinsic motivation in the majority of studies (Bieg et al., 2017; Elliot & Harackiewicz, 1996; Elliot & Church, 1997).

Lastly, although not as frequently examined, some studies have found that growth mindset predicts intrinsic motivation (Karlen et al., 2019; Heyder et al., 2020). A possible explanation for this finding is that students who believe that their intelligence can increase due to effort are more likely to persist in engaging in the task, which increases the likelihood that they will also enjoy the task over time, thus developing their intrinsic motivation as well (Wolters, 2003; Dweck 2000).

1.3 Motivation as mediating constructs

Although small in number, studies have produced findings in support of mediation models explaining the relation between motivation and achievement. One type of mediation is partial mediation, in which a variable has both a direct and an indirect association with an outcome variable via a mediator (Baron & Kenny, 1986). A particular case of partial mediation with multiple mediators where one mediator also predicts another is called serial multiple mediation (Hayes, 2013).

Some studies have found that mastery goal orientation partially mediates the relation between growth mindset and achievement (Blackwell et al., 2007; Hong et al., 2015). Intrinsic motivation also partially mediates the relation between mastery goal orientation and achievement (Cerasoli & Ford, 2014; Leung et al., 2014). Lastly, although infrequently studied, intrinsic motivation has also been shown to partially mediate the relation between growth mindset and achievement related measures (Renaud-Dube et al., 2015). Another variation on the partial mediation model is the serial multiple mediation model which not only accounts for multiple mediators but also accounts for the mediators predicting one another. Currently, no studies have examined a serial multiple mediation model between growth mindset, mastery goal orientation, intrinsic motivation, and achievement. However, a combination of all of the three partial mediation models above calls for the examination of a serial multiple mediation model in which growth mindset predicts achievement through the mediators mastery goal orientation and intrinsic motivation, with mastery goal orientation also predicting intrinsic motivation (Blackwell et al., 2007; Hong et al., 2015), and intrinsic motivation partially mediating the relation between mastery goal orientation and achievement (Cerasoli & Ford, 2014; Leung et al., 2014). Although no studies combine all of these partial mediation models in one paper, the mediation studies referenced above as well as the other studies referenced throughout the paper have provided evidence in support of each of the paths of a serial mediation model, which may suggest that a serial mediation model could also explain the relations between these motivation constructs and achievement.

Some studies shed light on why mediation may explain the relations between motivation and achievement. According to Blackwell, Trzesniewski, and Dweck (2007), individuals with growth mindset develop stronger mastery goal orientation, because they tend to believe that

putting in effort allows them to achieve their goals. They are also more likely to change strategies when they fail than those with a fixed mindset, all of which tends to lead to higher achievement scores for those with a growth mindset (Blackwell et al., 2007). In addition, according to Cerasoli and Ford (2014), intrinsic motivation is a mediator in the relation between mastery goal orientation and achievement because mastery goals give individuals who are intrinsically motivated additional purpose and focus in their pursuit of achievement (Elliot & Church, 1997, Maehr & Nicholls, 1980). Moreover, because some individuals could persist at an activity out of intrinsic interest but perform poorly, mastery goal orientation should mediate the relationship between intrinsic motivation and achievement because it focuses one's efforts on activities that are relevant to competence, rather than mere interest (Maehr & Nicholls, 1980; Rawsthorne & Elliot, 1999). Thus, mediation models are examined in this study are informed by the existing evidence.

1.4 Confucian Heritage Cultures

Although the PISA 2018 report refers to East Asian countries, the term Confucian Heritage Culture (CHC) may be more appropriate to use given that it emphasizes the shared dominant culture of these countries rather than their geographic location (Sun, 2012; Sheunck, 2015; Carlson, 1998). The CHCs have a shared dominant Confucian heritage that has permeated the educational attitudes, behaviors, and attainment of individuals in these contexts (Sheunck, 2017; Carlson, 1998; Guo, 2015; Marginson, 2011; Tran, 2013; Lau, 2014). The full list of CHCs, frequently cited in the literature, include the countries and territories China, Hong Kong, Japan, Korea, Macau, Singapore, Taiwan, and Vietnam (Carson, 1998; Nguyen et al., 2006; Turner, 2011; Guo, 2015). Among the CHCs, only China, Japan, Korea, Singapore, and Vietnam are considered officially recognized countries. Hong Kong and Macau are both special

administrative regions governed by China, and Taiwan is an independently governed place without nation status (Wang, 2020).

The CHCs have been grouped together due to a common culture rooted in the teachings of Confucius. Confucius (551–479 BCE) is one of the most, if not the most, well-known Chinese philosopher whose teachings have influenced generations of people across many countries in Asia. His teachings reflect the values of the Xia (c. 2070–1600 BCE), Shang (c. 1600–1046 BCE) and Zhou dynasties of China (c. 1046–256 BCE) (Guo, 2015). Due to China's influence on its neighboring regions and countries through political takeovers or migrations, Confucian teachings spread to all of the CHCs at some point in time (Li, 2003; Guo, 2015). Although the extent of its influence is difficult to gauge, the literature recognizes that Confucianism has contributed to the development of cultural norms in all of the CHCs, particularly in regard to education (Carson, 1998; Nguyen et al., 2006; Turner, 2011; Guo, 2015). According to Confucian teachings, the main goal of learning is to make the learner more moral and to contribute to society after having received an education (Li, 2003). Education is seen as necessary for personal improvement, as well as the improvement of society as a whole. As a result, students educated in this tradition tend to be highly motivated to learn and willing to invest a great deal of time in their education, as their peers, parents, teachers, and society all encourage them to pursue learning opportunities to the best of their abilities (Guo, 2015). Confucianism also emphasizes respect for elders in addition to dedication to one's studies (Sun et al., 2019).

Although other educational philosophies also espouse many of these principles, a defining feature of Confucian values is the greater emphasis on adhering to the expectations of one's parents, teachers, and greater society, often at the expense of one's personal interests (Guo,

2015; Sun et al., 2019). This aspect of Confucianism stands in contrast to those of many of the WEIRD countries that emphasize the need to prioritize one's own interests over that of others (Qu et al., 2016; Ma & Schoeneman, 1997; Markus & Kitayama, 1991). This Confucian belief also harks back to the primary purpose of learning which is to make a contribution to society rather than to exclusively pursue one's interests (Guo, 2015). In addition, a child's achievement is seen as a result of the entire family's effort rather than the child's individual effort in CHCs, which further deemphasizes the importance of pursuing one's personal interests (Watkins & Biggs, 1996; Chin, 1988). In these contexts, pursuing intrinsic interests can be impractical and socially unacceptable if those interests conflict with the expectations of family members or greater society (Watkins & Biggs, 1996; Chin, 1988). As a result, children strive to achieve not only for themselves but primarily to make their families and society proud. To do so, they focus on more tangible goals valued by families and society, such as attending a top college and contributing to society through work (Salili et al., 2001; Salili, 1996; Winter, 1996; Llewellyn et al., 1982). Although these goals are also important in many other countries, in the US for example, there is still a greater emphasis on pursuing one's interests, and the desire to please one's family or society is not considered to be as essential as in the CHCs (Qu et al., 2016; Wang & Pomerantz, 2009). Even if they do not have an intrinsic interest in a task, students will often work hard at the task if it is deemed valuable by parents, teachers, or society, which may account for the lack of association between intrinsic motivation and achievement in some studies conducted in CHCs (Lu et al., 2011; Cheng, 2019).

Despite the commonalities between their cultures, differences within and across the CHCs may lead to some variation in students' educational experiences or their academic motivations. Not all CHCs are similar in how ethnically or linguistically diverse their

populations are. Most of the CHCs are fairly ethnically homogenous with over 90% of their population identifying as the majority ethnic group, the exception being Singapore with the majority Chinese comprising 76.8% of the population (Nation Master, 2020). Singapore is also the only Confucian country that has a Western language, English, as its national language, due to its history of British occupation and the ethnic and linguistic diversity within the country (Brunero, 2019; Chew, 2013; Tong & Goh, 2008). Although Hong Kong also shares a history of British occupation, it has been governed by China for over two decades now and maintains Chinese as its national language (Lo & Merryfield, 2008; Lee et al., 2006; Tong & Goh, 2008). In addition, there is variation in wealth within and across the CHCs, with Singapore having the highest GDP per capita, while Vietnam has the lowest GDP per capita (IMF, 2020). Although many other differences between the CHCs exist (O'Dwyer, 2017), how those differences influence motivation has not been thoroughly examined in studies, and therefore no prior evidence can guide hypotheses of which differences may be most relevant to this study.

1.5 Motivation and achievement in Confucian Heritage Cultures

Given the differences in cultural expectations and educational systems, a growing number of studies have found that students in CHCs experience motivation differently than those in non-CHCs, a term that refers to all other countries excluding the CHCs. The results examining the association between growth mindset and achievement have been mixed, with some studies finding a positive association (Li et al., 2020; Wang et al., 2020; Chen & Wong, 2014; Jose & Bellamy, 2012; Chen et al., 2018; Lim et al., 2020) while other studies find no association or a negative association (Li & Bates, 2019; Wang et al., 2020; Sun et al., 2021a).

One explanation for the lack of association between growth mindset and achievement in some studies involves the focus on the value of effort for success in school. Because parents in

CHCs have high expectations for their children's academic success and consider effort to be the most important means to do well academically, the children are frequently encouraged to make an effort in their studies (Ho, 1986; Lin & Fu, 1990; Mau, 1997, Law, 2009). As a result, parents and teachers in CHCs tend to downplay students' successes and provide more negative emotional responses to failures, which encourages students to work harder (Miller et al., 1997; Ng et al., 2007; Bao & Lam, 2008). In a study comparing Chinese and US college students, researchers found that Chinese students are more likely to attribute success in school to effort than US students do (Sun et al., 2021a). Therefore, students in CHCs may already believe that they should put effort in their studies and thus do not need to have a growth mindset in order to succeed academically.

Another explanation for the lack of a positive association between growth mindset and achievement is that students in the CHCs may think about intelligence differently than those in the non-CHCs. Sun et al. (2021a) found that Chinese college students are more likely to think of intelligence as fluid intelligence, which includes comprehension and reasoning skills, whereas US college students are more likely to think of intelligence as crystallized, which involves recalling stored knowledge. Because students tend to think of fluid intelligence as fixed and crystallized intelligence as malleable, the lack of a positive association between growth mindset and achievement for students in the CHCs may be due to the fact that they are thinking of intelligence as fluid (Sun et al., 2021b).

Although PISA 2018 has also produced mixed results among CHCs, the report does little to provide an explanation for these findings regarding the association between growth mindset and achievement. In Korea, Macau, and Taiwan, there was only a small positive association between growth mindset and reading achievement compared to students in the majority of other

countries (OECD, 2019c). Moreover, there was no association in Hong Kong and a negative association in China between growth mindset and reading achievement (OECD, 2019c). For students in China, it appears that having a fixed mindset actually benefitted their scores, contrary to the findings and explanations provided by most studies (Dweck, 1986; Dweck, & Leggett, 1988; Blackwell et al., 2007; Chen & Pajares, 2010; Henderson & Dweck, 1990; Mueller & Dweck, 1998; Hong et al., 1999).

In addition, studies in CHCs also show that mastery goal orientation positively predicts achievement (Zhou & Wang, 2019; Hau & Ho, 2008; Ho & Hau, 2008; Salili et al., 2001; Salili & Lai, 2003; Shimizu et al., 2016; Tanaka & Yamauchi, 2001; Suzuki & Sakurai, 2011; Song et al., 2020; Chung et al., 2020; Lee et al., 2014; Shih, 2005; Lin, 1997), and intrinsic motivation positively predicts achievement in all CHCs except for Vietnam (Liu et al., 2018; Liu et al., 2019; Wu et al., 2019; Lau & Chan, 2003; Law, 2009; Nakayama et al., 2007; You et al., 2016; Lin et al., 2001; Wang & Guthrie, 2004; Huang, 2013; Liou & Liu, 2015; Lay & Chandrasegaran, 2016; Luo, 2012). Previous studies on past PISA data from 2003 (Ross, 2009) and 2012 (Liu et al., 2018) also indicate that intrinsic motivation positively predicts achievement in the CHCs.

However, some studies have not found an association between intrinsic motivation and achievement. In a study of Chinese fourth graders, Lu (2011) found no association between intrinsic motivation and achievement in either math or reading. Another study comparing US and Taiwanese college students found that there was a positive association between intrinsic motivation and GPAs for US students, but no association between intrinsic motivation and GPA's for Taiwanese students (Cheng, 2019). One possible explanation is that intrinsic motivation plays less of a role when participants are engaged in strenuous and challenging tasks

that involve frustration, anxiety, and uncertainty (Koestner & Losier, 2002; Noels et al., 2000; Wong & Csikszentmihalyi, 1991). Perhaps these students found the achievement tests or grades to be strenuous and challenging enough for intrinsic motivation not to matter. Another possible reason from a cultural perspective may be that children feel more obliged to satisfy the expectations of their parents who make significant sacrifices for the children's educational upbringing (Watkins & Biggs, 1996; Chin, 1988). In this type of environment, students are less incentivized to follow their own interests, and more incentivized to pursue outcomes that parents and society deem acceptable (Salili et al., 2001; Salili, 1996; Winter, 1996; Llewellyn et al., 1982). Even if the students do not feel intrinsically motivated by pursuing those outcomes, they will often do so anyway to fulfill their obligations to their parents and society (Lu et al., 2011; Cheng, 2019).

Similar to the majority of studies in non-CHCs, studies conducted in CHCs on the relations between growth mindset, mastery goal orientation, and intrinsic motivation show that all relations are positive and significant. In CHCs, studies also find a positive association between growth mindset and mastery goal orientation in China, Hong Kong, and Singapore (Dai, 2007; Hau & Hui, 1996; Wang et al., 2010). Studies conducted in CHCs also find that mastery goal orientation predicts intrinsic motivation in China, Hong Kong, Japan, Korea, Singapore, and Taiwan (Chen et al., 2019; Cheung, 1990; Tanaka & Yamauchi, 2001; Song & Grabowski, 2006; Lee et al., 2010; Shih, 2005; Lin, 1997). Lastly, although not as frequently examined, some studies have found that growth mindset predicts intrinsic motivation in CHCs, specifically in China and Hong Kong (Xu et al., 2018; Law, 2009). Results from these studies suggest that Chinese students who think of intelligence as malleable were more likely to be intrinsically motivated to learn to read and to use various reading strategies (Law, 2009). Thus, studies on

CHCs that have produced different results from the majority of findings in the field warrant more investigation to explore whether or not and why this difference exists (Li & Bates, 2019; Wang et al., 2020; OECD, 2019c).

1.6 Additional concerns

One of the concerns in conducting this study is that there have not been a large number of studies examining the three motivation constructs and achievement in all of the CHCs, making it difficult to develop evidence-informed hypotheses for each CHC. The only logical hypotheses that can be proposed are based on the majority of existing studies across all CHCs, while acknowledging that differences may exist. This is not problematic for Macau, where few studies have been conducted but is essentially a part of China (Chen et al., 2018), but can be problematic for Vietnam, where little to no motivation research has been conducted (Nguyen, 2019; Pham, 2014) and is also the country with the lowest GDP per capita among the CHCs (IMF, 2020). Given that SES predicts achievement (Li et al., 2020; Maheshwari & Singh, 2015) and SES moderates the relation between motivation and achievement (Hwang et al., 2019; Bernardo, 2020), there is some reason to believe that Vietnam may not produce the same results as the majority of the other CHCs. In addition, the grouping of CHCs may be too broad to be meaningful. Although this may be the case, the literature more frequently groups the CHCs together than identifies their differences (Liu et al., 2018; Carson, 1998; Nguyen et al., 2006; Turner, 2011; Guo, 2015). So far, evidence from the limited number of studies examining motivation and achievement in CHCs do not suggest that the relations between motivation and achievement differ between the CHCs.

In addition, another concern is that there may be a difference between achievement in different domains and how they relate to motivation. While few studies examine domain

differences, the existing studies provide little evidence that domain differences exist. A study by Guay and Bureau (2018) on Canadian students grades 7-9 examining motivation and achievement across the domains of math, English, and French did not find any noteworthy differences between domains. Similarly, a study by Liu et al. (2019) on grade 10 Chinese students found little difference between the domains of math, Chinese, and English. Thus, the literature does not provide a lot of evidence pointing to domain differences on the topic of motivation in CHCs.

Few studies on CHCs have thoroughly studied the relations between these constructs and achievement and far fewer have examined the mediating relations between these constructs and achievement within and across each of the CHCs. However, more studies on this topic may provide insight into the uncommon findings in the PISA 2018 report (OECD, 2019c), thus making them the focus of this study. In addition, the existing studies conducted on growth mindset, mastery goal orientation, and intrinsic motivation in CHCs have used smaller and less nationally representative samples than the PISA 2018 data set, which provides evidence of the greater generalizability of the results of this study. Countries in the PISA study that do not include the CHCs are referred to as non-CHCs in the remainder of this paper.

1.7 The present study

The present study examines the following research questions:

- 1) Does growth mindset predict achievement in CHCs and non-CHCs?
- 2) Does mastery goal orientation predict achievement in CHCs and non-CHCs?
- 3) Does intrinsic motivation predict achievement in CHCs and non-CHCs?

4) Does a serial multiple mediation model of the relations between growth mindset, mastery goal orientation, intrinsic motivation, and achievement fit the data for CHCs and non-CHCs?

5) Are there differences between the CHCs and non-CHCs? Are there differences when comparing CHCs to one another?

2 Methods

2.1 Data

The data used in this study is the Programme for International Student Assessment (PISA) 2018 data set, collected by the Organisation for Economic Co-operation and Development (OECD) on the math, reading, and science achievement of 15-year-old students in 79 countries. More specifically, this study focuses on the assessment and survey data from the CHCs that include China, Hong Kong, Macau, Taiwan, Singapore, Korea, Japan, and Vietnam ($n = 53,926$) and non-CHCs which include countries in North America, South America, Europe, Middle East, Central Asia, Africa, and Australia ($n = 558,079$). The PISA uses survey weights and multiple imputed plausible values for achievement scores (OECD, 2019a). According to the PISA report, PISA uses a stratified two-stage sample design, where schools are sampled using probability proportional to size sampling, and students are sampled with equal probability within schools for each participating country. Sampled students receive a final weight which indicates how many other students from the population are represented. The final student weight incorporates both the school weight (the inverse of the school's probability of selection) and the within-school student weight (the inverse of the student's probability of selection). The data for each country should in theory allow for generalization to the entire country. Although for China, in particular, this may not be the case because the data is sampled exclusively from four large

and wealthy cities, Beijing, Shanghai, Jiangsu, and Zhejiang, and may not be generalizable to other parts of the country (Luo, 2021).

2.2 Participants

The participants include 15-year-old students in 79 countries. In the CHCs, the number of participants from each country or region ranges from the smallest group, 3,775 participants in Macau, to the largest group, 12,058 participants in China. The sample is 50.70% male and 49.30% female overall. In the non-CHCs, the sample is 50.12% male and 49.88% female with a total of 558,079 participants. See Table 1 for a complete list of participant characteristics.

2.3 Measures

Growth mindset

Growth mindset is an observed student-level variable comprised of one item ranging from 1-4 points on a Likert scale 1=strongly agree to 4=strongly disagree: “Your intelligence is something about you that you can’t change very much.” The PISA measure of growth mindset is captured in one item, as opposed to 8-items in Dweck’s (1999) questionnaire. See Table A1 for a full list of items.

Mastery goal orientation

Mastery goal orientation is a latent student-level variable comprised of four items ranging from 1-4 points on a Likert scale 1=strongly disagree to 4=strongly agree (e.g. “I find satisfaction in working as hard as I can.”). The PISA measure has fewer items and uses similar but not exactly the same language as the most commonly used measure of mastery goal orientation, the Achievement Goal Questionnaire-Revised (Elliot & Murayama, 2008) first published by Elliot and McGregor (2001). See Table A1 for a full list of items.

Intrinsic motivation

Intrinsic motivation is a latent student-level variable comprised of four items ranging from 1-4 points on a Likert scale 1=strongly disagree to 4=strongly agree (e.g. “Reading is one of my favourite hobbies.”). Although the PISA survey included five items for intrinsic motivation, the fifth item was not included in this analysis due to its factor loading that was less than 0.2 and negative in value. Child (2006) recommends dropping items with a factor loading of less than 0.2 because they may not be adequately explaining the construct. In addition, the PISA measure uses similar but not exactly the same wording as the most commonly used measure of intrinsic motivation, the Intrinsic Motivation Inventory (Ryan, 1982; Deci et al., 1994). The PISA measure of intrinsic motivation is specific to reading and includes fewer items than the Intrinsic Motivation Inventory. See Table A1 for a full list of items.

Achievement

Achievement is a latent variable comprised of math and reading scores. Math scores are a measure of students’ capacity to formulate, employ and interpret mathematics in a variety of contexts. Math scores are scaled to fit approximately normal distributions, with means around 500 score points and standard deviations around 100 score points. In PISA 2018, the scores range from 0 to 916.276 points. The scores are comprised of ten imputed potential values. Reading scores are a measure of students’ capacity to understand, use, evaluate, reflect on and engage with texts in order to achieve one’s goals, develop one’s knowledge and potential, and participate in society. Reading scores are scaled to fit approximately normal distributions, with means around 500 score points and standard deviations around 100 score points. In PISA 2018, the scores range from 0 to 928.687 points. Like math scores, the reading scores are also comprised of ten imputed potential values (OECD, 2019a).

Covariates

Covariates include gender, age, SES, highest level of parent education, and second language status, which is a measure of whether the student speaks a language different from the test language at home. Second language status provides additional information related to academic achievement that is not captured by SES or parent education alone. Parent education may be SES is derived from several variables related to students' family background that are grouped into three components: parents' education, parents' occupations, and an index summarizing a number of home possessions that can be taken as proxies for material wealth or cultural capital, such as possession of a car, the existence of a quiet room to work, access to the Internet, the number of books and other educational resources available in the home (OECD, 2019b).

2.4 Analytic plan

All analysis was conducted using Mplus version 8.6. First, descriptive and correlational analyses were conducted. Then, confirmatory factory analysis (CFA) was conducted on the motivation constructs to analyze their factor structures. See Figure 1 for a conceptual model. Several goodness-of-fit indices were used to determine the model fit, including the Chi-square statistic, root mean square error of approximation (RMSEA), and the comparative fit index (CFI). For acceptable model fit, the chi-square statistic should be non-significant, although it is almost always significant for large sample sizes (Hu & Bentler, 1999). RMSEA should be less than .08, and CFI should be .90 or higher to show acceptable fit (Hu & Bentler, 1999).

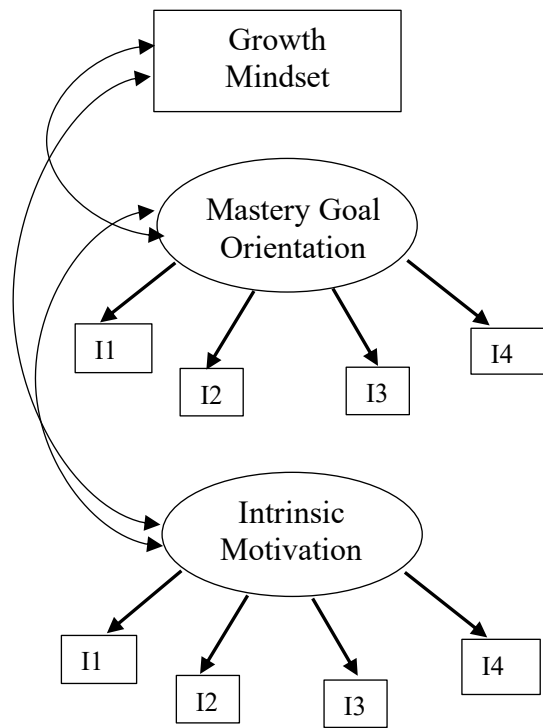


Figure 1. Conceptual model of mastery goal orientation and intrinsic motivation.

Finally, multigroup analysis using structural equation modeling (SEM) was employed to examine models for all CHCs and non-CHCs, as well as for the individual CHCs. See Figure 2 for conceptual models of the path analyses for questions one, two and, three. To address question four, a serial multiple mediation model was tested in which growth mindset predicts achievement through mastery goal orientation and intrinsic motivation with mastery goal orientation predicting intrinsic motivation. See Figure 3 for the serial multiple mediation model¹. The MLR robust standard error estimator was used to conduct the analysis and the cluster option was selected to account for nesting by schools in the data. The MLR estimator was also used to account for the missing data, < 10% on achievement scores and < 2% on the remaining measures, because it is the recommended choice that estimates models by applying missing data theory and using all available data (Muthén & Muthén, 2017). The models control for all

¹ The model presented is the most motivated by the literature. Although alternative models were also tested, the results were very similar to those for this model and therefore are not presented in this paper.

covariates. All analysis takes into account survey weights and uses an imputation method to incorporate all plausible values for achievement scores.

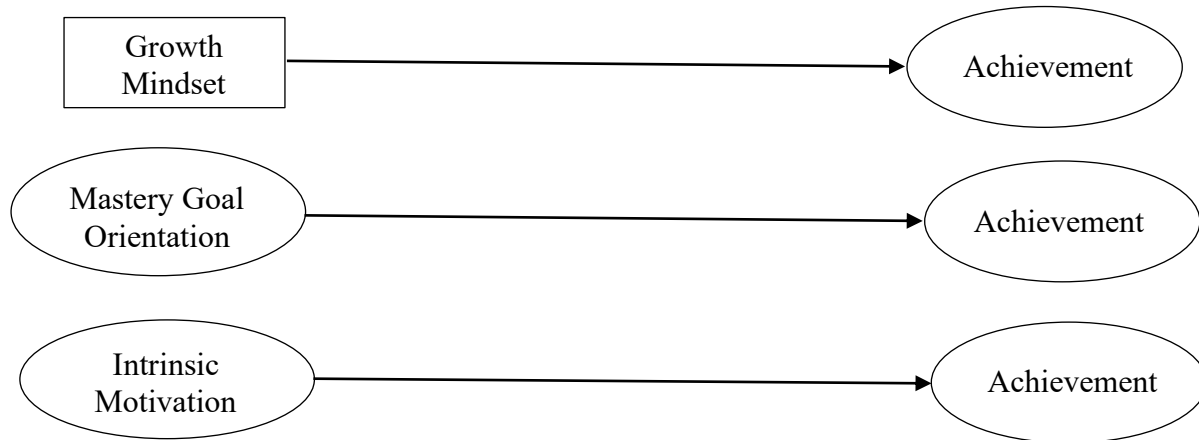


Figure 2. Conceptual models of growth mindset predicting achievement (Model 1), mastery goal orientation predicting achievement (Model 2), and intrinsic motivation predicting achievement (Model 3)

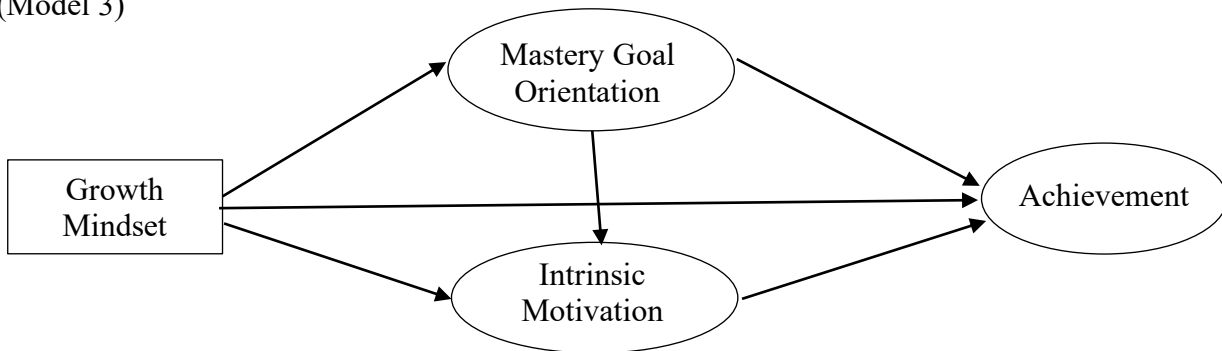


Figure 3. Conceptual model of serial multiple mediation model (Model 4)

3 Results

3.1 Descriptive and correlational statistics

The overall CHCs sample is fairly evenly distributed by gender, with 49.30% female and 50.66% male. The overall average parent education is a post-secondary education (such as vocational school but not university), ranging from Vietnamese parents who on average have a middle school education to Korean parents who on average have a college education. As indicated in Table 1, compared to the participants from all 79 countries in the PISA 2018 data set, the sample from CHCs is slightly below average (-0.36 scale points) for SES. Among the CHCs,

Vietnam has the lowest levels of SES at -1.61 scale points and Singapore has the highest levels of SES at 0.15 scale points in this group of CHCs, which is consistent with the relative GDP per capita levels in these countries (IMF, 2020). Approximately 11.44% of the sample reports speaking a second language other than the PISA test language at home, ranging from China at 0.48% to Singapore at 43.43%, which is also consistent with the multiethnic and multilingual population in Singapore (Tong & Goh, 2008; Nation Master, 2020).

Among the motivation constructs, the average mastery goal orientation scores are higher than the average growth mindset or intrinsic motivation scores. For all CHCs, the average mastery goal orientation score is 3.04 scale points (SD = 0.53). Mastery goal orientation scores range from lowest in Hong Kong (M = 2.93, SD = 0.50) to highest in Korea (M = 3.16, SD = 0.51). For the overall sample of CHCs, the average growth mindset score is 2.60 scale points (SD = 0.87). Growth mindset scores range from lowest in Macau (M = 2.48, SD = 0.88) to highest in Japan (M = 2.76, SD = 0.84). For the overall sample of CHCs, the average intrinsic motivation score is 2.82 scale points (SD = 0.71). Intrinsic motivation scores range from lowest in Singapore (M = 2.62, SD = 0.77) to highest in Vietnam (M = 2.90, SD = 0.50).

In terms of achievement scores, math scores tend to be higher than reading scores across the CHCs, while China has the highest scores, and Vietnam has the lowest scores overall compared to the other CHCs. The average math achievement score in the overall CHCs sample is 548.48 points (SD = 94.77), ranging from Vietnam at 494.19 points (SD = 73.71) to China at 592.43 points (SD = 83.37). The average reading achievement score in the overall CHCs sample is 526.77 points (SD = 99.34), ranging from Taiwan at 497.66 points (SD = 102.08) to China at 561.03 points (SD = 90.34).

The sample of non-CHCs is 49.88% female and 50.12% male. The average age of participants is 15.79 years old, while the average level of parent education is post-secondary education in the non-CHCs. Compared to the participants from all 79 countries in the PISA 2018 data set, the sample from non-CHCs is slightly above the sample of CHCs at -0.27 standard deviation units. 17.92% of students in the non-CHCs report speaking a second language other than the PISA test language at home. For non-CHCs, average growth mindset score is 2.63 points (SD = 0.94); the average mastery goal orientation score is 3.02 (SD = 0.62); and the average intrinsic motivation score is 2.59 points (SD = 0.76). The average math score is 453.11 (SD = 101.15), and the average reading score is 447.45 (SD = 106.79) for the non-CHCs. See Table 1 for a complete list of descriptive statistics.

Table 1. Descriptive Statistics for CHCs and non-CHCs

Characteristics	Mean (SD) or Percentage %									
	All CHCs n=53,925	CHN n=12,058	HKG n=6,037	JPN n=6,109	KOR n=6,650	MAC n=3,775	SGP n=6,676	TWN n=7,243	VNM n=5,377	Non-CHCs n=558,079
Gender										
Female (0)	49.30	47.89	51.07	47.98	49.32	49.32	49.09	50.03	51.70	49.88
Male (1)	50.70	52.11	48.93	52.02	50.68	50.68	50.91	49.97	48.30	50.12
Age	15.77	15.73	15.78	15.73	15.83	15.78	15.78	15.79	15.78	15.79
	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)	(0.30)	(0.29)	(0.29)
Parent education	4.36	4.07	3.85	5.09	5.34	3.88	4.97	4.53	2.86	4.69
	(1.58)	(1.72)	(1.50)	(0.99)	(1.04)	(1.66)	(1.15)	(1.28)	(1.59)	(1.50)
Pre-primary (0)	0.94	0.85	0.88	0.00	0.00	0.98	0.41	0.14	5.12	1.16
Primary (1)	3.45	3.75	5.05	0.00	0.14	5.26	1.69	1.13	12.98	2.91
Lower secondary (2)	14.35	25.60	14.39	1.38	1.25	23.95	2.34	7.72	36.93	7.59
Upper secondary (3)	5.67	4.20	17.49	2.38	3.59	6.01	0.00	11.67	1.18	5.64
Post-secondary (4)	25.76	19.73	33.55	29.29	23.00	26.95	30.66	20.86	29.87	23.54
College (5)	15.26	14.25	7.55	19.65	3.88	11.78	21.08	32.56	7.17	15.63
Graduate (6)	34.57	31.61	21.11	47.30	68.14	25.07	43.83	25.93	6.76	43.53
SES	-0.36	-0.36	-0.53	-0.11	0.09	-0.52	0.15	-0.33	-1.61	-0.27
	(1.07)	(1.09)	(1.02)	(0.73)	(0.77)	(0.91)	(0.91)	(0.92)	(1.08)	(1.12)
Second language	11.44	0.48	16.33	0.94	0.59	18.65	43.43	15.51	5.72	17.92
Growth	2.60	2.60	2.37	2.76	2.59	2.48	2.69	2.68	2.57	2.63
	(0.87)	(0.90)	(0.85)	(0.84)	(0.86)	(0.88)	(0.93)	(0.93)	(0.78)	(0.94)
Mastery goal orientation	3.04	3.14	2.93	2.82	3.16	2.94	3.05	3.07	3.06	3.02
	(0.53)	(0.50)	(0.50)	(0.64)	(0.51)	(0.49)	(0.51)	(0.50)	(0.45)	(0.62)
Intrinsic motivation	2.82	3.25	2.70	2.68	2.63	2.69	2.62	2.71	2.90	2.59
	(0.71)	(0.57)	(0.67)	(0.81)	(0.67)	(0.66)	(0.77)	(0.67)	(0.50)	(0.76)
Math achievement	548.48	592.43	554.42	528.21	526.54	556.63	566.05	527.49	494.19	453.11
	(94.77)	(83.37)	(86.49)	(99.19)	(80.46)	(94.61)	(94.61)	(101.16)	(73.71)	(101.15)
Reading achievement	526.77	561.03	527.33	502.91	515.58	525.08	548.58	497.66	503.57	447.45
	(99.34)	(90.34)	(97.90)	(97.15)	(101.22)	(92.51)	(110.34)	(102.08)	(73.14)	(106.79)

Note: CHN = China; HKG = Hong Kong; JPN = Japan; KOR = Korea; MAC = Macau; SGP = Singapore; TWN = Taiwan; VNM = Vietnam; SES = socioeconomic status.

Table 2 presents the correlation matrix. For CHCs, growth mindset has a small, positive correlation with mastery goal orientation ($r = 0.111, p < .001$), while mastery goal orientation has a larger positive correlation with intrinsic motivation ($r = 0.182, p < .001$). Of the motivation constructs, the correlation between growth mindset and intrinsic motivation is the smallest ($r = 0.100, p < .001$). All motivation constructs positively correlate with math and reading achievement, with the largest between intrinsic motivation and reading achievement ($r = 0.356, p < .001$) and the smallest between growth mindset and math achievement ($r = 0.044, p < .001$). The largest positive correlations are between math and reading achievement ($r = 0.803, p < .001$) and between SES and parent education ($r = 0.828, p < .001$).

For non-CHCs, growth mindset has a small negative correlation with mastery goal orientation ($r = -0.023, p < .001$) and a small positive correlation with intrinsic motivation ($r = 0.075, p < .001$), while mastery goal orientation has a moderate positive correlation with intrinsic motivation ($r = 0.196, p < .001$). Of the motivation constructs, the correlation between mastery goal orientation and intrinsic motivation is the largest ($r = 0.196, p < .001$). Nearly all motivation constructs positively correlate with math and reading achievement, with the largest correlation between growth mindset and reading achievement ($r = .253, p < .001$) and the smallest correlation between mastery goal orientation and math achievement ($r = 0.051, p < .001$). In addition, there are very large, positive correlations between math and reading achievement ($r = .823, p < .001$) and between SES and parent education ($r = .770, p < .001$). There is also a moderately large correlation between SES and math scores ($r = 0.438, p < .001$) and between SES and reading scores ($r = 0.417, p < .001$). Nearly all of the remaining correlations are significant and small in size.

Table 2. Correlation Matrix for Motivation, Achievement, and Covariates

Variable	1	2	3	4	5	6	7	8	9	10
1. Growth mindset		-0.023 ***	0.075 ***	0.216 ***	0.253 ***	-0.020 ***	0.018 ***	0.084 ***	0.143 ***	-0.040 ***
2. Mastery goal orientation	0.111 ***		0.196 ***	0.051 ***	0.080 ***	-0.084 ***	0.014 ***	-0.010 ***	0.016 ***	-0.015 ***
3. Intrinsic motivation	0.100 ***	0.182 ***		0.058 ***	0.157 ***	-0.263 ***	0.019 ***	0.013 ***	0.010 ***	0.014 ***
4. Math achievement	0.044 ***	0.063 ***	0.276 ***		0.823 ***	0.016 ***	0.041 ***	0.255 ***	0.438 ***	-0.085 ***
5. Reading achievement	0.045 ***	0.061 ***	0.356 ***	0.803 ***		-0.145 ***	0.036 ***	0.237 ***	0.417 ***	-0.145 ***
6. Gender (Male)	0.045 ***	-0.012 **	-0.142 ***	0.032 ***	-0.100 ***		-0.001 ***	0.034 ***	0.011 ***	0.011 ***
7. Age	-0.012 **	-0.017 ***	-0.012 *	0.035 ***	0.025 ***	0.005		-0.011 ***	-0.007 ***	0.001
8. Parent education	0.027 ***	0.028 ***	0.016 ***	0.066 ***	0.078 ***	0.004	-0.034 ***		0.770 ***	-0.053 ***
9. SES	0.040 ***	0.070 ***	0.104 ***	0.072 ***	0.088 ***	-0.018 ***	-0.028 ***	0.828 ***		-0.077 ***
10. Second language	-0.008	-0.02 ***	-0.122 ***	0.033 ***	0.050 ***	0.011 **	0.012 **	-0.017 ***	-0.033 ***	

Note: CHCs below the diagonal; Non-CHCs above the diagonal

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

3.2 Confirmatory Factor Analysis

CFA was conducted to examine the factor structures of growth mindset, mastery goal orientation and intrinsic motivation across all samples. Results indicate adequate fit for nearly all samples. CFI is slightly low for Hong Kong, but all other fit statistics are adequate. See Table 3 for a complete list of fit statistics. In addition, all factor loadings are positive and significant for all CHCs and non-CHCs. Tables 4 and 5 present a complete list of standardized factor loadings. The reliability results for the scales of mastery goal orientation and intrinsic motivation are also good with all alpha values above 0.636.

Table 3. Confirmatory Factor Analysis Model Fit and Reliability Statistics

Sample	$\chi^2(df)$	CFI	RMSEA	Mastery Goal Orientation (α)	Intrinsic Motivation (α)
All CHCs	3084.375(27)***	0.934	0.046	0.764	0.823
China	1268.592(27)***	0.903	0.062	0.796	0.804
Hong Kong	1018.437(27)***	0.893	0.079	0.761	0.792
Japan	887.674(27)***	0.933	0.072	0.811	0.830
Korea	944.758(27)***	0.917	0.072	0.756	0.797
Macau	317.469(27)***	0.950	0.053	0.678	0.808
Singapore	874.930(27)***	0.934	0.069	0.691	0.851
Taiwan	1055.861(27)***	0.916	0.073	0.806	0.794
Vietnam	504.171(27)***	0.902	0.057	0.636	0.667
Non-CHCs	4457.380(27)***	0.967	0.017	0.783	0.799

Note: CFI = comparative fit index; RMSEA = root mean square error of approximation; α = Cronbach's alpha; * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

Table 4. Confirmatory Factor Analysis Results for Growth Mindset and Mastery Goal Orientation

Sample	Growth (means)	Mastery I1	Mastery I2	Mastery I3	Mastery I4
All CHCs	3.137***	0.689***	0.702***	0.731***	0.628***
China	2.997***	0.705***	0.772***	0.704***	0.677***
Hong Kong	2.788***	0.713***	0.722***	0.692***	0.562***
Japan	3.300***	0.724***	0.697***	0.789***	0.666***
Korea	3.016***	0.769***	0.660***	0.612***	0.626***
Macau	2.829***	0.646***	0.586***	0.658***	0.475***
Singapore	2.901***	0.711***	0.644***	0.613***	0.454***
Taiwan	3.141***	0.709***	0.743***	0.773***	0.627***
Vietnam	3.275***	0.589***	0.632***	0.654***	0.396***
Non-CHCs	2.670***	0.735***	0.725***	0.746***	0.585***

Note: Growth = growth mindset; Mastery = mastery goal orientation

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

Table 5. Confirmatory Factor Analysis Results for Intrinsic Motivation

Sample	Intrinsic I1	Intrinsic I2	Intrinsic I3	Intrinsic I4
All CHCs	0.874***	0.749***	0.660***	0.599***
China	0.838***	0.735***	0.665***	0.618***
Hong Kong	0.884***	0.691***	0.606***	0.593***
Japan	0.906***	0.752***	0.694***	0.605***
Korea	0.897***	0.758***	0.584***	0.552***
Macau	0.836***	0.637***	0.685***	0.717***
Singapore	0.858***	0.738***	0.756***	0.724***
Taiwan	0.904***	0.742***	0.572***	0.586***
Vietnam	0.728***	0.643***	0.426***	0.506***
Non-CHCs	0.576***	0.840***	0.750***	0.564***

Note: Intrinsic = intrinsic motivation; * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

3.3 Multigroup SEM analysis

The fit statistics for Models 1, 2 and 3 are good for the sample of all CHCs (M1, M2, M3), China (M1, M2, M3), Hong Kong (M2), Japan (M2), Macau (M2, M3), Singapore (M2), Taiwan (M2), Vietnam (M1, M2, M3), and non-CHCs (M1, M2, M3). However, fit statistics are inadequate for some samples, including Hong Kong (M1, M3), Japan (M1, M3), Korea (M1, M2, M3), Macau (M1), Singapore (M1, M3), and Taiwan (M1, M3). The serial multiple mediation model (M4) indicates good fit for all samples. All models are estimated freely. See Table 6 for a list of fit statistics.

Table 6. Model Fit Statistics

Model	Sample	$\chi^2(df)$	CFI	RMSEA
Model 1:	All CHCs	956.211(5)***	0.987	0.009
Growth	China	279.142(5)***	0.991	0.068
mindset	Hong Kong	---	---	---
predicting	Japan	6370.103(5)***	0.721	0.330
achievement	Korea	979.649(5)***	0.928	0.168
	Macau	714.558(5)***	0.878	0.181
	Singapore	1250.501(5)***	0.907	0.171
	Taiwan	365.186(5)***	0.975	0.100
	Vietnam	126.543(5)***	0.991	0.067
	Non-CHCs	2617.117(5)***	0.995	0.033
Model 2:	All CHCs	2596.434(33)***	0.998	0.012
Mastery goal	China	1135.820(33)***	0.940	0.053
orientation	Hong Kong	580.685(33)***	0.941	0.053
predicting	Japan	1060.599(33)***	0.935	0.072
achievement	Korea	1560.458(33)***	0.894	0.084
	Macau	581.282(33)***	0.930	0.066
	Singapore	1279.788(33)***	0.912	0.075
	Taiwan	726.269(33)***	0.958	0.054
	Vietnam	377.736(33)***	0.962	0.044
	Non-CHCs	8975.808(33)***	0.957	0.022
Model 3:	All CHCs	5251.086(33)***	0.921	0.054
Intrinsic	China	1702.604(33)***	0.918	0.065
motivation	Hong Kong	1362.342(33)***	0.883	0.083
predicting	Japan	1473.146(33)***	0.917	0.085
achievement	Korea	1475.823(33)***	0.907	0.081
	Macau	672.252(33)***	0.926	0.072
	Singapore	1811.926(33)***	0.917	0.090
	Taiwan	2134.868(33)***	0.892	0.094
	Vietnam	746.854(33)***	0.916	0.064
	Non-CHCs	17257.975(33)***	0.916	0.031
Model 4:	All CHCs	6252.131(74)***	0.989	0.024
Serial	China	2223.781(74)***	0.920	0.049
multiple	Hong Kong	1580.037(74)***	0.902	0.060
mediation	Japan	1723.790(74)***	0.929	0.061
model	Korea	2210.891(74)***	0.901	0.066
	Macau	822.981(74)***	0.932	0.052
	Singapore	1934.545(74)***	0.926	0.062
	Taiwan	2096.586(74)***	0.921	0.062
	Vietnam	909.728(74)***	0.925	0.046
	Non-CHCs	20786.579(74)***	0.920	0.024

Note: CFI = comparative fit index; RMSEA = root mean square error of approximation

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

Table 7 presents the full list of results for Models 1, 2 and 3. Standardized coefficients are reported for all paths. See Figure 4 for a graphical model of the results for the sample of all CHCs and non-CHCs. The following presentation of results only focuses on the models that have adequate fit statistics.

Of all of the motivation constructs, growth mindset is the only one for which the association with achievement is not positive or significant for the sample of all CHCs, which contrasts with the findings for non-CHCs. For all CHCs, the relation between growth mindset and achievement is not significant, $\beta = 0.060$ ($SE = 0.051$), $p = .242$. This association is negative in China, $\beta = -0.079$ ($SE = 0.014$), $p < .001$, and positive in Vietnam, $\beta = 0.221$ ($SE = 0.019$), $p < .001$. In contrast to the sample of all CHCs, the relation between growth mindset and achievement is positive in non-CHCs, $\beta = 0.196$ ($SE = 0.004$), $p < .001$. Of all the associations between the motivation constructs and achievement, the association between growth mindset and achievement is the largest for non-CHCs.

Aligned with the findings in the literature, mastery goal orientation positively predicts achievement in the sample of all CHCs, $\beta = 0.077$ ($SE = 0.018$), $p < .001$, and non-CHCs, $\beta = 0.088$ ($SE = 0.005$), $p < .001$, however there is some variation between the CHCs. Mastery goal orientation also positively predicts achievement in Taiwan, $\beta = 0.061$ ($SE = 0.018$), $p < .001$, and Vietnam, $\beta = 0.078$ ($SE = 0.025$), $p < .01$. However, there is no association in China, $\beta = 0.016$ ($SE = 0.016$), $p = .320$, Hong Kong, $\beta = 0.016$ ($SE = 0.019$), $p = .406$, Japan, $\beta = 0.017$ ($SE = 0.022$), $p = .441$, Macau, $\beta = 0.018$ ($SE = 0.015$), $p = .226$, and Singapore, $\beta = 0.021$ ($SE = 0.019$), $p = .269$.

Of all the motivation constructs, the relation between intrinsic motivation and achievement most consistently aligns with the literature across the CHCs and non-CHCs. This

association is positive for the sample of all CHCs, $\beta = 0.348$ ($SE = 0.053$), $p < .001$, China, $\beta = 0.268$ ($SE = 0.017$), $p < .001$, Macau, $\beta = 0.173$ ($SE = 0.055$), $p < .01$, Vietnam, $\beta = 0.126$ ($SE = 0.024$), $p < .001$, and non-CHCs, $\beta = 0.085$ ($SE = 0.006$), $p < .001$. In addition, the sizes of the associations are larger than that of growth mindset and mastery goal orientation predicting achievement in the CHCs. Finally, this association is larger for the CHCs as compared to the non-CHCs.

Table 7. Path Analysis of Growth Mindset Predicting Achievement, Mastery Goal Orientation Predicting Achievement, and Intrinsic Motivation Predicting Achievement

Sample	Growth Mindset	Mastery Goal Orientation	Intrinsic Motivation
All CHCs	0.060 (p=.242)	0.077***	0.348***
China	-0.079***	0.016 (p=.320)	0.268***
Hong Kong	-0.009 (p=.617)	0.016 (p=.406)	0.248***
Japan	0.115***	0.017 (p=.441)	0.321***
Korea	0.083***	0.117***	0.252***
Macau	0.030 (p=.065)	0.018 (p=.226)	0.173**
Singapore	0.152***	0.021 (p=.269)	0.289***
Taiwan	0.058***	0.061***	0.337***
Vietnam	0.221***	0.078**	0.126***
Non-CHCs	0.196***	0.088***	0.085***

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

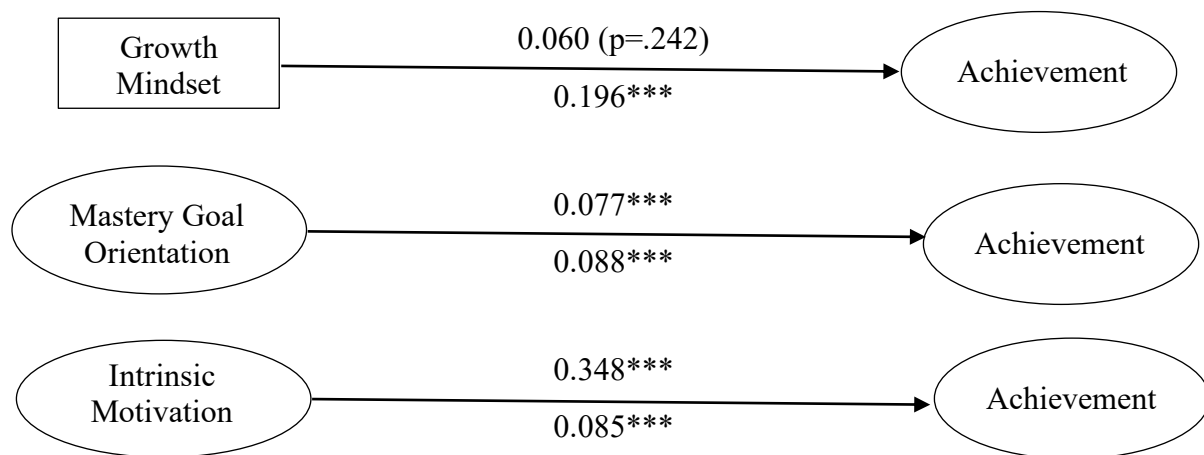


Figure 4. Path analysis model for growth mindset predicting achievement, mastery goal orientation predicting achievement, and intrinsic motivation predicting achievement for all CHCs and non-CHCs. *Note: Coefficients above represent the sample of all CHCs; coefficients below represent non-CHCs.*

Table 8 presents the list of results for the serial multiple mediation model. See Figure 5 for a graphical model of the results for the sample of all CHCs and non-CHCs. The serial multiple mediation does not provide evidence of classic mediation for most samples. The results indicate that there is no mediation or inconsistent mediation for the sample of all CHCs, China, Hong Kong, Macau, and Taiwan. However, there is some evidence of classic mediation. Intrinsic motivation mediates the relation between growth mindset and achievement for Japan, Korea, Singapore, Vietnam, and non-CHCs, and also mediates the relation between mastery goal orientation and achievement for Korea and non-CHCs. Only in Korea does mastery goal orientation mediate the relation between growth mindset and achievement.

Table 8. Path Analysis Coefficients of Serial Multiple Mediation Model

Sample	Growth → Mastery	Growth → Intrinsic	Mastery → Intrinsic	Intrinsic → Achievement	Growth → Achievement	Mastery → Achievement
All CHCs	0.100***	0.061***	0.204**	0.344***	0.033 (p=.599)	0.011 (p=.553)
China	0.168***	0.071***	0.328***	0.307***	-0.100***	-0.073***
Hong Kong	0.111***	0.078***	0.135***	0.261***	-0.031 (p=.059)	-0.019 (p=.298)
Japan	0.126***	0.089***	0.022 (p=.207)	0.316***	0.079***	-0.038*
Korea	0.166***	0.058***	0.187***	0.233***	0.055***	0.065**
Macau	0.156***	0.134***	0.204***	0.172**	0.016 (p=.182)	-0.010**
Singapore	0.099***	0.119***	0.149***	0.289***	0.115***	-0.037*
Taiwan	0.095***	0.101***	0.171***	0.339***	0.021 (p=.122)	-0.009 (p=.576)
Vietnam	0.056*	0.068**	0.326***	0.103***	0.211***	0.033 (p=.199)
Non-CHCs	-0.033***	0.033***	0.236***	0.069***	0.197***	0.079***

Note: Growth = growth mindset; Mastery = mastery goal orientation; Intrinsic = intrinsic motivation; * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

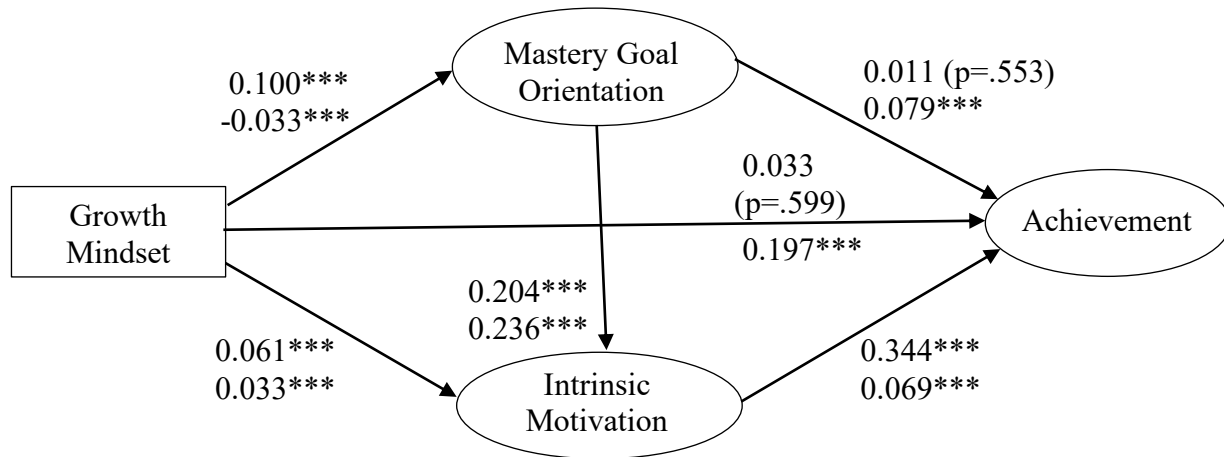


Figure 5. Path analysis for the serial multiple mediation model for all CHCs and non-CHCs. *Note: Coefficients above represent the sample of all CHCs; coefficients below represent non-CHCs.*

4 Discussion

The findings from this study indicate that growth mindset does not positively predict achievement for the sample of all CHCs, which stands in contrast to the results for non-CHCs and the findings in the majority of the literature. This result is mostly driven by China and the CHCs that are a part of China, such as Hong Kong and Macau, while there is a weakly positive association for the remaining CHCs. While mastery goal orientation does positively predict achievement for the sample of all CHCs in this study, there is no association for most of the individual CHCs. In addition, the inconsistent evidence of classic mediation in the serial multiple mediation model for most CHCs is due to the lack of consistent positive associations between growth mindset and mastery goal orientation with achievement for most CHCs in this study. Although classic mediation is not present for all samples in the serial multiple mediation model, there is some evidence that intrinsic motivation mediates the relation between growth mindset and achievement for some of the CHCs and the non-CHCs. In particular, intrinsic motivation appears to mediate the relation between growth mindset and achievement for several CHCs.

Moreover, although the serial multiple mediation model does not provide consistent evidence for classic mediation, the serial multiple mediation model indicates that the motivation constructs positively predict one another. Lastly, results from this study indicate that intrinsic motivation is the construct that most consistently has a positive association with achievement for both CHCs and non-CHCs. In contrast to some of the results for CHCs, growth mindset and mastery goal orientation positively predict achievement for non-CHCs.

The results from this study for CHCs are surprising, because they contradict the findings in the majority of the literature, which posit that growth mindset should positively predict achievement. According to the literature, individuals with a growth mindset are more likely to put in more effort expand their abilities than those with fixed mindsets who tend to withdraw in the face of challenge or failure, thus making those with growth mindsets more likely to succeed (Dweck & Leggett, 1988; Dinger, et al., 2013; Blackwell et al., 2007; Hong et al., 1999; Blackwell et al., 2007; Chen & Pajares, 2010; Henderson & Dweck, 1990; Mueller & Dweck, 1998; Chen & Wong, 2014; Jose & Bellamy, 2012; Chen et al., 2018; Lim et al., 2020). Although having a fixed mindset should not positively predict achievement, this study finds that a fixed mindset has a positive relation with achievement in China. In addition, for the sample of all CHCs, growth mindset does not positively predict achievement.

The findings from this study support some of the growing body of studies conducted in CHCs that also find that growth mindset does not have a positive relation with achievement (Li & Bates, 2019; Wang et al., 2020). One possible explanation for this finding is that students in CHCs already strongly believe in the value of effort and apply effort to their studies, such that they do not need to believe in growth mindset in order to work hard (Ho, 1986; Lin & Fu, 1990; Mau, 1997, Lau, 2009). The literature also suggests that parents, teachers, and society put a lot of

pressure on students in CHCs to work hard at school regardless of their ability levels, which means that these students may be less susceptible to giving up if they think that they are unlikely to succeed or if they do not believe that their intelligence can grow (Hong, 2001; Miller et al., 1997; Ng et al., 2007; Bao & Lam, 2008). In other words, whether they believe in growth mindset could be irrelevant to their attitudes towards working hard to succeed academically. Another possible explanation for the finding in China is that students in China tend to think of intelligence as fluid, which is associated with a fixed mindset, whereas students in the US tend to think of intelligence as crystallized, which is associated with a growth mindset (Sun et al., 2021a; Sun et al., 2021b). Given that growth mindset and mastery goal orientation are such related constructs, a similar explanation could be proposed to explain the lack of association between mastery goal orientation and achievement for the CHCs in this study.

This study also finds that while mastery goal orientation positively predicts achievement for the sample of all CHCs, there is no association for most of the individual CHCs. The finding for the sample of all CHCs aligns with the literature that posits that having a mastery goal orientation makes learners engage in a task or activity for the purpose of mastery, which makes them more likely to put in the necessary amount of effort in order to succeed (Elliot & Harackiewicz, 1996; Dweck & Leggett, 1988; Zhou & Wang, 2019; Hau & Ho, 2008; Shimizu et al., 2016; Song et al., 2020; Lee, Ning & Goh, 2014; Lin, 1997; Dweck & Elliott, 1983; Harackiewicz, et al., 1997; Harackiewicz et al., 2000; Harackiewicz, et al., 2002). However, in contrast to the majority of findings in the literature, this study also finds that mastery goal orientation does not predict achievement for China, Hong Kong, Japan, Macau, and Singapore, which suggests that mastery goal orientation is not consistently beneficial for achievement across each of the CHCs. As with growth mindset, it is possible that students in some CHCs simply do

not need to be motivated by pursuing a task for the sake of mastery. Perhaps these students are already motivated by the expectations of their parents and society to perform well academically (Ho, 1986; Lin & Fu, 1990; Mau, 1997; Lau, 2009), and they see no purpose to pursuing academic achievements for the sake of mastery too. Again, it is possible that mastery goal orientation like growth mindset is irrelevant, or of lesser importance, to the motivations and behaviors of students in CHCs.

In addition, the results from the serial multiple mediation model provide more evidence that growth mindset and mastery goal orientation do not positively predict achievement. According to the literature, the serial multiple mediation model should provide evidence of classic mediation between growth mindset, mastery goal orientation, intrinsic motivation, and achievement, because these motivation constructs should predict achievement as well as each other (Blackwell, Trzesniewski, & Dweck, 2007; Hong, Chen & Wong, 2014; Cerasoli & Ford, 2014; Leung, Chen, & Chen, 2014). However, the results from this study indicate little support for the serial multiple mediation model because growth mindset and mastery goal orientation do not predict achievement for most of the CHCs. There is a bit of evidence of classic mediation between growth mindset, intrinsic motivation, and achievement for some of the CHCs, which suggests that those with a growth mindset may not only benefit from a positive association with achievement, but also from the positive indirect association to intrinsic motivation, which positively predicts achievement (Renaud-Dube et al., 2015).

Although there is little evidence in support of classic mediation in the serial multiple mediation model, this model does provide evidence that the motivation constructs positively predict one another for CHCs and non-CHCs. According to the literature, those with a growth mindset believe that they can put in effort to learn more and improve their intelligence, which

makes them more likely to have a mastery goal orientation or to engage in a task for its own sake without external rewards (Dweck, 1986; Dweck & Leggett, 1988; Dweck & Molden, 2017; Dai, 2007; Hau & Hui, 1996; Wang et al., 2010). Those with a mastery goal orientation tend to have an increased desire to approach tasks and to feel in control over a situation, which are all factors that facilitate intrinsic motivation (Deci & Ryan, 1985; Dweck, 1986; Rawsthorne & Elliot, 1999); Bieg, Reindl, & Dresel, 2017; Elliot & Harackiewicz, 1996; Elliot & Church, 1997; Chen et al., 2019; Cheung, 1990; Tanaka & Yamauchi, 2001; Song & Grabowski, 2006; Lee et al., 2010; Shih, 2005; Lin, 1997). Those who believe in growth mindset are more likely to persist at a task, which increases the likelihood that they will be intrinsically motivated to perform the task (Wolters, 2003; Dweck 2000; Karlen et al., 2019; Heyder et al., 2020; Xu et al., 2018; Law, 2009). Interestingly, an unusual finding in this study is that growth mindset negatively predicts mastery goal orientation for non-CHCs. There is little evidence in the research to support this finding, especially given that growth mindset and mastery goal orientation are closely related constructs, making it difficult to explain this unexpected result.

In spite of all the differences between CHCs and non-CHCs, the results from this study show that intrinsic motivation positively predicts achievement for both CHCs and non-CHCs, which supports the majority of findings in the literature. The results from this study on intrinsic motivation provide evidence to suggest that intrinsic motivation may be more generalizable across contexts than growth mindset and mastery goal orientation. It may be that students more easily grasp the desire to perform a task or activity out of enjoyment, whereas the concepts of growth mindset or mastery goal orientation may be more complex or less intuitive to understand. Students may struggle to understand what it means for one's intelligence to change or why they should complete a task solely to master it but more easily understand what it means to like doing

an activity. It is even possible that these concepts may not translate equally well across cultures and languages. Intrinsic motivation is also the only motivation measure examined that is reading specific, although the significance of this point is difficult to determine, especially because math and reading scores are so highly correlated. As the literature indicates, studies conducted in both CHCs and non-CHCs show a positive association between intrinsic motivation and achievement (Guthrie et al., 2013; Froiland & Davison, 2016; Niehaus et al., 2012; Liu et al., 2019; Lau & Chan, 2003; Nakayama et al., 2007; You et al., 2016; Lin et al., 2001; Liou & Liu, 2015; Luo, 2012). Intrinsic motivation positively predicts achievement because intrinsically motivated students engage in an activity for enjoyment's sake, thus tending to be persistent in the activity even when they fail or lack affirmation (Deci & Ryan, 1985; Deci & Ryan, 2002). Interestingly, the association is larger for the CHCs as compared to the non-CHCs. There are no studies that support this result, which makes it difficult to explain this finding. It is possible that because the CHCs tend to encourage extrinsic motivation, the students who report having an intrinsic interest in the task must actually enjoy it, because they have no other incentive to appear intrinsically motivated. These intrinsically motivated students are then more likely to put in the effort to succeed at the task, which may explain the larger association between intrinsic motivation and achievement. On the other hand, students in the non-CHCs who are encouraged to have intrinsic motivation may report being more intrinsically motivated than they actually feel because that is how they think they should be. Therefore, they might claim to be intrinsically motivated but not do what is necessary to perform well at the task, which may explain the lower association between intrinsic motivation and achievement for these students.

Lastly, although this study finds many similarities between the CHCs, it also finds some differences as well. The results for China, Hong Kong, and Macau are more similar than the

results from the rest of the CHCs, in that students' achievement scores tended not benefit from having a growth mindset or mastery goal orientation. This could be due to the fact that all of them share a similar Chinese nationality, ethnic ancestry, language, and culture, in contrast to other countries which do not share Chinese ethnicity, such as Korea, Japan, or Vietnam, or has a more ethnically heterogeneous population like Singapore. For instance, students in Vietnam appear to be the most positively motivated by growth mindset among all the CHCs. It is difficult to explain this finding due to the lack of existing research on Vietnam. Vietnam also has the lowest GDP per capita of all the CHCs (IMF, 2020). Since SES is an important factor that relates to motivation and achievement, it may be a factor that explains the different results in Vietnam compared to the rest of the CHCs (Hwang et al., 2019; Bernardo, 2020; Li et al., 2020; Maheshwari & Singh, 2015).

5 Limitations

A limitation of this study is the PISA data itself. First, PISA 2018 only includes three motivation constructs, but not extrinsic motivation or performance goal orientation. Had these additional measures been included, this study could have provided more insight into the relations between motivation and achievement for CHCs. In addition, the items of the motivation constructs on the PISA survey could be problematic given that PISA uses fewer items with similar but slightly different wording when compared to the original questionnaires (Dweck, 1986; Elliot & Murayama, 2008; Deci et al., 1994). For instance, the one-item growth mindset measure could have benefitted from additional items from a measurement perspective, although it is likely that only one item was included because the other items are so similar to that item (Dweck, 1986). Moreover, although the PISA data can show the associations between motivation and achievement, it is difficult to explain why these associations exist. Although the results show

that growth mindset negatively predicts achievement in China, it is not possible to know what was going on in the minds of the students who took the PISA assessment and survey. There would need to be additional studies conducted examining this relation, perhaps paired with qualitative methods such as interviews. Lastly, due to the sampling procedures of PISA, the results from the study may not be as readily generalizable across entire countries. For example, the data from China comes from four large cities which may not be representative of other parts of the country (Luo, 2021).

Another concern is that other motivation constructs should have been considered. The only other major motivation construct measured in the PISA survey was self-efficacy, which is associated with expectancy value theory. Because the relation between self-efficacy and achievement has produced the most consistent results across both CHCs and non-CHCs compared to other motivation constructs, it was not included because this study aims to examine relations that may differ between CHCs and non-CHCs (Eccles et al., 1998; Multon et al., 1991; Teng et al., 2018; Bong, 2002; Eng et al., 2016). Expectancy value theory posits that academic achievement depends on students' sense of self-efficacy, the belief that one can successfully carry out given academic tasks at designated levels (Schunk, 1991), and students' task-value, the desire to engage in academic activities and represents a composite construct that encompasses perceived importance, usefulness, and interest (Wigfield & Eccles, 1992).

An additional limitation is that achievement was considered as a latent variable instead of separating reading and math scores in the analyses. This decision was due to the very high correlation between reading and math scores. Although unlikely, it is still possible that differences in the relations between the motivation constructs and achievement differ between the domains.

Yet another concern is that the category of CHCs may be too inclusive given the differences between the CHCs, the majority of results from this study reveal both commonalities and differences across the CHCs (Liu, Hau, & Zheng, 2018; Carson, 1998; Nguyen, Terlouw, & Pilot, 2006; Turner, 2011; Guo, 2015). In addition, although there are differences between the CHCs, it is very difficult to explain why these differences exist. In order to truly answer those questions, the PISA survey would have needed to collect qualitative data that asked students whether or not they believed that having a growth mindset or mastery goal orientation was important to their achievement and why or why not they thought it was important for their achievement to have a growth mindset or mastery goal orientation.

One last concern is that that these constructs of motivation, developed from the perspective of WEIRD researchers and primarily conducted on WEIRD (Western, Educated, Industrialized, Rich and Democratic) participants, do not completely capture the motivation of individuals in CHCs (Henrich et al., 2010). For instance, emerging studies conducted in CHCs and non-CHCs have also examined a motivation measure not from the main motivation theories called social goals, which measures the extent to which parents, teachers, peers, and society influence students' behaviors (Watkins & Hattie, 2012; Yu & McLellan, 2019). In CHCs, individuals are taught to value the expectations of parents, teachers, peers, and society overall, often times above their own interests, which may make social goals a more appropriate measure of motivation in these contexts (Cheng & Lam, 2013; Chan, 2008). However, work on this measure has been published in the past two decades and only two studies have validated a social goals measure among Chinese and Filipino students (King & Watkins, 2012; King & Watkins, 2013), which may account for lack of widespread use and lack of inclusion in studies such as PISA. Although there may be other better motivation measures for CHCs, this study was limited

to the constructs in the current PISA data. In addition, none of the results from this study indicate that the motivation constructs failed to measure what they had intended to measure, although it is impossible to be sure without additional qualitative data.

6 Conclusion

In contrast to the studies in the majority of the literature, this study finds that growth mindset does not predict achievement for the overall sample of CHCs, and mastery goal orientation does not predict achievement across most of the CHCs. These results are driven by China and other CHCs that are a part of China including Macau and Hong Kong. On the other hand, aligned with the main studies in the literature, intrinsic motivation positively predicts achievement for both CHCs and non-CHC, which suggests that intrinsic motivation may be the most generalizable of the motivation constructs. Moreover, this study also finds that growth mindset, mastery goal orientation, and intrinsic motivation positively predict one another. In addition, there are more commonalities than differences among the CHCs, however Vietnam appears to differ the most from the other CHCs. More studies need to be conducted in order to determine whether or not relations between motivation and achievement differ in CHCs versus in the most commonly studied countries. If future studies on CHCs produce similar results, then there will be a growing body of evidence suggesting that motivation is contextually bound and worth studying across different contexts.

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Appendix

Appendix 1. Items for Motivation Measures

Measure	Items
Growth Mindset	1. Your intelligence is something about you that you can't change very much.
Mastery Goal Orientation	1. I find satisfaction in working as hard as I can. 2. Once I start a task, I persist until it is finished. 3. Part of the enjoyment I get from doing things is when I improve on my past performance. 4. If I am not good at something, I would rather keep struggling to master it than move on to something I may be good at.
Intrinsic Motivation	1. I only read if I have to. 2. Reading is one of my favourite hobbies. 3. I like talking about books with other people. 4. For me, reading is a waste of time.

Study 2: Effort, Motivation, and Achievement in Confucian Heritage Cultures

1 Introduction

Believing in the value of effort is positively associated with student achievement, a well-established finding across many contexts (Mrazek, 2018; Blackwell, 2002; Baldrige, 2010; Duco, 2017; Li et al., 2019). Not only does this belief positively predict achievement, it is also considered a necessary intermediate step to explaining the relation between motivation and achievement. One of the most widely studied motivation constructs, growth mindset, or the belief that intelligence is malleable, emphasizes the importance of believing in the value of effort. According to this theory, students with a growth mindset are more likely to believe that effort is important and useful, and thus are more likely to put in the needed amount of effort to succeed (Dweck, 1986; Dweck & Leggett, 1988; Dinger, et al., 2013).

Given that the concept of growth mindset is so frequently associated with the belief in the value of effort and achievement, the report released by the Programme for International Student Assessment (PISA) 2018, which is administered by the Organisation for Economic Co-operation and Development (OECD) to assess the academic achievement of 15-year-old students in 79 countries around the world (OECD, 2019a), was surprising in that it found growth mindset to be a negative or weak predictor of achievement for students in East Asian countries (OECD, 2019c; OECD, 2021). This finding conflicted with the results for most of the remaining countries, where growth mindset positively predicted achievement (OECD, 2019c).

This finding is particularly surprising because the belief in the value of effort has been a key tenet of education in East and some Southeast Asian countries, which have also been referred to as Confucian Heritage Cultures (CHCs). Research conducted on students in CHCs which include China, Hong Kong, Korea, Japan, Macau, Taiwan, Singapore, and Vietnam

reveals that these students believe that effort is a fundamental part of achieving success, and that putting in more effort can overcome even low ability or economic hardship (Hong, 2001; Stiles, 2005; Stevenson & Stigler, 1992; Stevenson et al., 1990; Fwu et al., 2017; Krashen, 2005). If growth mindset is so closely tied to belief in effort, then why should growth mindset not predict achievement for students in these countries? Perhaps belief in the value of effort does not lead to achievement for these students?

This study addresses these questions by exploring the relations between growth mindset, value of effort in school, and achievement in the PISA 2018 data set by comparing CHCs to non-CHCs, a term used to refer to all other countries excluding the CHCs. In addition, this study also looks at how two other key motivation constructs, mastery goal orientation and intrinsic motivation, relate to the value of effort in school and achievement across CHCs and non-CHCs in this data set. The value of effort in school measures beliefs about the value of putting in effort or trying hard at school and is the best measure of effort available in the PISA 2018 dataset (OECD, 2021). Mastery goal orientation refers to the focus on mastering a task for its own sake and not for external rewards, while intrinsic motivation involves doing a task out of interest or enjoyment (Elliot & Harackiewicz, 1996; Dweck & Leggett, 1988; Deci & Ryan, 1985; Deci & Ryan, 2002).

1.1 Effort, growth mindset, mastery goal orientation, and intrinsic motivation predicting achievement

Research shows that belief in the value of effort has a positive association with achievement. Those who believe in the value of effort tend to put in more effort, which then increases the chances of improving achievement (Blackwell, 2002; Baldrige, 2010; Mrazek, 2018; Duco, 2017; Li et al., 2019). Conversely, those who dismiss the value of effort tend to

think that it is a sign of lack of intelligence, which leads to lower achievement (Blackwell, 2002; Baldrige, 2010).

In the literature, the effort construct includes Likert scale items that measure one's beliefs about the value of effort in general or in school. Although there is some variation in the wording and content of the items, the items tend to include phrases that are synonymous with effort, such as "trying hard", "working hard", or "effort". In an effort construct developed by Sorich and Dweck (1997) and used in some studies (Blackwell, 2002; Baldrige, 2010; Mrazek, 2018; Duco, 2017; Tempelaar et al., 2015), the items focus on how one's beliefs about the value of effort relate to beliefs about ability. For example, one item is "If you're not good at a subject, working hard won't make you good at it." As suggested by this item, if one believes that having strong ability in a subject is innately determined and cannot change, then that can influence beliefs about the value of putting in effort. Variations of this construct have been used in other studies as well (Hong, 2011; Stipek & Gralinski) where the items are worded differently but the content is similar (e.g. "You must work hard to solve problems in order to utilize your ability on the subjects."; "You can get smarter by working harder in school."). In addition, other studies (Wang et al., 2010; McAuley et al., 1989) use the effort measure developed by Ryan (1982), which assess whether or not students put in effort and how important it was to put in effort ("I put a lot of effort into this.", "It was important to me to do well at this task."). Still, other studies include constructs that measure beliefs about the importance of effort in different tasks, such as achieving an A in a middle-school level algebra course (Sun et al., 2021a) or math and reading ability (Stevenson et al., 1990).

In addition, growth mindset also positively predicts achievement in the majority of findings in the literature. The construct of growth mindset emerges from goal orientation theory,

which posits that goals influence a person's learning behavior and those who are successful in learning tend to focus on mastering the task (Dweck & Leggett, 1988; Ames, 1992; Elliot & Harackiewicz, 1996). Those who believe in the malleability of intelligence have a growth mindset, whereas those who believe that intelligence is immutable have a fixed mindset (Dweck, 2000). In the studies conducted on non-CHCs, growth mindset positively predicts achievement, while the opposite is true for a fixed mindset (Blackwell et al., 2007; Chen & Pajares, 2010; Henderson & Dweck, 1990; Mueller & Dweck, 1998). This is because people with a growth mindset tend to think about the possibilities to extend their abilities through achievement, and therefore tend to focus on increasing their knowledge through effort and persistence (Dweck & Leggett, 1988; Dinger, et al., 2013). In contrast, people with a fixed mindset tend to want to demonstrate their abilities or to avoid inadequacy when engaged in academic tasks in order to protect their egos (Dweck & Leggett, 1988; Dinger, et al., 2013).

Closely related to growth mindset, mastery goal orientation has a positive association with achievement as well. Mastery goal orientation is also a construct from goal orientation theory which describes people who strives to gain skills and knowledge to be a better learner (Dweck & Leggett, 1988; Ames, 1992; Elliot & Harackiewicz, 1996). Mastery goal orientation has a positive association with achievement because people with a mastery goal orientation tend to use more effective strategies for learning, such as studying their mistakes, adapting to new strategies, and seeking help from others (Elliot & Harackiewicz, 1996; Dweck & Leggett, 1988). Studies conducted in non-CHCs reveal that mastery goal orientation positively predicts achievement, whereas a performance goal orientation which involves being motivated by external rewards or avoiding failure is associated with lower achievement (Dweck & Elliott, 1983; Harackiewicz, et al., 1997; Harackiewicz et al., 2000; Harackiewicz, et al., 2002).

Like the other motivation constructs, intrinsic motivation positively predicts achievement. Intrinsic motivation, which is derived from self-determination theory, involves being compelled by internal rewards such as joy or interest in the task or activity (Deci & Ryan, 1985; Deci & Ryan, 2002). Intrinsic motivation is positively associated with achievement because those who are intrinsically motivated perform a task or activity out of enjoyment which allows them to persist in the activity even if they fail or lack positive feedback (Deci & Ryan, 1985; Deci & Ryan, 2002). Intrinsic motivation positively predicts achievement in studies conducted on non-CHCs, whereas extrinsic motivation which involves being compelled by external rewards has a negative association with achievement (Guthrie et al., 2013; Froiland & Davison, 2016; Niehaus et al., 2012).

1.2 Growth mindset, mastery goal orientation, and intrinsic motivation predicting effort

Not only do belief in the value of effort and the above motivation constructs predict achievement, growth mindset, mastery goal orientation, and intrinsic motivation also predict belief in the value of effort. Belief in the value of effort is seen as an intermediate step in the relation between these motivation constructs and achievement. People with a growth mindset believe that they can grow their intelligence through concerted effort, and this belief in the value of effort leads them to work hard towards improving their academic achievements (Dweck, 1986; Dweck & Leggett, 1988). Studies show that individuals with a growth mindset tend to perceive effort as useful as opposed to ineffective and also believe that hard work tends to lead to academic improvements (Hong et al., 1999; Miele et al., 2011; Miele & Molden, 2010; Blackwell et al., 2007; Tempelaar et al., 2015; Post & van der Molen, 2021). Similarly, people with a mastery goal orientation believe that exerting effort will help them achieve mastery of the task or activity, which then encourages them to put in the work to achieve success. As with

growth mindset studies, studies on mastery goal orientation also find that it positively predicts the belief in the value of effort (Stipek & Gralinski, 1996; Chouinhard et al., 2007; Tempelaar et al., 2015; Post & van der Molen, 2021). Finally, people who are intrinsically motivated tend to be more engaged in a task and less susceptible to external influences, and as a result, more likely to put in effort and to believe in the value of effort (Albrecht et al., 2009; Logan & Medford, 2011; Dev, 1996). For those with a growth mindset, mastery goal orientation, and intrinsic motivation, the belief in the value of effort often leads to a substantial increase in the amount of effort they put in to achieve their goals, particularly in the face of challenges or failures (Henderson & Dweck, 1990; Hong et al., 1999; Robins & Pals, 2002; Post & van der Molen, 2021; Mrazek, 2018). When faced with setbacks, these individuals tend to attribute their failures to lack of effort and are more likely to seek out extra help from instructors in order to improve (Hong et al., 1999; Robins & Pals, 2002).

1.3 Confucian Heritage Cultures

This section turns to a discussion of the Confucian Heritage Cultures (CHCs) examined in this study. The term CHC indicates the shared Confucian culture that a group of East and some Southeast Asian countries or territories have in common beyond geographic location (Sun, 2012; Sheunck, 2015; Carlson, 1998; Guo, 2015; Marginson, 2011; Tran, 2013; Lau, 2014). The CHCs include the countries and territories China, Hong Kong, Japan, Korea, Macau, Singapore, Taiwan, and Vietnam (Carson, 1998; Nguyen et al., 2006; Turner, 2011; Guo, 2015).

This common Confucian culture originated with Confucius (551–479 BCE), the most well-known and influential Chinese philosopher throughout many countries in Asia, whose teachings reflect the values of the Xia (c. 2070–1600 BCE), Shang (c. 1600–1046 BCE) and Zhou dynasties of China (c. 1046–256 BCE) (Guo, 2015). As a result of China's influence on

neighboring regions and countries through political takeovers or migrations, Confucius' philosophy spread to all of the CHCs (Li, 2003; Guo, 2015). The extent of the influence on different CHCs is difficult to gauge, but the literature recognizes that Confucianism has contributed to the development of cultural values and conventions in all of the CHCs, especially in the area of education (Carson, 1998; Nguyen et al., 2006; Turner, 2011; Guo, 2015). According to Confucius, the primary purpose of learning is to make one more moral and more capable of making a positive contribution to society (Li, 2003). Not only is education seen as necessary for personal improvement, but it is also seen as necessary for the improvement of society at large. Thus, these students tend to be highly motivated to learn and willing to invest a great deal of time in their education (Guo, 2015).

In accordance with Confucian values, these students also tend to value the expectations and advice espoused by their parents, teachers, and greater society, which often take precedence above an individual's personal interests (Guo, 2015; Sun et al., 2019). These values contrast with those in many other countries, particularly in WEIRD countries (Western, Educated, Industrialized, Rich and Democratic) such as the US, where there is more of an emphasis on prioritizing one's own interests over that of others (Henrich et al., 2010; Qu et al., 2016; Ma & Schoeneman, 1997; Markus & Kitayama, 1991). In CHCs, this belief harks back to the primary purpose of learning which is to make a contribution to society rather than to exclusively pursue one's interests (Guo, 2015). In addition, a child's achievement is seen as a result of the entire family's effort rather than the child's individual effort in CHCs, which further deemphasizes the importance of pursuing one's personal interests (Watkins & Biggs, 1996; Chin, 1988). In these contexts, pursuing intrinsic interests can be impractical and socially unacceptable if those interests conflict with the expectations of family members or greater society (Watkins & Biggs,

1996; Chin, 1988). As a result, children strive to achieve not only for themselves but primarily to make their families and society proud. To do so, they focus on more tangible goals valued by families and society, such as attending a top college and contributing to society through work (Salili et al., 2001; Salili, 1996; Winter, 1996; Llewellyn et al., 1982). Although these goals are also important in many other countries, in the US for example, there is still a greater emphasis on pursuing one's interests, and the desire to please one's family or society is not considered to be as essential as in the CHCs (Qu et al., 2016; Wang & Pomerantz, 2009). Even if they do not have an intrinsic interest in a task, students will often work hard at the task if it is deemed valuable by parents, teachers, or society, which may account for the lack of association between intrinsic motivation and achievement in some studies conducted in CHCs (Lu et al., 2011; Cheng, 2019).

Despite the similarities between their cultures, there are also differences within and across the CHCs that may lead to some variation in students' educational experiences or their academic motivations. Although most of the CHCs are fairly ethnically homogenous with over 90% of their population identifying as the majority ethnic group, Singapore is the least homogenous with only 76.8% of the population identifying as the majority ethnicity of Chinese (Nation Master, 2020). Singapore is also the only CHC that has a Western language, English, as its national language, due to its history of British occupation and the ethnic and linguistic diversity within the country (Brunero, 2019; Chew, 2013; Tong & Goh, 2008). Although Hong Kong also shares a history of British occupation, it has been governed by China for over two decades now and maintains Chinese as its national language (Lo & Merryfield, 2008; Lee et al., 2006; Tong & Goh, 2008). In addition, the CHCs vary in levels of wealth, with Singapore having the highest GDP per capita and Vietnam having the lowest GDP per capita (IMF, 2020).

Although many other differences between the CHCs exist (O'Dwyer, 2017), how those differences influence motivation has not been thoroughly examined in studies. Thus, it is difficult to make definitive claims regarding which differences are most relevant to this study.

1.4 Effort, motivation and achievement in Confucian Heritage Cultures

Given the differences in cultural expectations and educational systems, some burgeoning studies have found that students in CHCs experience effort and motivation differently than those in non-CHCs. The belief in the value of effort positively predicts achievement in CHCs as in non-CHCs, although some scholars suggest that students in CHCs place an even greater emphasis on the value of effort. Because parents in CHCs have high expectations for their children's academic success and consider effort to be the most important means to do well academically, their children are frequently encouraged to make an effort in their studies (Ho, 1986; Lin & Fu, 1990; Mau, 1997, Law, 2009). As a result, these parents and teachers tend to downplay students' successes and provide more negative emotional responses to failures, which encourages students to work even harder (Miller et al., 1997; Ng et al., 2007; Bao & Lam, 2008). Thus, many students in CHCs have a belief that effort leads to increased achievement or ability and therefore value effort (Huang & O'Neil, 1993; Salili et al., 2001).

In addition, although some studies have found growth mindset to positively predict achievement in China (Li et al., 2020; Wang et al., 2020), Hong Kong (Chen & Wong, 2014), Japan (Jose & Bellamy, 2012), Macau (Chen et al., 2018), and Singapore (Lim et al., 2020), other studies conducted on Chinese students have found that growth mindset does not predict achievement (Li & Bates, 2019; Wang et al., 2020; Sun et al., 2021a). Although the studies do not propose a reason to explain this finding, some researchers suggest that students in CHCs may simply work hard regardless of their mindsets or ability levels. Chinese students are more likely

to attribute success in school to effort than US students do (Sun et al., 2021a). In addition, Chinese and Japanese mothers are more likely to attribute their children's success in school to effort than US mothers do (Stevenson & Sigler, 1992; Stevenson et al., 1990). While students in CHCs believe that effort and ability are correlated, they also tend to believe that high achievers who have high ability do not need much effort to succeed, and thus, low achievers often work harder than high achievers (Hong, 2001). Another explanation for the lack of a positive association between growth mindset and achievement is that students in the CHCs may define intelligence differently than those in the non-CHCs. Chinese students are more likely to think of intelligence as fluid intelligence, which includes comprehension and reasoning skills, whereas US college students are more likely to think of intelligence as crystallized, which involves recalling stored knowledge (Sun et al., 2021a). Because students tend to think of fluid intelligence as fixed and crystallized intelligence as malleable, the lack of a positive association between growth mindset and achievement for students in the CHCs may be due to the fact that they are thinking of intelligence as fluid rather than crystallized (Sun et al., 2021b). However, studies conducted in CHCs are more consistent in showing that mastery goal orientation positively predicts achievement in China (Zhou & Wang, 2019), Hong Kong (Hau & Ho, 2008; Ho & Hau, 2008; Salili et al., 2001; Salili & Lai, 2003), Japan (Shimizu et al., 2016; Tanaka & Yamauchi, 2001; Suzuki & Sakurai, 2011), Korea (Song et al., 2020; Chung et al., 2020), Singapore (Lee, Ning & Goh, 2014), and Taiwan (Shih, 2005; Lin, 1997).

Moreover, intrinsic motivation has mostly been shown to have a positive association with achievement in China (Liu et al., 2018; Liu et al., 2019; Wu et al., 2019), Hong Kong (Lau & Chan, 2003; Law, 2009), Japan (Nakayama et al., 2007), Korea (You et al., 2016; Lin et al., 2001), Taiwan (Wang & Guthrie, 2004; Huang, 2013; Liou & Liu, 2015), and Singapore (Lay &

Chandrasegaran, 2016; Luo, 2012). Previous studies on PISA data in 2003 (Ross, 2009) and 2012 (Liu et al., 2018) indicate that intrinsic motivation has a positive association with achievement in the CHCs. However, some studies conducted in China and Taiwan have found no association between intrinsic motivation and achievement (Lu et al., 2011; Cheng, 2019). It is possible that intrinsic motivation plays less of a role when engaged in strenuous and challenging tasks that involve frustration, anxiety, and uncertainty (Koestner & Losier, 2002; Noels, Clément, & Pelletier, 2000; Wong & Csikszentmihalyi, 1991). Perhaps these students find the achievement tests or grades to be strenuous and challenging enough for intrinsic motivation not to matter. It is also possible that children in CHCs will work hard to pursue outcomes that make their parents or society proud, such as scoring well on exams, rather than focus on their own intrinsic interests (Watkins & Biggs, 1996; Chin, 1988; Salili et al., 2001; Salili, 1996; Winter, 1996; Llewellyn et al., 1982; Lu et al., 2011; Cheng, 2019).

Lastly, similar to the studies conducted on non-CHCs, there is evidence from a small handful of studies in CHCs that the three motivation constructs have positive associations with the belief in the value of effort. In studies conducted in Singapore, Taiwan and China, results show that growth mindset (Wang et al., 2010), mastery goal orientation (Wang et al., 2018; Wang et al., 2010; Fryer et al., 2014; Wang et al., 2018), and intrinsic motivation (Wey, 1999; Wang et al., 2010; Hong et al., 2009) all positively predict belief in the value of effort.

Although no studies specifically examine the mediating effect of belief in the value of effort in the relation between these three motivation constructs and achievement, the studies cited above provide enough evidence for each of the paths of the mediation model to warrant an investigation of a mediation model in this study. The most commonly examined type of mediation is partial mediation, in which a variable has both a direct and an indirect association

with an outcome variable via a mediator (Baron & Kenny, 1986). Classic mediation occurs when the direct and indirect paths are significant and have the same sign (Baron & Kenny, 1986).

1.5 Additional concerns

One of the concerns in conducting this study is that there have been few studies examining the three motivation constructs and achievement in all of the CHCs, making it difficult to develop accurate hypotheses for each CHC. The lack of studies is not of great concern in a place such as Macau, where the people are considered Chinese (Chen et al., 2018). The most unexpected results would likely occur in Vietnam, the CHC with the lowest GDP per capita where little to no motivation research has been conducted (Nguyen, 2019; Pham, 2014; IMF, 2020). Given that SES predicts achievement (Li et al., 2020; Maheshwari & Singh, 2015) and SES moderates the relation between motivation and achievement (Hwang et al., 2019; Bernardo, 2020), Vietnam may not produce the same results as the majority of the other CHCs. However, due to the lack of existing studies in Vietnam, one can only hypothesize that Vietnam behaves similarly to the rest of the CHCs, while keeping in mind that it may have differences that can only be revealed after conducting the analysis. Similarly, the category of CHCs may simply be too broad to be meaningful. Although that may be true, the literature more frequently groups the CHCs together than identifies their differences, which suggests that there is more evidence supporting the similarities, even if some differences are likely to exist as well (Liu et al., 2018; Carson, 1998; Nguyen et al., 2006; Turner, 2011; Guo, 2015). Studies examining motivation and achievement in the countries and regions that comprise the CHCs do not propose that the relations between motivation and achievement differ between the CHCs.

In addition, another concern is that there may be a difference between achievement in different domains and how they relate to motivation. While few studies examine domain

differences, the existing studies provide little evidence that domain differences exist. A study by Guay and Bureau (2018) on Canadian students grades 7-9 examining motivation and achievement across the domains of math, English, and French did not find any noteworthy differences between domains. Similarly, a study by Liu et al. (2019) on grade 10 Chinese students found little difference between the domains of math, Chinese, and English. Thus, the literature does not provide a lot of evidence pointing to domain differences on the topic of motivation in CHCs.

1.6 The present study

The present study examines the following research questions:

1) Does the value of effort in school mediate the relation between growth mindset and achievement for CHCs and non-CHCs?

2) Does the value of effort in school mediate the relation between mastery goal orientation and achievement for CHCs and non-CHCs?

3) Does the value of effort in school mediate the relation between intrinsic motivation and achievement for CHCs and non-CHCs?

4) Are there differences between the CHCs and non-CHCs? Are there differences when comparing CHCs to one another?

2 Methods

2.1 Data

The data used in this study is the Programme for International Student Assessment (PISA) 2018 data set, collected by the Organisation for Economic Co-operation and Development (OECD) on the math, reading, and science achievement of 15-year-old students in 79 countries. More specifically, this study focuses on the assessment and survey data from the

CHCs that include China, Hong Kong, Korea, Japan, Macau, Taiwan, Singapore, and Vietnam ($n = 53,926$) and non-CHCs which include countries in North America, South America, Europe, Middle East, Central Asia, Africa, and Australia ($n = 558,079$). The PISA uses survey weights and multiple imputed plausible values for achievement scores (OECD, 2019a). According to the PISA report, PISA uses a stratified two-stage sample design, where schools are sampled using probability proportional to size sampling, and students are sampled with equal probability within schools for each participating country. Sampled students receive a final weight which indicates how many other students from the population are represented. The final student weight incorporates both the school weight (the inverse of the school's probability of selection) and the within-school student weight (the inverse of the student's probability of selection). The data for each country should in theory allow for generalization to the entire country. Although for China, in particular, this may not be the case because the data is sampled exclusively from four large and wealthy cities, Beijing, Shanghai, Jiangsu, and Zhejiang, and may not be generalizable to other parts of the country (Luo, 2021).

2.2 Participants

The participants include 15-year-old students in 79 countries. In the CHCs, the number of participants from each country or region ranges from the smallest group, 3,775 participants in Macau, to the largest group, 12,058 participants in China. The sample is 50.70% male and 49.30% female overall. In the non-CHCs, the sample is 50.12% male and 49.88% female with a total of 558,079 participants. See Table 1 for a complete list of participant characteristics.

2.3 Measures

Value of effort in school

Value of effort in school is a latent student-level variable comprised of three items ranging from 1-4 points on a Likert scale 1=strongly agree to 4=strongly disagree (e.g. “Trying hard at school is important.”). Although this variable is originally named “Value of school” in the PISA survey, it is more appropriate to refer to it as “Value of effort in school” based on the language used in the items. Because all of the items begin with the phrase, “Trying hard at school –,” the emphasis is on the value of *trying hard* at school, not simply the value of school itself. If the item were to say, “School is important” or “Doing well at school is important”, it would be more reasonable to label the variable as “Value of School.” Students who believe that school plays an important role in determining their futures, but that trying hard at school is not important, may disagree with these items, even though these students actually believe in the value of school. Only students who agree that *trying hard* at school is important would score high on this measure. Thus, incorporating the word effort into the variable name is more indicative of what these items actually measure. See Table A1 for a list of items.

Growth mindset

Growth mindset is an observed student-level variable comprised of one item ranging from 1-4 points on a Likert scale 1=strongly agree to 4=strongly disagree: “Your intelligence is something about you that you can’t change very much.”

Intrinsic motivation

Intrinsic motivation is a latent student-level variable comprised of four items ranging from 1-4 points on a Likert scale 1=strongly disagree to 4=strongly agree (e.g. “Reading is one of my favourite hobbies.”). Although the PISA survey included five items for intrinsic motivation, the fifth item was not included in this analysis due to its factor loading that was less than 0.2 and negative in value. Child (2006) recommends dropping items with a factor loading of

less than 0.2 because they may not be adequately explaining the construct. See Table A1 for a list of items.

Mastery goal orientation

Mastery goal orientation is a latent student-level variable comprised of four items ranging from 1-4 points on a Likert scale 1=strongly disagree to 4=strongly agree (e.g. “I find satisfaction in working as hard as I can.”) See Table A1 for a list of items.

Achievement

Achievement is a latent variable comprised of math and reading scores. Math scores are a measure of students’ capacity to formulate, employ and interpret mathematics in a variety of contexts. Math scores are scaled to fit approximately normal distributions, with means around 500 score points and standard deviations around 100 score points. In PISA 2018, the scores range from 0 to 916.276 points. The scores are comprised of ten imputed potential values. Reading scores are a measure of students’ capacity to understand, use, evaluate, reflect on and engage with texts in order to achieve one’s goals, develop one’s knowledge and potential, and participate in society. Reading scores are scaled to fit approximately normal distributions, with means around 500 score points and standard deviations around 100 score points. In PISA 2018, the scores range from 0 to 928.687 points. Like math scores, the reading scores are also comprised of ten imputed potential values (OECD, 2019a).

Covariates

Covariates include gender, age, SES, highest level of parent education, and second language status. SES is derived from several variables related to students’ family background that are grouped into three components: parents’ education, parents’ occupations, and an index summarizing a number of home possessions that can be taken as proxies for material wealth or

cultural capital, such as possession of a car, the existence of a quiet room to work, access to the Internet, the number of books and other educational resources available in the home (OECD, 2019b). Second language status provides additional information related to academic achievement that is not captured by SES or parent education alone. The closest proxy of second language status is a measure of whether or not the student speaks a language different from the test language at home.

2.4 Analytic plan

All analysis was conducted using Mplus version 8.5. First, descriptive and correlational analyses were conducted. Then, confirmatory factor analysis (CFA) was conducted on the motivation constructs to analyze their factor structures. See Figure 1 for a conceptual model. Several goodness-of-fit indices were used to determine the model fit, including the Chi-square statistic, root mean square error of approximation (RMSEA), and the comparative fit index (CFI). For acceptable model fit, the chi-square statistic should be non-significant, although it is almost always significant for large sample sizes (Hu & Bentler, 1999). RMSEA should be less than .08, and CFI should be .90 or higher to show acceptable fit (Hu & Bentler, 1999).

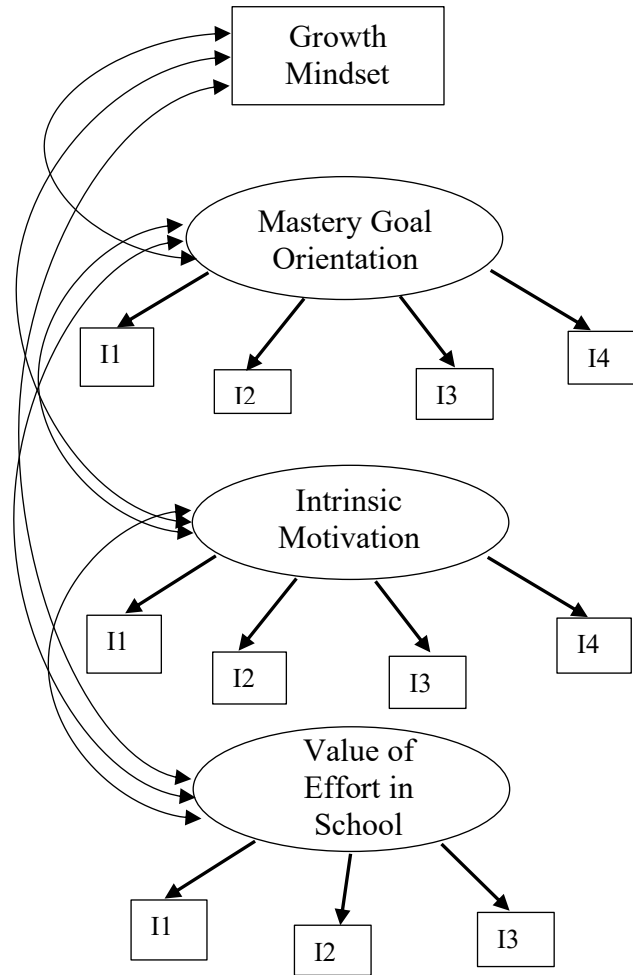


Figure 1. Conceptual model of growth mindset, mastery goal orientation, intrinsic motivation, and value of effort in school

Finally, multigroup analysis using structural equation modeling (SEM) was employed to examine the following models for the full sample of CHCs and each individual CHC: 1) value of effort in school mediating the relation between growth mindset and achievement, 2) value of effort in school mediating the relation between mastery goal orientation and achievement, and 3) value of effort in school mediating the relation between intrinsic motivation and achievement. See Figures 2-4 for conceptual models of the path analyses. For a point of comparison, analysis was also conducted for non-CHCs in PISA 2018. Both direct and indirect paths were reported.

The MLR robust standard error estimator was used to conduct the analysis and the cluster option was selected to account for nesting by schools in the data. The MLR estimator was also used to account for the missing data, < 10% on achievement scores and < 2% on the remaining measures, because it is the recommended choice that estimates models by using all available data (Muthén & Muthén, 2017). The models include all of the following covariates: gender, age, SES, highest level of parent education, and second language status. All analysis takes into account survey weights and uses an imputation method to incorporate all plausible values for achievement scores.

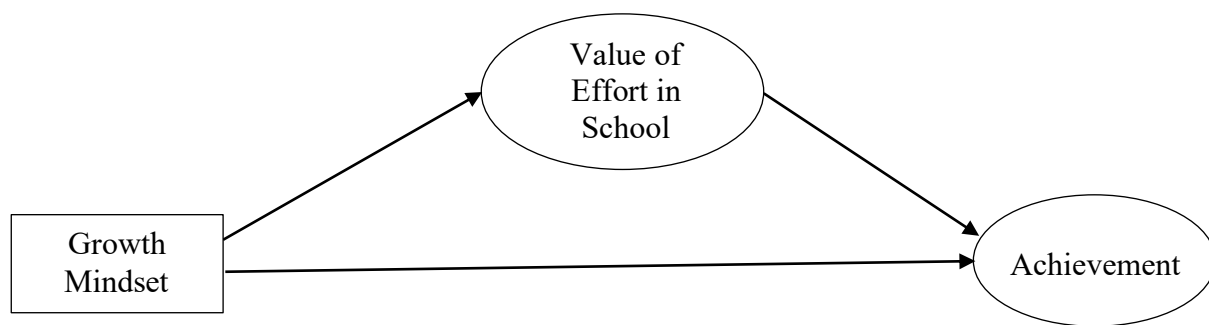


Figure 2. Conceptual model of the value of effort in school mediating the relation between growth mindset and achievement (Model 1)

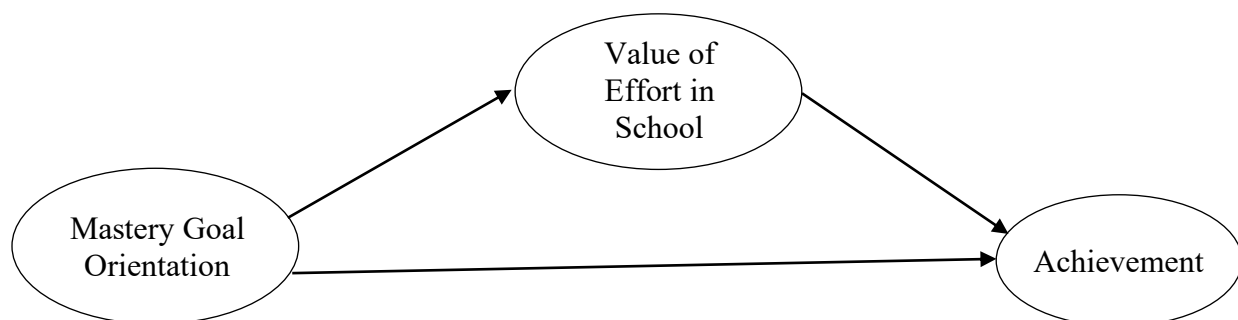


Figure 3. Conceptual model of value of effort in school mediating the relation between mastery goal orientation and achievement (Model 2)

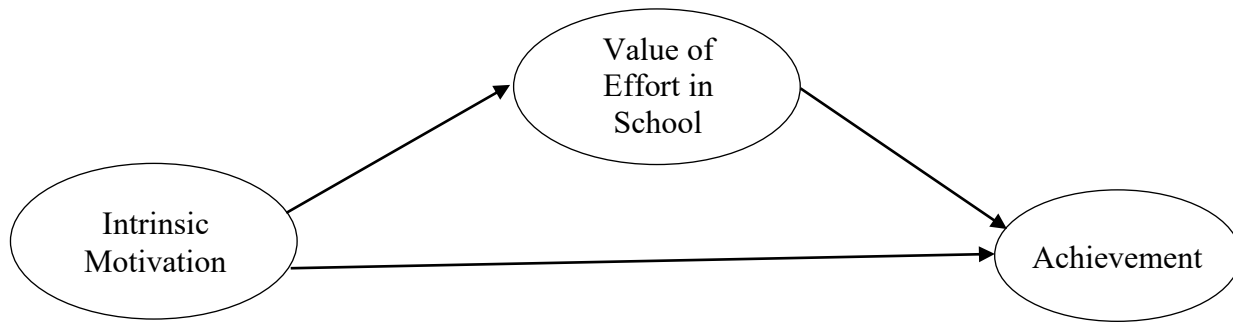


Figure 4. Conceptual model of value of effort in school mediating the relation between intrinsic motivation and achievement (Model 3)

3 Results

3.1 Descriptive and correlational statistics

The overall CHCs sample is fairly evenly distributed by gender, with 49.30% female and 50.66% male. The overall average parent education is a post-secondary education (such as vocational school but not university), ranging from Vietnamese parents who on average have a middle school education to Korean parents who on average have a college education. As indicated in Table 1, compared to the participants from all 79 countries in the PISA 2018 data set, the sample from CHCs is slightly below average (-0.36 scale points) for SES. Among the CHCs, Vietnam has the lowest levels of SES at -1.61 scale points and Singapore has the highest levels of SES at 0.15 scale points in this group of CHCs, which is consistent with the relative GDP per capita levels in these countries (IMF, 2020). Approximately 11.44% of the CHCs sample reports speaking a second language other than the PISA test language at home, ranging from China at 0.48% to Singapore at 43.43%, which is also consistent with the multiethnic and multilingual population in Singapore (Tong & Goh, 2008; Nation Master, 2020).

Among the motivation constructs, the average mastery goal orientation scores are higher than the average growth mindset or intrinsic motivation scores for the CHCs. For the overall sample of CHCs, the average mastery goal orientation score is 3.04 scale points (SD = 0.53).

Mastery goal orientation scores range from lowest in Hong Kong ($M = 2.93$, $SD = 0.50$) to highest in Korea ($M = 3.16$, $SD = 0.51$). For the overall sample of CHCs, the average growth mindset score is 2.60 scale points ($SD = 0.87$). Growth mindset scores range from lowest in Macau ($M = 2.48$, $SD = 0.88$) to highest in Japan ($M = 2.76$, $SD = 0.84$). For the overall sample of CHCs, the average intrinsic motivation score is 2.82 scale points ($SD = 0.71$). Intrinsic motivation scores range from lowest in Singapore ($M = 2.62$, $SD = 0.77$) to highest in Vietnam ($M = 2.90$, $SD = 0.50$). The average value of effort in school is 3.29 points ($SD = 0.66$) for all CHCs, ranging from lowest in Vietnam ($M = 3.00$, $SD = 0.66$) to highest in China ($M = 3.44$, $SD = 0.62$) and Japan ($M = 3.44$, $SD = 0.66$).

In terms of achievement scores, math scores tend to be higher than reading scores across the CHCs, while China has the highest scores, and Vietnam has the lowest scores overall compared to the other CHCs. The average math achievement score in the overall CHCs sample is 554.50 points ($SD = 94.93$), ranging from Vietnam at 494.19 points ($SD = 73.71$) to China at 592.43 points ($SD = 83.37$). The average reading achievement score in the overall CHCs sample is 529.34 points ($SD = 101.34$), ranging from Taiwan at 497.66 points ($SD = 102.08$) to China at 561.03 points ($SD = 90.34$).

In the sample of non-CHCs, the sample is 49.88% female and 50.12% male. The average age of participants is 15.79 years old, while the average level of parent education is post-secondary education in the non-CHCs. Compared to the participants from all 79 countries in the PISA 2018 data set, the sample from non-CHCs is slightly above the sample of CHCs at -0.27 standard deviation units. 17.92% of students in the non-CHCs report speaking a second language other than the PISA test language at home. For non-CHCs, average growth mindset score is 2.63 points ($SD = 0.94$); the average mastery goal orientation score is 3.02 ($SD = 0.62$); the average

intrinsic motivation score is 2.59 points (SD = 0.76); and the value of effort in school is 3.32 points (SD = 0.73). The average math score is 453.11 (SD = 101.15), and the average reading score is 447.45 (SD = 106.79) for the non-CHCs. See Table 1 for a complete list of descriptive statistics.

Table 1. Descriptive Statistics for CHCs and non-CHCs

Characteristics	Mean (SD) or Percentage %									
	All CHCs	CHN	HKG	JPN	KOR	MAC	SGP	TWN	VNM	Non-CHCs
	n=53,925	n=12,058	n=6,037	n=6,109	n=6,650	n=3,775	n=6,676	n=7,243	n=5,377	n=558,079
Gender										
Female (0)	49.30	47.89	51.07	47.98	49.32	49.32	49.09	50.03	51.70	49.88
Male (1)	50.70	52.11	48.93	52.02	50.68	50.68	50.91	49.97	48.30	50.12
Age	15.77	15.73	15.78	15.73	15.83	15.78	15.78	15.79	15.78	15.79
	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)	(0.30)	(0.29)	(0.29)
Parent education	4.36	4.07	3.85	5.09	5.34	3.88	4.97	4.53	2.86	4.69
	(1.58)	(1.72)	(1.50)	(0.99)	(1.04)	(1.66)	(1.15)	(1.28)	(1.59)	(1.50)
Pre-primary (0)	0.94	0.85	0.88	0.00	0.00	0.98	0.41	0.14	5.12	1.16
Primary (1)	3.45	3.75	5.05	0.00	0.14	5.26	1.69	1.13	12.98	2.91
Lower secondary (2)	14.35	25.60	14.39	1.38	1.25	23.95	2.34	7.72	36.93	7.59
Upper secondary (3)	5.67	4.20	17.49	2.38	3.59	6.01	0.00	11.67	1.18	5.64
Post-secondary (4)	25.76	19.73	33.55	29.29	23.00	26.95	30.66	20.86	29.87	23.54
College (5)	15.26	14.25	7.55	19.65	3.88	11.78	21.08	32.56	7.17	15.63
Graduate (6)	34.57	31.61	21.11	47.30	68.14	25.07	43.83	25.93	6.76	43.53
SES	-0.36	-0.36	-0.53	-0.11	0.09	-0.52	0.15	-0.33	-1.61	-0.27
	(1.07)	(1.09)	(1.02)	(0.73)	(0.77)	(0.91)	(0.91)	(0.92)	(1.08)	(1.12)
Second language	11.44	0.48	16.33	0.94	0.59	18.65	43.43	15.51	5.72	17.92
Value of effort in school	3.29	3.44	3.17	3.44	3.38	3.12	3.33	3.20	3.00	3.32
	(0.66)	(0.62)	(0.63)	(0.66)	(0.65)	(0.62)	(0.65)	(0.67)	(0.66)	(0.73)
Growth mindset	2.60	2.60	2.37	2.76	2.59	2.48	2.69	2.68	2.57	2.63
	(0.87)	(0.90)	(0.85)	(0.84)	(0.86)	(0.88)	(0.93)	(0.93)	(0.78)	(0.94)
Mastery goal orientation	3.04	3.14	2.93	2.82	3.16	2.94	3.05	3.07	3.06	3.02
	(0.53)	(0.50)	(0.50)	(0.64)	(0.51)	(0.49)	(0.51)	(0.50)	(0.45)	(0.62)
Intrinsic motivation	2.82	3.25	2.70	2.68	2.63	2.69	2.62	2.71	2.90	2.59
	(0.71)	(0.57)	(0.67)	(0.81)	(0.67)	(0.66)	(0.77)	(0.67)	(0.50)	(0.76)
Math achievement	548.48	592.43	554.42	528.21	526.54	556.63	566.05	527.49	494.19	453.11
	(94.77)	(83.37)	(86.49)	(99.19)	(80.46)	(94.61)	(94.61)	(101.16)	(73.71)	(101.15)
Reading achievement	526.77	561.03	527.33	502.91	515.58	525.08	548.58	497.66	503.57	447.45
	(99.34)	(90.34)	(97.90)	(97.15)	(101.22)	(92.51)	(110.34)	(102.08)	(73.14)	(106.79)

Note: CHN = China; HKG = Hong Kong; JPN = Japan; KOR = Korea; MAC = Macau; SGP = Singapore; TWN = Taiwan; VNM = Vietnam; SES = socioeconomic status.

Correlations were examined among all variables in the full sample of CHCs and non-CHCs. See Table 2 for a full correlation matrix. For the CHCs, the results indicate that growth mindset has a small, positive correlation with mastery goal orientation ($r = 0.111, p < .001$), while mastery goal orientation has a slightly larger positive correlation with intrinsic motivation ($r = 0.182, p < .001$). Of the correlations between the motivation constructs, the correlation between growth mindset and intrinsic motivation is the smallest ($r = 0.100, p < .001$). The value of effort in school has the smallest positive correlation with growth mindset ($r = 0.089, p < .001$) and the largest with mastery goal orientation ($r = 0.207, p < .001$). All of the motivation constructs positively correlate with math and reading achievement, with the largest correlation between intrinsic motivation and reading achievement ($r = 0.356, p < .001$) and the smallest correlation between growth mindset and math achievement ($r = 0.044, p < .001$). In addition, there are very large, positive correlations between math and reading achievement ($r = 0.811, p < .001$) and between SES and parent education ($r = 0.803, p < .001$). Nearly all of the remaining correlations are significant and small in size.

For the non-CHCs, the results indicate that growth mindset has a small negative correlation with mastery goal orientation ($r = -0.023, p < .001$), while mastery goal orientation has a moderate positive correlation with intrinsic motivation ($r = 0.196, p < .001$). Of the correlations between the motivation constructs, the correlation between mastery goal orientation and intrinsic motivation is the largest ($r = 0.196, p < .001$). The value of effort in school positively correlates with all motivation constructs, the largest being mastery goal orientation ($r = 0.164, p < .001$). Nearly all of the motivation constructs positively correlate with math and reading achievement, with the largest correlation between growth mindset and reading achievement ($r = .253, p < .001$) and the smallest correlation between mastery goal orientation

and math achievement ($r = 0.051, p < .001$). In addition, there are very large, positive correlations between math and reading achievement ($r = .823, p < .001$) and between SES and parent education ($r = .770, p < .001$). There is also a moderately large correlation between SES and math scores ($r = 0.438, p < .001$) and between SES and reading scores ($r = 0.417, p < .001$). Nearly all of the remaining correlations are significant and small in size.

Table 2. Correlation Matrix for Motivation, Achievement, and Covariates

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Value of effort in school											
2. Growth mindset	0.089 ***	0.048 ***	0.164 ***	0.059 ***	0.041 ***	0.079 ***	-0.095 ***	-0.004 ***	-0.006 ***	0.022 ***	-0.001 ***
3. Mastery goal orientation	0.207 ***	0.111 ***	-0.023 ***	0.075 ***	0.216 ***	0.253 ***	-0.020 ***	0.018 ***	0.084 ***	0.143 ***	-0.040 ***
4. Intrinsic motivation	0.128 ***	0.100 ***	0.182 ***	0.196 ***	0.051 ***	0.080 ***	-0.084 ***	0.014 ***	-0.010 ***	0.016 ***	-0.015 ***
5. Math achievement	0.136 ***	0.044 ***	0.063 ***	0.276 ***	0.058 ***	0.157 ***	-0.263 ***	0.019 ***	0.013 ***	0.010 ***	0.014 ***
6. Reading achievement	0.135 ***	0.045 ***	0.061 ***	0.356 ***	0.803 ***	0.823 ***	0.016 ***	0.041 ***	0.255 ***	0.438 ***	-0.085 ***
7. Gender (Male)	-0.054 ***	0.045 ***	-0.012 **	-0.142 ***	0.032 ***	-0.100 ***	-0.145 ***	0.036 ***	0.237 ***	0.417 ***	-0.145 ***
8. Age	-0.008 (p=.06)	-0.012 **	-0.017 ***	-0.012 *	0.035 ***	0.025 ***	0.005 (p=.27)	-0.001 ***	-0.011 ***	-0.007 ***	0.001 (p=.32)
9. Parent education	0.119 ***	0.027 ***	0.028 ***	0.016 ***	0.066 ***	0.078 ***	0.004 (p=.42)	-0.034 ***	0.770 ***	0.770 ***	-0.053 ***
10. SES	0.145 ***	0.040 ***	0.070 ***	0.104 ***	0.072 ***	0.088 ***	-0.018 ***	-0.028 ***	0.828 ***	0.828 ***	-0.077 ***
11. Second language	-0.035 ***	-0.008 (p=.06)	-0.02 ***	-0.122 ***	0.033 ***	0.050 ***	0.011 **	0.012 **	-0.017 ***	-0.033 ***	-0.033 ***

Note: CHCs below the diagonal; Non-CHCs above the diagonal

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

3.2 Confirmatory Factor Analysis

CFA was conducted to examine the factor structures of growth mindset, value of effort in school, mastery goal orientation, and intrinsic motivation. Results indicate adequate fit for all CHCs and non-CHCs, which suggests that the factor structures for the measures are broadly applicable across all samples. See Table 3 for a list of fit statistics and Tables 4-6 for a list of factor loadings. The reliability results for the scales of value of effort in school, mastery goal orientation and intrinsic motivation are also good with all alpha values above 0.636.

Table 3. CFA Model Fit and Reliability Statistics

Sample	$\chi^2(df)$	CFI	RMSEA	Value of Effort in School (α)	Mastery Goal Orientation (α)	Intrinsic Motivation (α)
All CHCs	3829.663(52)***	0.949	0.037	0.977	0.764	0.823
China	1372.103(52)***	0.932	0.046	0.968	0.796	0.804
Hong Kong	1142.763(52)***	0.925	0.060	0.993	0.761	0.792
Japan	1067.488(52)***	0.950	0.057	0.970	0.811	0.830
Korea	1210.699(52)***	0.935	0.058	0.956	0.756	0.797
Macau	404.014(52)***	0.961	0.042	0.855	0.678	0.808
Singapore	1129.946(52)***	0.943	0.056	0.963	0.691	0.851
Taiwan	1241.871(52)***	0.937	0.056	0.977	0.806	0.794
Vietnam	565.984(52)***	0.939	0.043	0.927	0.636	0.667
Non-CHCs	13247.620(52)***	0.944	0.022	0.863	0.783	0.799

Note: CFI = comparative fit index; RMSEA = root mean square error of approximation; α = Cronbach's alpha

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

Table 4. CFA Results for Growth Mindset and Value of Effort in School

Sample	Growth (means)	Effort I1	Effort I2	Effort I3
All CHCs	3.137***	0.840***	0.842***	0.815***
China	2.997***	0.835***	0.875***	0.828***
Hong Kong	2.788***	0.829***	0.849***	0.787***
Japan	3.300***	0.905***	0.856***	0.853***
Korea	3.016***	0.850***	0.810***	0.851***
Macau	2.829***	0.761***	0.785***	0.748***
Singapore	2.901***	0.808***	0.839***	0.754***
Taiwan	3.141***	0.820***	0.851***	0.843***
Vietnam	3.275***	0.727***	0.787***	0.711***
Non-CHCs	2.701***	0.833***	0.835***	0.850***

Note: Growth = growth mindset; Effort = value of effort in school

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

Table 5. CFA Results for Mastery Goal Orientation

Sample	Mastery I1	Mastery I2	Mastery I3	Mastery I4
All CHCS	0.695***	0.697***	0.732***	0.625***
China	0.709***	0.768***	0.707***	0.674***
Hong Kong	0.717***	0.714***	0.697***	0.558***
Japan	0.730***	0.692***	0.792***	0.660***
Korea	0.781***	0.645***	0.624***	0.616***
Macau	0.655***	0.573***	0.660***	0.475***
Singapore	0.720***	0.636***	0.615***	0.448***
Taiwan	0.711***	0.742***	0.773***	0.627***
Vietnam	0.590***	0.632***	0.654***	0.396***
Non-CHCs	0.737***	0.724***	0.746***	0.583***

Note: Mastery = mastery goal orientation

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

Table 6. CFA Results for Intrinsic Motivation

Sample	Intrinsic I1	Intrinsic I2	Intrinsic I3	Intrinsic I4
All CHCS	0.873***	0.749***	0.660***	0.600***
China	0.833***	0.733***	0.669***	0.623***
Hong Kong	0.879***	0.691***	0.610***	0.599***
Japan	0.907***	0.752***	0.694***	0.604***
Korea	0.896***	0.758***	0.584***	0.554***
Macau	0.836***	0.637***	0.684***	0.719***
Singapore	0.858***	0.738***	0.756***	0.725***
Taiwan	0.901***	0.743***	0.575***	0.590***
Vietnam	0.727***	0.643***	0.426***	0.508***
Non-CHCs	0.568***	0.839***	0.750***	0.565***

Note: Intrinsic = intrinsic motivation

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

3.3 Multigroup SEM analysis

Results from the multigroup SEM analysis indicate that all samples of CHCs and non-CHCs produced adequate fit statistics for all three models. See Tables 7-9 for a complete list of fit statistics.

Table 7. Model 1 Fit Statistics

Sample	$\chi^2(df)$	CFI	RMSEA
All CHCs	1501.339(22)***	0.988	0.011
China	517.704(22)***	0.971	0.043
Hong Kong	417.868(22)***	0.966	0.056
Japan	627.771(22)***	0.961	0.068
Korea	553.603(22)***	0.963	0.061
Macau	328.898(22)***	0.973	0.061
Singapore	709.204(22)***	0.957	0.069
Taiwan	787.199(22)***	0.958	0.070
Vietnam	274.876(22)***	0.978	0.046
Non-CHCs	1738.480(22)***	0.999	0.013

Note: CFI = comparative fit index; RMSEA = root mean square error of approximation

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

Table 8. Model 2 Fit Statistics

Sample	$\chi^2(df)$	CFI	RMSEA
All CHCs	3288.531(59)***	0.997	0.013
China	1367.739(59)***	0.946	0.043
Hong Kong	757.806(59)***	0.954	0.045
Japan	1068.509(59)***	0.954	0.053
Korea	1684.220(59)***	0.920	0.065
Macau	706.198(59)***	0.942	0.054
Singapore	1541.727(59)***	0.927	0.062
Taiwan	1123.491(59)***	0.955	0.050
Vietnam	520.785(59)***	0.962	0.038
Non-CHCs	3217.533(59)***	0.999	0.010

Note: CFI = comparative fit index; RMSEA = root mean square error of approximation

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

Table 9. Model 3 Fit Statistics

Sample	$\chi^2(df)$	CFI	RMSEA
All CHCs	6111.812(59)***	0.933	0.044
China	1958.319(59)***	0.926	0.052
Hong Kong	1632.178(59)***	0.910	0.068
Japan	1577.242(59)***	0.937	0.065
Korea	1656.632(59)***	0.925	0.064
Macau	842.355(59)***	0.938	0.059
Singapore	2032.071(59)***	0.927	0.071
Taiwan	2637.357(59)***	0.904	0.078
Vietnam	917.762(59)***	0.928	0.052
Non-CHCs	4515.075(59)***	0.998	0.012

Note: CFI = comparative fit index; RMSEA = root mean square error of approximation

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

Table 10 presents the full list of multigroup SEM direct path results for Model 1. Standardized coefficients are reported for all paths. For the majority of CHCs, including the sample of all CHCs, China, Hong Kong, Macau, and Vietnam, there is no classic mediation, whereas there is classic mediation for Japan, Korea, Singapore, Taiwan, and non-CHCs. However, for most of the samples without classic mediation, except for Macau and Vietnam, growth mindset positively predicts achievement indirectly through the value of effort in school. See Figure 5 for a graphical model of the results for the sample of all CHCs and non-CHCs.

Table 10. Direct Path Analysis of the Value of Effort in School Mediating the Relation between Growth Mindset and Achievement

Sample	Growth → Effort	Effort → Achievement	Growth → Achievement
All CHCs	0.085***	0.101*	0.050 (p=.347)
China	0.070***	0.133***	-0.091***
Hong Kong	0.054***	0.177***	-0.023 (p=.151)
Japan	0.103***	0.052**	0.108***
Korea	0.125***	0.154***	0.065***
Macau	0.103***	0.026 (p=.098)	0.028 (p=.070)
Singapore	0.070***	0.040*	0.150***
Taiwan	0.132***	0.121***	0.042**
Vietnam	0.031 (p=.070)	-0.005 (p=.747)	0.221***
Non-CHCs	0.055**	0.039**	0.194***

Note: Growth = growth mindset; Effort = value of effort in school

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

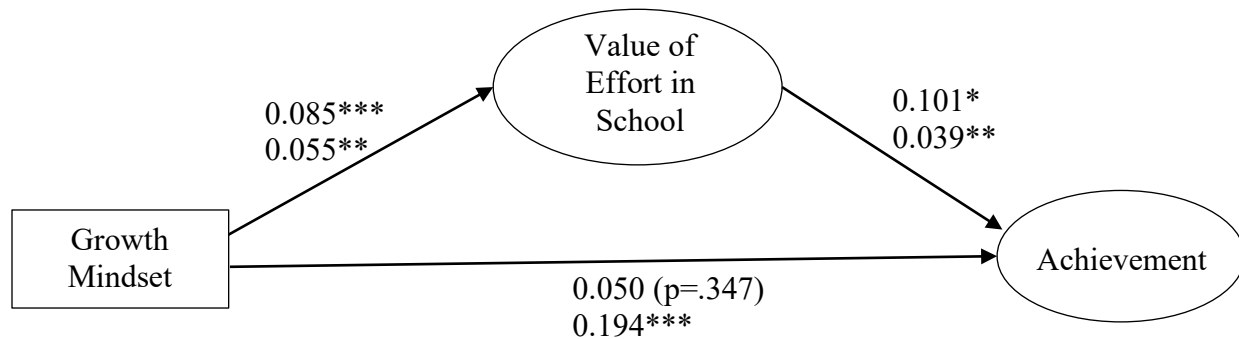


Figure 5. Path analysis model for the value of effort in school mediating the relation between growth mindset and achievement for all CHCs and non-CHCs. *Note:* Coefficients above represent the sample of all CHCs; coefficients below represent non-CHCs.

Table 11 presents the full list of direct path results for Model 2. For the majority of CHCs, including China, Hong Kong, Japan, Macau, Singapore, Taiwan, and Vietnam, there is no

classic mediation, whereas there is classic mediation for the sample of all CHCs, Korea, and non-CHCs. See Figure 6 for a graphical model of the results for the sample of all CHCs and non-CHCs.

Table 11. Direct Path Analysis of Value of Effort in School Mediating the Relation between Mastery Goal Orientation and Achievement

Sample	Mastery → Effort	Effort → Achievement	Mastery → Achievement
All CHCs	0.200***	0.095*	0.058***
China	0.259***	0.129***	-0.016 (p=.320)
Hong Kong	0.288***	0.181***	-0.031 (p=.101)
Japan	0.307***	0.066***	-0.002 (p=.942)
Korea	0.321***	0.140***	0.075***
Macau	0.335***	0.025 (p=.114)	0.011 (p=.428)
Singapore	0.227***	0.049**	0.011 (p=.577)
Taiwan	0.224***	0.122***	0.035 (p=.065)
Vietnam	0.040 (p=.108)	-0.001 (p=.934)	0.078**
Non-CHCs	0.173***	0.035**	0.083***

Note: Mastery = mastery goal orientation; Effort = value of effort in school

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

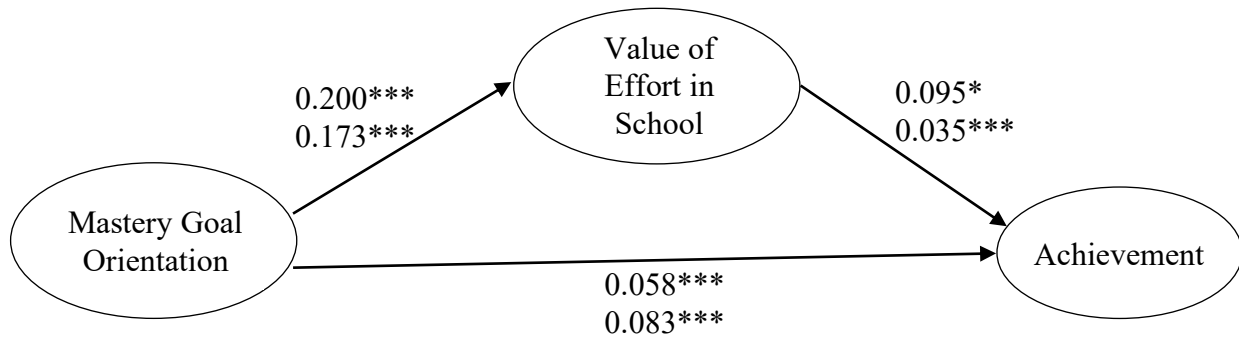


Figure 6. Path analysis model for the value of effort in school mediating the relation between mastery goal orientation and achievement for all CHCs and non-CHCs. *Note:* Coefficients above represent the sample of all CHCs; coefficients below represent non-CHCs.

Table 12 presents the full list of direct path results for Model 3. Of all the models, this model has the most evidence of classic mediations across all samples. There is classic mediation for the sample of all CHCs, China, Hong Kong, Korea, Singapore, Taiwan, and non-CHCs, whereas there is no classic mediation for Japan, Macau and Vietnam. See Figure 7 for a graphical model of the results for the sample of all CHCs and non-CHCs.

Table 12. Direct Path Analysis of the Value of Effort in School Mediating the Relation between Intrinsic Motivation and Achievement

Sample	Intrinsic → Effort	Effort → Achievement	Intrinsic → Achievement
All CHCs	0.065***	0.079***	0.340***
China	0.220***	0.061**	0.258***
Hong Kong	0.132***	0.131***	0.241***
Japan	-0.021 (p=.228)	0.048**	0.324***
Korea	0.080***	0.155***	0.239***
Macau	0.182***	0.011 (p=.421)	0.171**
Singapore	0.056**	0.043**	0.298***
Taiwan	0.142***	0.087***	0.325***
Vietnam	0.074***	-0.007 (p=.655)	0.127***
Non-CHCs	0.061***	0.045**	0.084**

Note: Intrinsic = intrinsic motivation; Effort = value of effort in school

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

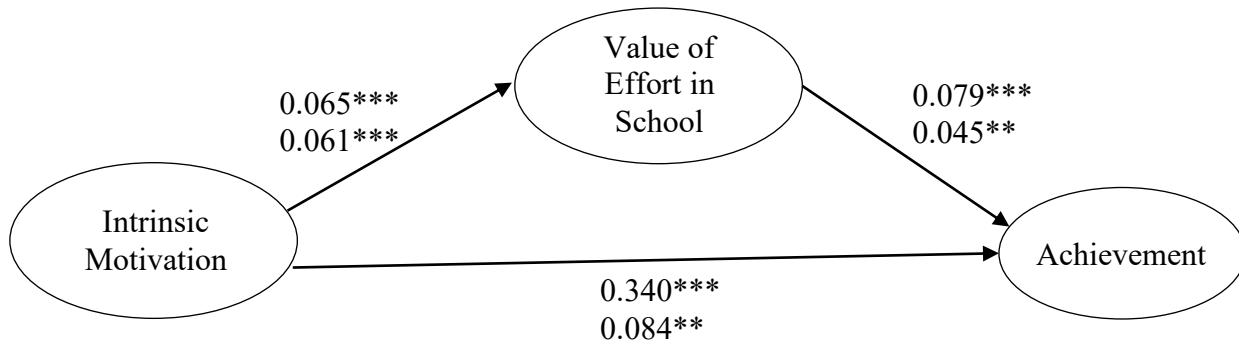


Figure 7. Path analysis model for the value of effort in school mediating the relation between intrinsic motivation and achievement for all CHCs and non-CHCs. *Note:* Coefficients above represent the sample of all CHCs; coefficients below represent non-CHCs.

Lastly, Table 13 presents positive and significant indirect paths observed from growth mindset, mastery goal orientation, and intrinsic motivation to achievement through the value of effort in school. Growth mindset and mastery goal orientation may not directly have an association with achievement for all samples, but they can have a positive indirect association with achievement through the value of effort in school most cases. The size of this association is larger for the CHCs as compared to the non-CHCs. In addition, the value of effort in school explains more of the total association between growth mindset/mastery goal orientation and achievement for the CHCs than the non-CHCs. Moreover, the value of effort in school explains

more of the total association between mastery goal orientation and achievement than it does for the associations between the other motivation constructs and achievement. Lastly, the value of effort in school explains approximately the same percentage of the total association between intrinsic motivation and achievement for both CHCs and non-CHC, which provides evidence that intrinsic motivation is the most generalizable of the motivation constructs. Interestingly, only for Macau and Vietnam does the value of effort in school not explain any percentage of the associations between the motivation constructs and achievement. This is due to the fact that the value of effort in school does not predict achievement for both Macau and Vietnam, and growth mindset and mastery goal orientation do not predict the value of effort in school for Vietnam.

Table 13. Standardized Indirect Path Coefficients and Percent of Total Association Explained through the Value of Effort in School

Sample	Growth → Effort → Achievement		Mastery → Effort → Achievement		Intrinsic → Effort → Achievement	
	Indirect path coefficient	% of total association	Indirect path coefficient	% of total association	Indirect path coefficient	% of total association
All CHCs	0.009***	15%	0.019***	25%	0.005***	1%
China	0.009***	9%	0.033***	68%	0.013***	5%
Hong Kong	0.010***	29%	0.052***	63%	0.017***	7%
Japan	0.005***	5%	0.020***	91%	0.000***	0%
Korea	0.019***	23%	0.045***	37%	0.012***	5%
Macau	0.003***	9%	0.008***	43%	0.002***	1%
Singapore	0.003***	2%	0.011***	50%	0.002***	1%
Taiwan	0.016***	28%	0.027***	44%	0.012***	4%
Vietnam	0.000***	0%	0.000***	0%	0.000***	0%
Non-CHCs	0.002***	1%	0.006***	7%	0.003***	3%

Note: Effort = value of effort in school; Growth = growth mindset; Mastery = mastery goal orientation; Intrinsic = intrinsic motivation; * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

4 Discussion

First, the results from this study indicate that although growth mindset and mastery goal orientation do not directly predict achievement across all CHCs, these motivation constructs more consistently predict achievement through the value of effort in school. This finding can be interpreted from the lack of direct association from growth mindset and mastery goal orientation

to achievement, but the positive indirect influence of value of effort in school on the relation between these motivation constructs and achievement. In other words, students in the CHCs believe in the value of effort in school and their achievement is positively associated with this belief, even if their achievement does not appear to be directly associated with having a growth mindset or a mastery goal orientation. By looking exclusively at the relations between growth mindset and mastery goal orientation with achievement, one may come to the conclusion that these motivation constructs are not associated with or weakly associated with achievement for students in CHCs. But the findings from this study indicate that growth mindset and mastery goal orientation have a positive indirect association with achievement through the value of effort in school.

The results from this study support the findings from many existing studies in the literature that have been conducted in CHCs. As in this study, a few existing studies conducted in China also find no positive association between growth mindset and achievement (Li & Bates, 2019; Wang et al., 2020; Sun et al., 2021a). Because students in CHCs are given a great deal of pressure to work hard towards achievements and they strongly believe that effort leads to improvement, they may not need to have a growth mindset in order to succeed because they will work hard with or without one (Ho, 1986; Lin & Fu, 1990; Mau, 1997, Lau, 2009; Miller et al., 1997; Ng et al., 2007; Bao & Lam, 2008; Hong, 2001). Although most of the existing studies conducted in CHCs on the relation between mastery goal orientation and achievement show a positive association, given that the construct of mastery goal orientation is so closely related to growth mindset, it is not unreasonable to expect that if one of the constructs does not relate to achievement, that the other one does not either. In addition, the results from this study also support the existing studies in the literature on CHCs that find that growth mindset (Wang et al.,

2010) and mastery goal orientation (Wang et al., 2018; Wang et al., 2010; Fryer et al., 2014) are positively associated with belief in the value of effort, which is also positively associated with achievement (Huang & O'Neil, 1993; Salili et al., 2001).

Next, the findings from this study also dispel the possibility that students in CHCs do not believe in the value of effort in school or that value of effort in school does not have a positive association with achievement. In this study, students in CHCs do believe in the value of effort in school which also has a positive association with achievement, even more so than for students in non-CHCs. As Table 13 indicates, for most CHCs as compared to non-CHCs, there is a higher percent of total association between growth mindset and mastery goal orientation with achievement via value of effort in school, which suggests that the indirect effect of value of effort in school is larger for most CHCs than for non-CHCs. Moreover, based on the sizes of the paths in the models, students from CHCs, as opposed to non-CHCs, tend to have a stronger association from the indirect effect of value of effort in school on achievement, whereas students from non-CHCs tend to have a stronger association from the direct relation between growth mindset and mastery goal orientation on achievement. These findings are also supported by existing studies on CHCs. Parents and teachers in CHCs place a great deal of pressure on students to put in the necessary amount of effort to succeed academically (Guo, 2015; Ho, 1986; Lin & Fu, 1990; Mau, 1997; Lau, 2009), which is likely due to the Confucian belief that educational attainment is central to one's life purpose and one's contribution to society (Li, 2003). As a result, students in CHCs believe that effort improves achievement and consequently value effort (Huang & O'Neil, 1993; Salili et al., 2001). They believe that effort can even allow one to overcome low ability or economic hardship (Salili et al., 2001; Stiles, 2005; Stevenson & Stigler, 1992; Stevenson et al., 1990; Fwu et al., 2017; Krashen, 2005). Thus, their belief in the

value of effort encourages them to put in the effort necessary to succeed academically, which leads to a positive association between the value of effort and achievement.

In addition, the results from this study also indicate that the constructs of growth mindset, mastery goal orientation, and intrinsic motivation are associated, but not synonymous, with the value of effort in school across both CHCs and non-CHCs. In particular, growth mindset, which is commonly conflated with the belief in the value of effort, is a distinct construct that is only associated with belief in the value of effort (Hong et al., 1999; Miele et al., 2011; Miele & Molden, 2010; Blackwell et al., 2007; Tempelaar et al., 2015; Post & van der Molen, 2021; Wang et al., 2010). Even though the value of effort is embedded in the constructs of growth mindset, mastery goal orientation, and intrinsic motivation, these constructs are also comprised of other elements as well (Stipek & Gralinski, 1996; Chouinhard et al., 2007; Tempelaar et al., 2015; Post & van der Molen, 2021; Albrecht et al., 2009; Logan & Medford, 2011; Dev, 1996; Wang et al., 2018; Wang et al., 2010; Fryer et al., 2014; Huang & O'Neil, 1993; Salili et al., 2001). In addition to emphasizing the value of effort, growth mindset also emphasizes the belief in the malleability of intelligence, while mastery goal orientation emphasizes the pursuit of mastering a task for its own sake, and intrinsic motivation emphasizes the pursuit of personal interests (Dweck, 1986; Elliot & Harackiewicz, 1996; Dweck & Leggett, 1988; Deci & Ryan, 1985; Deci & Ryan, 2002). These motivation constructs are distinct from the value of effort in school as well as from each other in this study.

Moreover, results from this study also indicate that out of all the motivation constructs, intrinsic motivation is the one that behaves most similarly across all of the CHCs and non-CHCs, which suggests that it may be the most generalizable motivation construct across different contexts. This finding can be interpreted from the evidence of classic mediation for the intrinsic

motivation model across nearly all the CHCs and non-CHCs, in contrast to the lack of classic mediation for the growth mindset and mastery goal orientation models for most CHCs. This is an interesting finding because the literature on the relation between intrinsic motivation and achievement in CHCs includes mixed results. However, the results from this study provide evidence in support of the major findings in the literature that suggest that intrinsic motivation positively predicts the value of effort and achievement (Liu et al., 2018; Nakayama et al., 2007; You et al., 2016; Lu et al., 2011; Cheng, 2019). Those who are intrinsically motivated are more likely to continue performing a task because they enjoy it, and more likely to think of the effort that they put into the task as enjoyable rather than a hassle (Deci & Ryan, 1985; Deci & Ryan, 2002). As a result, intrinsically motivated people tend not to give up in the face of failure or lack of rewards, which makes them more likely to be successful (Henderson & Dweck, 1990; Hong et al., 1999; Robins & Pals, 2002; Post & van der Molen, 2021; Mrazek, 2018). Note that because intrinsic motivation measure in this study is reading specific, the association between intrinsic motivation and achievement for math and reading is nearly the same but slightly smaller in size than the association between intrinsic motivation and reading achievement, due to the high over 0.8 correlation between math and reading scores.

Surprisingly, the association between intrinsic motivation and achievement is larger for the CHCs when compared to the non-CHCs. Although no studies in the literature support this finding, there may be a possible explanation for it. In the CHCs, students tend not to be encouraged to pursue intrinsic motivators. Therefore, students who report having intrinsic motivation are more likely to be accurately depicting themselves, instead of trying to appear desirable, because they have no pressure to appear intrinsically motivated. As a result, these intrinsically motivated students are more likely to put in the effort to do well, which may explain

the larger association between intrinsic motivation and achievement. On the other hand, students in the non-CHCs may be more encouraged to have intrinsic motivation. Thus, they may report being more intrinsically motivated than they actually feel because they believe that being intrinsically motivated is desirable. They might claim to be intrinsically motivated but not do what is necessary to perform well at the task, which may explain the lower association between intrinsic motivation and achievement for these students.

Lastly, although there are commonalities among the CHCs, the results from this study also find differences between the CHCs, the most obvious being between Vietnam and the rest of the CHCs. The results for Vietnam differ the most from the majority of the CHCs across all three models. In contrast to most CHCs, in Vietnam, the value of effort in school does not predict achievement, while there is a small positive association between growth mindset and mastery goal orientation with achievement. The lack of previous studies conducted in this country made it difficult to predict whether Vietnam would behave similarly enough to the rest of the CHCs. The results from this study provide evidence that Vietnam may not be as similar to the rest of the CHCs as the grouping of CHCs may suggest (Nguyen, 2019; Pham, 2014). The most obvious possible explanation for this difference is that Vietnam has less wealth than the rest of the CHCs (IMF, 2020). Given that SES has a great deal of influence over a variety of educational outcomes, it is not surprising that a country with a lower GDP per capita may produce different results from other countries with much higher GDPs per capita (Li et al., 2020; Maheshwari & Singh, 2015). Students' motivations or beliefs about effort may not matter if they lack the necessary educational resources. It is possible that a country with less wealth also has fewer economic opportunities for social mobility, which may lead people to think effort may not be associated with greater achievements. It is also possible that in this type of economic climate,

people benefit from believing in the malleability of intelligence and the value of pursuing a task for itself, because external achievements or validation may be scarcer in a place with poorer economic conditions.

5 Limitations

One limitation of this study involves the PISA items and sampling procedures. PISA models the growth mindset, mastery goal orientation, and intrinsic motivation items off the original questionnaires but does not always use the exact wording or the same number of items. For instance, the PISA growth mindset measure uses one item instead of eight, while the PISA mastery orientation measure uses slightly different wording, and the PISA intrinsic motivation measure includes fewer items as well (Dweck, 2000; Elliot & Murayama, 2008; Deci et al., 1994). In addition, the value of effort measure in the PISA is specific to school, whereas other measures of the value of effort in the literature include both school-related and general items. Although these differences could suggest that the PISA items do not fully capture the entirety of the original constructs, the results from this study on non-CHCs suggests that the items are capturing the constructs in a way that align with the majority of the findings in the literature. This does not eliminate all possibility of problems with the items, but it is a positive indication that the PISA items do measure what they intend to measure. In addition, the PISA measure of the value of effort is related to school only and not to effort more generally, whereas other effort constructs have both general and school-related items. Moreover, due to the sampling procedures of PISA, the results from the study may not be as readily generalizable across entire countries. For example, the data from China comes from four large cities which may not be representative of other parts of the country (Luo, 2021).

Another limitation is that the constructs of motivation examined in this study, which were developed by WEIRD researchers and primarily conducted on WEIRD (Western, Educated, Industrialized, Rich and Democratic) participants, may not accurately capture the motivation of individuals in CHCs (Henrich et al., 2010). Although this may be true to some extent, there is no evidence to suggest that these constructs are not measuring what they intend to measure. The differences that arise between CHCs and non-CHCs are likely due to the differences in the relations between motivation and achievement, not in what is being measured by the constructs, although it is impossible to be sure without additional qualitative data. Additionally, some researchers of CHCs have called for the inclusion of motivation measures such as social goals, which measure the extent to which parents, teachers, peers, and society influence students' behaviors (Watkins & Hattie, 2012; Yu & McLellan, 2019). Although this type of measure was not included in this survey, perhaps future PISA surveys could incorporate such measures that could provide additional insight into the motivations of students in CHCs.

An additional limitation is that achievement was considered as a latent variable instead of separating reading and math scores in the analyses. This decision was due to the very high correlation between reading and math scores. Although unlikely, it is still possible that differences in the relations between the motivation constructs and achievement differ between the domains.

Yet another concern is that the category of CHCs may be too inclusive given the differences between the CHCs, the majority of results from this study reveal both commonalities and differences across the CHCs (Liu, Hau, & Zheng, 2018; Carson, 1998; Nguyen, Terlouw, & Pilot, 2006; Turner, 2011; Guo, 2015). Although the results from this study show that there are differences between CHCs and non-CHCs, it is very difficult to explain why these differences

exist. In order to truly answer those questions, the PISA survey would have needed to collect qualitative data that asked students whether or not they believed that having a growth mindset or mastery goal orientation was important to their achievement and why or why not they thought it was important for their achievement to have a growth mindset or mastery goal orientation.

6 Conclusion

This study shows that although students in the CHCs do not have a positive direct association between achievement and growth mindset or mastery goal orientation, they do have a positive indirect association between achievement and value of effort in school. This finding is important in establishing growth mindset, mastery goal orientation, intrinsic motivation as distinct constructs from the value of effort in school. This finding also dispels the hypothesis that students in CHCs do not believe in the value of effort in school or that there is no association at all between growth mindset or mastery goal orientation and achievement. It further reveals that although growth mindset and mastery goal orientation may not function in the same ways for students in CHCs as compared to non-CHCs, both growth mindset and mastery goal orientation can still have a positive indirect association with achievement for those in CHCs. For both CHCs and non-CHCs, intrinsic motivation appears to behave the most similarly across contexts, a finding that may suggest that this construct is more generalizable across contexts than growth mindset or mastery goal orientation. Lastly, although the results are fairly consistent across all CHCs, the findings for Vietnam indicate that it differs the most from the rest of the CHCs, which may be due to its lowest GDP per capita status among the CHCs. Although these results indicate that differences exist between CHCs and non-CHCs, they do not indicate why these differences exist. More studies need to be conducted in the future that illuminate the reasons why students in

CHCs think about and experience motivation differently from those studied in the majority of the literature.

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Appendix

Appendix 1. Items for Motivation Measures

Measure	Items
Value of Effort in School	1. Trying hard at school will help me get a good job. 2. Trying hard at school will help me get into a good college. 3. Trying hard at school is important.
Mastery Goal Orientation	1. I find satisfaction in working as hard as I can. 2. Once I start a task, I persist until it is finished. 3. Part of the enjoyment I get from doing things is when I improve on my past performance. 4. If I am not good at something, I would rather keep struggling to master it than move on to something I may be good at.
Intrinsic Motivation	1. I only read if I have to. 2. Reading is one of my favourite hobbies. 3. I like talking about books with other people. 4. For me, reading is a waste of time.

Study 3: SES and Gender Moderating the Relation between Growth Mindset and Achievement in Confucian Heritage Cultures

1 Introduction

Growth mindset, the belief that intelligence is malleable, has been shown to positively predict achievement in many studies (Dweck, 1986, Blackwell et al., 2007; Chen & Pajares, 2010; Henderson & Dweck, 1990; Mueller & Dweck, 1998). However, these studies, which have been primarily conducted in the US and Europe, or WEIRD (Western, Educated, Industrialized, Rich and Democratic) countries, may not be representative of all contexts. Specifically, there is a growing body of literature that suggests that growth mindset does not necessarily predict achievement for students in Confucian Heritage Cultures (CHCs) (Li & Bates, 2019; Wang et al., 2020; Sun et al., 2021a; OECD, 2019c). According to the literature, the group of CHCs include China, Hong Kong, Japan, Korea, Macau, Singapore, Taiwan, and Vietnam (Carson, 1998; Nguyen et al., 2006; Turner, 2011; Guo, 2015). Moreover, one of the most comprehensive surveys of students in CHCs and other countries around the world, the Programme for International Student Assessment (PISA) 2018, also provides evidence that the relation between growth mindset and achievement may differ for students in CHCs as opposed to non-CHCs. As presented in the OECD (2021) report analyzing growth mindset in the PISA 2018 results, growth mindset was not as strongly associated with academic performance in Asian countries that share a Confucian cultural heritage when compared with other countries. Although the studies cited above have found that growth mindset may predict achievement differently in the CHCs, there is very little research that moves beyond simply noting a difference in the association between growth mindset and achievement. Thus, this study contributes to a more in-depth understanding of the relation between growth mindset and achievement by examining how SES and gender

moderate this association. SES and gender are the two most frequently studied moderators of the association between growth mindset and achievement, which makes them the focus of this study.

1.1 Growth mindset predicting achievement

Growth mindset originally evolved from goal orientation theory, which is a prominent theory within the field of motivation that is examined in this study. Goal orientation theory, which was developed by scholars such as Dweck, Elliot, and Harackiewicz, emphasizes the influence of an individual's goals over his or her behavior towards learning and suggests that successful learners tend to engage in tasks when concerned about mastering the content or task (Dweck & Leggett, 1988; Ames, 1992; Elliot & Harackiewicz, 1996). Within goal orientation theory, Dweck popularized the concept that one's growth mindset regarding the malleability of intelligence leads to acquiring knowledge and skills for the purpose of becoming a more competent learner.

Growth mindset refers to the implicit or incremental theory of intelligence, which is defined as individuals' personal conceptions about the nature of intelligence (Sternberg et al., 1981). According to this theory, individuals can have either a growth mindset, the belief that intelligence is malleable, or a fixed mindset, the belief that intelligence cannot be changed, but not both at once (Dweck, 1986; Dweck, 2000). Studies show that having a growth mindset positively predicts achievement in the majority of studies, while having a fixed mindset negatively predicts achievement (Blackwell et al., 2007; Chen & Pajares, 2010; Henderson & Dweck, 1990; Mueller & Dweck, 1998). Individuals with a growth mindset are more likely to think about their achievement in terms of possibilities to extend their capabilities, and thus tend to focus on increasing their knowledge through practice and persistence rather than thinking of themselves as limited by their abilities (Dweck & Leggett, 1988; Dinger, et al., 2013). On the

other hand, individuals with a fixed mindset tend to focus on demonstrating their adequacy or avoiding inadequacy when engaged in academic tasks (Dweck & Leggett, 1988; Dinger, et al., 2013). When individuals are successful at a task, those with growth and fixed mindset tend to behave similarly academically (Dweck, 2002; Grant & Dweck, 2003). However, when faced with a challenge, individuals with growth mindsets see the opportunity to expand their intelligence by learning new skills or knowledge (Blackwell et al., 2007; Hong et al., 1999), whereas individuals with fixed mindsets see challenge as an indication of their inadequacy, and thus withdraw from the task or activity to protect their egos (Hong et al., 1999).

1.2 Moderators of the relation between growth mindset and achievement

In recent years, a growing number of studies have found that growth mindset may predict achievement differently depending on one's individual characteristics. Because mindsets are influenced by one's contexts and experiences, it is not inconceivable that having a growth mindset might be associated with different outcomes for students who have different characteristics (Cimpian et al., 2007; Haimovitz & Dweck, 2016; O'Rourke et al., 2014; Paunesku et al., 2015; Yeager et al., 2016). The most commonly studied characteristics in the literature are based on SES and gender, which some studies have shown to moderate the relation between growth mindset and achievement (King & Trinidad, 2021; Bernardo, 2020; Claro, Paunesku, Dweck, 2016; Destin et al., 2019; Zhao et al., 2021; Heyder et al., 2021). However, due to the limited numbers of studies available on this topic and the lack of consensus on the results, it is difficult to predict how each of these moderators may behave and whether or not the results are accurate.

Studies examining how SES moderates the association between growth mindset and achievement find varying results, even though all of them use large-scale nationally representative data sets. Some studies show that growth mindset positively predicts achievement only among students from high SES families but not among those from low SES families (King & Trinidad, 2021; Bernardo, 2020). The study by King and Trinidad (2021) used a nationally representative sample of tenth grade US students from the Educational Longitudinal Study conducted by the National Center for Education Statistics, while the Bernardo (2020) study used a nationally representative sample of tenth grade students from the Philippines. In these studies, it is possible that students with higher SES tend to perform better academically than low SES students, due to various factors such as increased access to educational resources or additional parent support. When high SES students put in effort, they are more likely to see their performance increase due to the advantages associated with SES; therefore, they are more likely to perceive growth mindset to be beneficial because they tend to experience success as a result of their efforts (King & Trinidad, 2021; Bernardo, 2020). Low SES students, on the other hand, may find that putting in effort does not necessarily allow them to overcome the barriers associated with inequality. Therefore, even with a high growth mindset, they may not achieve high scores due to other reasons associated with access to fewer resources, which makes them less likely to have a positive association between growth mindset and achievement (Destin et al., 2019). Moreover, growth mindset may even be harmful to low SES who may blame their failures entirely on themselves.

Other studies find that growth mindset is positively associated with achievement for low SES but not high SES students, or that there is no difference between SES groups at all. In PISA 2018, growth mindset had a stronger association with achievement for low SES students than

high SES students (OECD, 2021). Growth mindset may be more predictive of achievement for low SES groups because those students most want to believe that their efforts can help them overcome their situation, whereas high SES groups may see growth mindset as irrelevant, taking their high achievement as a given or the result of innate abilities, which means they may not exert more effort even if they had high growth mindset (Claro et al., 2016; Destin et al., 2019). Low SES students with greater obstacles to overcome may need to have a growth mindset because of the heightened levels of resilience that they need to succeed (Destin et al., 2019). The study by Claro et al. (2016) used a nationally representative sample of tenth graders from Chile, while the Destin et al. (2016) study used a nationally representative sample of US ninth graders from the National Study of Learning Mindsets. Still, another study conducted by Hwang et al. (2016) using the nationally representative US Educational Longitudinal Study data set finds that growth mindset does not predict achievement differently among high and low SES students. It may be that those in different SES groups do not experience the relation between growth mindset and achievement any differently.

In addition to SES, gender is also known as another moderator of the relation between growth mindset and achievement. In PISA 2018, there is a slightly larger association between growth mindset and achievement for girls as compared to boys (OECD, 2021). Due to stereotypes about female performance in math and lower female representation in STEM fields, some studies suggest that females are more susceptible to the harmful effects of a fixed mindset in math or that females respond more to growth mindset than males do in STEM subjects (Dweck, 2007; Good, Rattan, & Dweck, 2012; Degal et al., 2018). However, no existing studies provide an explanation for the larger association between growth mindset and reading achievement for females (OECD, 2021).

Another study finds that growth mindset positively predicts math achievement for boys, but not for girls (Zhao et al., 2021). Math, as compared to reading, is considered a domain that requires more innate ability, which stereotypically has been ascribed to males more frequently than females (Steffens & Jelenec, 2011; Chestnut & Markman, 2018). As a result, male students may experience fewer barriers to success in math, which may increase the likelihood that the effort they put in helps their performance (Zhao et al., 2021). Females, on the other hand, may find that even having a growth mindset does not allow them to overcome the obstacles they face from differential treatment or gender stereotypes, which results in no association between growth mindset and achievement (Zhao et al., 2021; Claro et al., 2016; Pierce, 2017; Hwang et al., 2016; Gandhi et al., 2020; Macnamara & Rupani, 2017). Among these studies, only the one conducted by Hwang et al. (2016) used a nationally representative data set from the Educational Longitudinal Study.

In contrast, another study finds that growth mindset negatively correlates with math achievement for male students, but there is also no correlation for female students, nor is there a correlation between growth mindset or reading for either males or females (Heyder et al., 2021). This study by Heyder et al. (2021) was conducted using a nationally representative data set from Germany. Because females are seen as having less of the innate ability needed for math achievement, having a fixed mindset should be even more detrimental to their success because it would lead to their lack of resilience and effort (Heyder et al., 2021; Lee et al., 2021). Males, in contrast, might even benefit from a fixed mindset because they believe that they have a higher innate ability in math and might benefit from believing that others with less innate ability could not reach the same level (Heyder et al., 2021; Lee et al., 2021). Another explanation for this difference is to say that females are experiencing stereotype threat, while males are experiencing

stereotype boost in math (Steffens & Jelenec, 2011; Cvencek et al., 2011; Ambady et al., 2001). Stereotype threat occurs when those of a stigmatized group suffer from higher anxiety caused by the internal pressure to disprove a negative stereotype, which then contributes to their lower performance, whereas stereotype boost occurs when those of the advantaged group perform better due to confidence in their abilities (Steele, 1997; Steele et al., 2002). Thus, according to this explanation, females who suffer due to stereotype threat need to have a growth mindset in order to overcome their disadvantaged position, while males who benefit from stereotype boost see their performance improved by endorsing a fixed mindset.

Ultimately, given the small handful of studies on this topic, it is difficult to say which of these explanations is more robust, particularly in light of majority of the studies that do not find any differences between genders in growth mindset and achievement (Claro et al., 2016; Pierce, 2017; Hwang et al., 2016; Gandhi et al., 2020; Macnamara & Rupani, 2017). Moreover, there have been an even smaller number of studies conducted using nationally representative samples. However, it is interesting to note that no studies have found gender differences in the relation between growth mindset and reading achievement.

Under these circumstances, focusing on multiple moderators instead of only one provides more results to examine and more opportunities to evaluate the data. In addition, examining multiple moderators in this paper allows for comparison between the moderators, which may provide more information about the differences between CHCs and non-CHCs, a term used to refer to countries excluding the CHCs.

1.3 Confucian Heritage Cultures

This section presents a discussion of the Confucian Heritage Cultures examined in this study. The CHCs have a shared Confucian heritage that has permeated the educational attitudes,

behaviors, and attainment of individuals in these contexts (Sun, 2012; Sheunck, 2017; Carlson, 1998; Guo, 2015; Marginson, 2011; Tran, 2013; Lau, 2014). The full list of CHCs, frequently cited in the literature, include the countries and territories China, Hong Kong, Japan, Korea, Macau, Singapore, Taiwan, and Vietnam (Carson, 1998; Nguyen et al., 2006; Turner, 2011; Guo, 2015). Among the CHCs, only China, Japan, Korea, Singapore, and Vietnam are considered officially recognized countries. Hong Kong and Macau are both special administrative regions governed by China, and Taiwan is an independently governed place without nation status (Wang, 2020).

The CHCs have been grouped together due to a common culture rooted in the teachings of Confucius. Confucius (551–479 BCE) is one of the most, if not the most, well-known Chinese philosopher whose teachings have influenced generations of people across many countries in Asia. His teachings reflect the values of the Xia (c. 2070–1600 BCE), Shang (c. 1600–1046 BCE) and Zhou dynasties of China (c. 1046–256 BCE) (Guo, 2015). Due to China's influence on its neighboring regions and countries through political takeovers or migrations, Confucian teachings spread to all of the CHCs at some point in time (Li, 2003; Guo, 2015). Although the extent of its influence is difficult to gauge, the literature recognizes that Confucianism has contributed to the development of cultural norms in all of the CHCs, particularly in regard to education (Carson, 1998; Nguyen et al., 2006; Turner, 2011; Guo, 2015). According to Confucian teachings, the main goal of learning is to make the learner more moral and to contribute to society after having received an education (Li, 2003). Education is seen as necessary for personal improvement, as well as the improvement of society as a whole. As a result, students educated in this tradition tend to be highly motivated to learn and willing to invest a great deal of time in their education, as their peers, parents, teachers, and society all

encourage them to pursue learning opportunities to the best of their abilities (Guo, 2015).

Confucianism also emphasizes respect for elders in addition to dedication to one's studies (Sun et al., 2019).

A defining feature of Confucian values is the greater emphasis on adhering to the expectations of one's parents, teachers, and greater society, often at the expense of one's personal interests (Guo, 2015; Sun et al., 2019). This aspect of Confucianism stands in contrast to those of many of the WEIRD countries that emphasize the need to prioritize one's own interests over that of others (Qu et al., 2016; Ma & Schoeneman, 1997; Markus & Kitayama, 1991). This Confucian belief also harkens back to the primary purpose of learning which is to make a contribution to society rather than to exclusively pursue one's interests (Guo, 2015). In addition, a child's achievement is seen as a result of the entire family's effort rather than the child's individual effort in CHCs, which further deemphasizes the importance of pursuing one's personal interests (Watkins & Biggs, 1996; Chin, 1988). In these contexts, pursuing intrinsic interests can be impractical and socially unacceptable if those interests conflict with the expectations of family members or greater society (Watkins & Biggs, 1996; Chin, 1988). As a result, children strive to achieve not only for themselves but primarily to make their families and society proud. To do so, they focus on more tangible goals valued by families and society, such as attending a top college and contributing to society through work (Salili et al., 2001; Salili, 1996; Winter, 1996; Llewellyn et al., 1982). Although these goals are also important in many other countries, in the US for example, there is still a greater emphasis on pursuing one's interests, and the desire to please one's family or society is not considered to be as essential as in the CHCs (Qu et al., 2016; Wang & Pomerantz, 2009). Even if they do not have an intrinsic interest in a task, students will often work hard at the task if it is deemed valuable by parents,

teachers, or society, which may account for the lack of association between intrinsic motivation and achievement in some studies conducted in CHCs (Lu et al., 2011; Cheng, 2019).

Despite the commonalities between their cultures, the CHCs also have differences that may lead to some variation in students' educational experiences or their academic motivations. Not all CHCs are equally homogeneous ethnically or linguistically. Most of the CHCs are ethnically homogenous with over 90% of their population identifying as the majority ethnic group, the exception being Singapore with the majority Chinese comprising 76.8% of the population (Nation Master, 2020). Singapore is also the only Confucian country that still maintains a Western language, English, as its national language, due to its history of British occupation and the ethnic and linguistic diversity within the country (Brunero, 2019; Chew, 2013; Tong & Goh, 2008). Although Hong Kong also shares a history of British occupation, it has been governed by China for over two decades now and maintains Chinese as its national language (Lo & Merryfield, 2008; Lee, Stewart, & Chan, 2006; Tong & Goh, 2008). In addition, there is variation in wealth among the CHCs, with Singapore having the highest GDP per capita, while Vietnam has the lowest GDP per capita (IMF, 2020). Although many other differences between the CHCs exist (O'Dwyer, 2017), how those differences influence motivation has not been thoroughly examined in studies, and therefore it is difficult to make predictions about which differences may influence the results of this study.

1.4 Growth mindset and achievement in Confucian Heritage Cultures

Given the differences in cultural expectations and educational systems, a growing number of studies have found that students in CHCs experience growth mindset differently than those in non-CHCs. Studies that have found growth mindset to positively predict achievement have been conducted in China, Hong Kong, Japan, Macau, and Singapore (Li et al., 2020; Wang et al.,

2020; Chen & Wong, 2014; Jose & Bellamy, 2012; Chen et al., 2018; Lim et al., 2020). In contrast, a series of four studies conducted on 9-13-year-old Chinese children found that growth mindset did not predict students' grades or their performance on cognitive tests (Li & Bates, 2019). Another study on Chinese adolescents found that growth mindset did not predict achievement for all students (Wang et al., 2020).

One explanation for the lack of association between growth mindset and achievement in some studies involves the focus on the value of effort for success in academic settings. Because parents in CHCs have high expectations for their children's academic success and consider effort to be the most important means to do well academically, the children are frequently encouraged to make an effort in their studies (Ho, 1986; Lin & Fu, 1990; Mau, 1997, Law, 2009). As a result, parents and teachers in CHCs tend to downplay students' successes and provide more negative emotional responses to failures, which encourages students to work harder (Miller et al., 1997; Ng, Pomerantz, & Lam, 2007; Bao & Lam, 2008), leading Chinese students to be more likely to attribute success in school to effort than US students do (Sun et al., 2021a). While students in CHCs believe that effort and ability are correlated, they also tend to believe that high achievers who have high ability do not need much effort to succeed, and thus, low achievers often work harder than high achievers (Hong, 2001). Certainly, not every student who works hard does well, but research suggests that putting in effort tends to lead to better outcomes on average (Blackwell et al., 2007). Therefore, students tend to make an effort in their studies regardless of their beliefs about intelligence, which may explain why students in CHCs do not need to have a growth mindset in order to succeed.

Another explanation for the lack of association between growth mindset and achievement is that students in the CHCs may define intelligence differently than those in the non-CHCs.

Chinese students are more likely to think of intelligence as fluid intelligence, which includes comprehension and reasoning skills, whereas US college students are more likely to think of intelligence as crystallized, which involves recalling stored knowledge (Sun et al., 2021a). Because students tend to think of fluid intelligence as fixed and crystallized intelligence as malleable, the lack of association between growth mindset and achievement for students in the CHCs may be due to the fact that they are thinking of intelligence as fluid rather than crystallized (Sun et al., 2021b)

Moreover, the most recent PISA 2018 report indicates that growth mindset has no positive association or a weak association with achievement in the CHCs, whereas there is a larger positive association for most of the other countries (OECD, 2019c). However, the report provides little explanation for these findings regarding the association between growth mindset and achievement in the CHCs. It does suggest that in the CHCs even fixed mindset students may have internalized the value of working hard, which mitigates the negative effects of a fixed mindset (OECD, 2021). In Korea, Macau, and Taiwan, there was only a small positive association between growth mindset and reading achievement compared to students in the majority of other countries (OECD, 2019c). Moreover, there was no association in Hong Kong and a negative association in China between growth mindset and reading achievement (OECD, 2019c). For students in China, having a fixed mindset had a positive association with their scores, contrary to the findings and explanations provided by most studies (Dweck, 1986; Dweck, & Leggett, 1988; Blackwell et al., 2007; Chen & Pajares, 2010; Henderson & Dweck, 1990; Mueller & Dweck, 1998; Hong et al., 1999).

Although there have been few studies that examine moderators of the association between growth mindset and achievement, a small body of emerging studies provide enough

evidence to warrant further investigation of these moderators. Currently, no studies to date examine how SES or gender moderates the relation between growth mindset and achievement in CHCs. The OECD (2021) report on the PISA 2018 incorporated data from the CHCs in the results on moderators, but only presented average results for the entire 79 countries and territories. The report did not focus exclusively on the CHCs when presenting the results on the moderators of the association between growth mindset and achievement.

1.5 Additional concerns

An additional concern when studying the differences between CHCs and non-CHCs is that the grouping of CHCs may be too broad to be meaningful. Although this may be the case, the literature more frequently groups the CHCs together than identifies their differences (Liu et al., 2018; Carson, 1998; Nguyen et al., 2006; Turner, 2011; Guo, 2015). Studies examining motivation and achievement in CHCs do not propose that the relations between motivation and achievement differ between the CHCs.

Lastly, another concern is that motivation constructs other than growth mindset should have been considered. However, compared to other motivation constructs, growth mindset has been most frequently examined for moderators of achievement. There is little research to suggest that SES or gender moderates the relation between other motivation constructs and achievement. Therefore, only growth mindset is examined in this study.

Due to the few studies conducted on this topic, this study examines how SES and gender moderate the relation between growth mindset and achievement in CHCs and non-CHCs. Given the evidence that gender may moderate the relation between growth mindset and achievement differently for math versus reading, this study examines achievement separately as math and reading scores. There is no evidence in the literature that the relation between growth mindset

and achievement moderated by SES differs by math or reading, but for consistency and a point of comparison, the present study also separates achievement by domain when examining the moderation of SES on growth mindset and achievement.

1.7 The present study

The present study examines the following research questions:

- 1) Does SES moderate the relation between growth mindset and math/reading achievement in CHCs and non-CHCs?
- 2) Does gender moderate the relation between growth mindset and math/reading achievement in CHCs and non-CHCs?
- 3) Do the results differ between CHCs and non-CHCs? Are there differences when comparing CHCs to one another?

2 Methods

2.1 Data

The data used in this study is the Programme for International Student Assessment (PISA) 2018 data set, collected by the Organisation for Economic Co-operation and Development (OECD) on the math, reading, and science achievement of 15-year-old students in 79 countries. More specifically, this study focuses on the assessment and survey data from the CHCs that include China, Hong Kong, Macau, Taiwan, Singapore, Korea, Japan, and Vietnam ($n = 53,926$) and non-CHCs which include countries in North America, South America, Europe, Middle East, Central Asia, Africa, and Australia ($n = 558,079$).

The PISA uses survey weights and multiple imputed plausible values for achievement scores (OECD, 2019a). According to the PISA report, PISA uses a stratified two-stage sample design, where schools are sampled using probability proportional to size sampling, and students

are sampled with equal probability within schools. Sampled students receive a final weight which indicates how many other students from the population are represented. The final student weight incorporates both the school weight (the inverse of the school's probability of selection) and the within-school student weight (the inverse of the student's probability of selection). The data for each country should in theory allow for generalization to the entire country. Although for China, in particular, this may not be the case because the data is sampled exclusively from four large and wealthy cities, Beijing, Shanghai, Jiangsu, and Zhejiang, and may not be generalizable to other parts of the country (Luo, 2021).

2.2 Participants

The participants include 15-year-old students in 79 countries. In the CHCs, the number of participants from each country or region ranges from the smallest group, 3,775 participants in Macau, to the largest group, 12,058 participants in China. The sample is 50.70% male and 49.30% female overall. In the non-CHCs, the sample is 50.12% male and 49.88% female with a total of 558,079 participants. See Table 1 for a complete list of participant characteristics.

2.3 Measures

Growth mindset

Growth mindset is an observed student-level variable comprised of one item from 1-4 points on a Likert scale 1=strongly agree to 4=strongly disagree: "Your intelligence is something about you that you can't change very much."

SES

SES is an observed student-level variable provided by PISA. According to the PISA report (OECD, 2019b), a student's socio-economic status is estimated by the PISA index of economic, social and cultural status, a composite measure that combines into a single score the

financial, social, cultural and human-capital resources available to students. It is derived from several variables related to students' family background that are then grouped into three components: parents' education, parents' occupations, and an index summarizing a number of home possessions that can be taken as proxies for material wealth or cultural capital, such as possession of a car, the existence of a quiet room to work, access to the Internet, the number of books and other educational resources available in the home. SES values range from the lowest at -8.173 to the highest at 4.205 ($M = -0.28$, $SD = 1.12$).

Gender

Gender is an observed student-level variable comprised of one item: "Are you female or male?"

Math Achievement

Math scores are a measure of students' capacity to formulate, employ and interpret mathematics in a variety of contexts. Math scores are scaled to fit approximately normal distributions, with means around 500 score points and standard deviations around 100 score points. In PISA 2018, the scores range from 0 to 916.276 points. The scores are comprised of ten imputed potential values (OECD, 2019a).

Reading Achievement

Reading scores are a measure of students' capacity to understand, use, evaluate, reflect on and engage with texts in order to achieve one's goals, develop one's knowledge and potential, and participate in society. Reading scores are scaled to fit approximately normal distributions, with means around 500 score points and standard deviations around 100 score points. In PISA 2018, the scores range from 0 to 928.687 points. Reading scores are also comprised of ten imputed potential values (OECD, 2019a).

Control variables

Control variables include age, highest level of parent education, and second language status. Second language status provides additional information related to academic achievement that is not captured by SES or parent education alone. The closest proxy of second language status is a measure of whether or not the student speaks a language different from the test language at home.

2.4 Analytic plan

All analysis was conducted using Mplus version 8.6. First, descriptive and correlational analyses were conducted. Then, multiple regression analysis was employed to examine all the models for CHCs and non-CHCs. The following models were tested.

Model 1:

$$READ_i = \beta_0 + \beta_1 GROWTH_i + \beta_2 SES_i + \beta_3 SES * GROWTH_i + XB_i + \epsilon_i$$

$$MATH_i = \beta_0 + \beta_1 GROWTH_i + \beta_2 SES_i + \beta_3 SES * GROWTH_i + XB_i + \epsilon_i$$

Model 2:

$$READ_i = \beta_0 + \beta_1 GROWTH_i + \beta_2 MALE_i + \beta_3 MALE * GROWTH_i + XB_i + \epsilon_i$$

$$MATH_i = \beta_0 + \beta_1 GROWTH_i + \beta_2 MALE_i + \beta_3 MALE * GROWTH_i + XB_i + \epsilon_i$$

XB represents a vector of all control variables. The MLR robust standard error estimator was used to conduct the analysis and the cluster option was selected to account for nesting by schools in the data. The MLR estimator was also used to account for the missing data, < 10% on achievement scores and < 2% on the remaining measures, because it is the recommended choice that estimates models by using all available data (Muthén & Muthén, 2017). All analysis takes into account survey weights and uses an imputation method to incorporate all plausible values for achievement scores.

3 Results

3.1 Descriptive and correlational statistics

The overall CHCs sample is fairly evenly distributed by gender, with 49.30% female and 50.66% male. The overall average parent education is a post-secondary education (such as vocational school but not university), ranging from Vietnamese parents who on average have a middle school education to Korean parents who on average have a college education. As indicated in Table 1, compared to the participants from all 79 countries in the PISA 2018 data set, the sample from CHCs is slightly below average (-0.36 scale points) for SES. Among the CHCs, Vietnam has the lowest levels of SES at -1.61 scale points and Singapore has the highest levels of SES at 0.15 scale points in this group of CHCs, which is consistent with the relative GDP per capita levels in these countries (IMF, 2020). Approximately 11.44% of the sample reports speaking a second language other than the PISA test language at home, ranging from China at 0.48% to Singapore at 43.43%, which is also consistent with the multiethnic and multilingual population in Singapore (Tong & Goh, 2008; Nation Master, 2020). For the overall sample of CHCs, the average growth mindset score is 2.60 scale points ($SD = 0.87$). Growth mindset scores range from lowest in Macau ($M = 2.48$, $SD = 0.88$) to highest in Japan ($M = 2.76$, $SD = 0.84$).

In terms of achievement scores, math scores tend to be higher than reading scores across the CHCs, while China has the highest scores and Vietnam has the lowest scores overall when compared to the other CHCs. The average math achievement score in the overall CHCs sample is 548.48 points ($SD = 94.77$), ranging from Vietnam at 494.19 points ($SD = 73.71$) to China at 592.43 points ($SD = 83.37$). The average reading achievement score in the overall CHCs sample is 526.77 points ($SD = 99.34$), ranging from Taiwan at 497.66 points ($SD = 102.08$) to China at 561.03 points ($SD = 90.34$).

The sample of non-CHCs is 49.88% female and 50.12% male. The average age of participants is 15.79 years old, while the average level of parent education is post-secondary education in the non-CHCs. Compared to the participants from all 79 countries in the PISA 2018 data set, the sample from non-CHCs is slightly above the sample of CHCs at -0.27 scale points. 17.92% of students report speaking a second language other than the PISA test language at home. The average growth mindset score in the non-CHCs is 2.63 points (SD = 0.94). The average math score is 453.11 (SD = 101.15), and the average reading score is 447.45 (SD = 106.79) for the non-CHCs. See Table 1 for all statistics.

Table 1. Descriptive Statistics for CHCs and non-CHCS

Characteristics	Mean (SD) or Percentage %									
	All CHCs	CHN	HKG	JPN	KOR	MAC	SGP	TWN	VNM	Non-CHCs
	n=53,925	n=12,058	n=6,037	n=6,109	n=6,650	n=3,775	n=6,676	n=7,243	n=5,377	n=558,079
Gender										
Female (0)	49.30	47.89	51.07	47.98	49.32	49.32	49.09	50.03	51.70	49.88
Male (1)	50.70	52.11	48.93	52.02	50.68	50.68	50.91	49.97	48.30	50.12
SES	-0.36	-0.36	-0.53	-0.11	0.09	-0.52	0.15	-0.33	-1.61	-0.27
	(1.07)	(1.09)	(1.02)	(0.73)	(0.77)	(0.91)	(0.91)	(0.92)	(1.08)	(1.12)
Age	15.77	15.73	15.78	15.73	15.83	15.78	15.78	15.79	15.78	15.79
	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)	(0.30)	(0.29)	(0.29)
Parent education	4.36	4.07	3.85	5.09	5.34	3.88	4.97	4.53	2.86	4.69
	(1.58)	(1.72)	(1.50)	(0.99)	(1.04)	(1.66)	(1.15)	(1.28)	(1.59)	(1.50)
Pre-primary (0)	0.94	0.85	0.88	0.00	0.00	0.98	0.41	0.14	5.12	1.16
Primary (1)	3.45	3.75	5.05	0.00	0.14	5.26	1.69	1.13	12.98	2.91
Lower secondary (2)	14.35	25.60	14.39	1.38	1.25	23.95	2.34	7.72	36.93	7.59
Upper secondary (3)	5.67	4.20	17.49	2.38	3.59	6.01	0.00	11.67	1.18	5.64
Post-secondary (4)	25.76	19.73	33.55	29.29	23.00	26.95	30.66	20.86	29.87	23.54
College (5)	15.26	14.25	7.55	19.65	3.88	11.78	21.08	32.56	7.17	15.63
Graduate (6)	34.57	31.61	21.11	47.30	68.14	25.07	43.83	25.93	6.76	43.53
Second language	11.44	0.48	16.33	0.94	0.59	18.65	43.43	15.51	5.72	17.92
Growth mindset	2.60	2.60	2.37	2.76	2.59	2.48	2.69	2.68	2.57	2.63
	(0.87)	(0.90)	(0.85)	(0.84)	(0.86)	(0.88)	(0.93)	(0.93)	(0.78)	(0.94)
Math achievement	548.48	592.43	554.42	528.21	526.54	556.63	566.05	527.49	494.19	453.11
	(94.77)	(83.37)	(86.49)	(99.19)	(80.46)	(94.61)	(94.61)	(101.16)	(73.71)	(101.15)
Reading achievement	526.77	561.03	527.33	502.91	515.58	525.08	548.58	497.66	503.57	447.45
	(99.34)	(90.34)	(97.90)	(97.15)	(101.22)	(92.51)	(110.34)	(102.08)	(73.14)	(106.79)
Note: CHN = China; HKG = Hong Kong; JPN = Japan; KOR = Korea; MAC = Macau; SGP = Singapore; TWN = Taiwan; VNM = Vietnam; SES = socioeconomic status.										

Table 2 presents the correlation matrix. For CHCs, growth mindset positively correlates with SES ($r = 0.040$, $p < .001$) and with being male ($r = 0.045$, $p < .001$). Growth mindset and SES positively correlate with math and reading achievement. The largest positive correlations are between math and reading achievement ($r = 0.803$, $p < .001$) and between SES and parent education ($r = 0.828$, $p < .001$).

For non-CHCs, growth mindset also positively correlates with SES ($r = -0.023$, $p < .001$), but negatively correlates with being male ($r = -0.023$, $p < .001$). Growth mindset, SES, and being male positively correlate with math and reading achievement. In addition, there are very large, positive correlations between math and reading achievement ($r = .823$, $p < .001$) and between SES and parent education ($r = .770$, $p < .001$). There is also a moderately large correlation between SES and math scores ($r = 0.438$, $p < .001$) and between SES and reading scores ($r = 0.417$, $p < .001$). Nearly all of the remaining correlations are significant and small in size.

Table 2. Correlation Matrix for Growth Mindset, SES, Gender, Achievement, and Covariates

Variable	1	2	3	4	5	6	7	8
1. Growth mindset		0.143 ***	-0.020 ***	0.216 ***	0.253 ***	-0.040 ***	0.018 ***	0.084 ***
2. SES	0.040 ***		0.011 ***	0.438 ***	0.417 ***	-0.077 ***	-0.007 ***	0.770 ***
3. Gender (Male)	0.045 ***	-0.018 ***		0.016 ***	-0.145 ***	0.011 ***	-0.001 ***	0.034 ***
4. Math achievement	0.044 ***	0.319 ***	0.032 ***		0.823 ***	-0.085 ***	0.041 ***	0.255 ***
5. Reading achievement	0.045 ***	0.293 ***	-0.100 ***	0.803 ***		-0.145 ***	0.036 ***	0.237 ***
6. Second language	-0.008	-0.033 ***	0.011 **	-0.086 ***	-0.132 ***		0.001	-0.041 ***
7. Age	-0.012 **	-0.028 ***	0.005	0.035 ***	0.025 ***	0.012 **		-0.011 ***
8. Parent education	0.027 ***	0.828 ***	0.004	0.200 ***	0.184 ***	-0.017 ***	-0.034 ***	

Note: CHCs below the diagonal; Non-CHCs above the diagonal

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

3.2 Multiple regression results

Table 4 presents the full list of results for SES moderating the relation between growth mindset and achievement. See Figure 1 for a graphical representation for a comparison of low SES (25th percentile) and high SES (75th percentile) groups across each sample.

For the CHCs, growth mindset has a stronger positive association with achievement for low SES students than for high SES students. This is also the case for China, Singapore, and Taiwan. For Hong Kong, Japan, Korea, Macau, and Vietnam, there is no difference in the relation between growth mindset and achievement for low versus high SES students. For non-CHCs, growth mindset does not predict achievement differently for high and low SES students. In addition, high SES student tend to perform better than low SES students, and there are no discernible differences in the results between reading and math when examining the moderation of SES on growth mindset predicting achievement.

Table 4. Growth Mindset, SES, and SES x Growth Mindset Predicting Achievement

Sample	Domain	Growth Mindset	SES	SES x Growth Mindset
All CHCs	Reading	0.034 (p=.562) (0.059)	0.695*** (0.127)	-0.193** (0.076)
	Math	0.031 (p=.581) (0.057)	0.535*** (0.141)	-0.126** (0.070)
China	Reading	-0.111*** (0.016)	0.530*** (0.070)	-0.193*** (0.048)
	Math	-0.105*** (0.015)	0.479*** (0.069)	-0.181*** (0.049)
Hong Kong	Reading	-0.005 (p=.809) (0.020)	0.261*** (0.056)	0.039 (p=.450) (0.051)
	Math	-0.020 (p=.256) (0.018)	0.301*** (0.056)	0.023 (p=.636) (0.048)
Japan	Reading	0.112*** (0.013)	0.228*** (0.043)	-0.014 (p=.733) (0.041)
	Math	0.103*** (0.014)	0.219*** (0.051)	-0.011 (p=.822) (0.047)
Korea	Reading	0.072*** (0.014)	0.297*** (0.049)	0.011 (p=.810) (0.044)
	Math	0.081*** (0.015)	0.393*** (0.047)	-0.024 (p=.573) (0.043)
Macau	Reading	0.075** (0.023)	0.274*** (0.069)	0.036 (p=.516) (0.055)
	Math	0.046* (0.022)	0.280*** (0.079)	-0.020 (p=.722) (0.056)
Singapore	Reading	0.154*** (0.014)	0.496*** (0.054)	-0.128** (0.039)
	Math	0.129*** (0.015)	0.581*** (0.048)	-0.168*** (0.039)
Taiwan	Reading	0.049** (0.015)	0.451*** (0.050)	-0.105* (0.043)
	Math	0.034* (0.016)	0.483*** (0.049)	-0.118** (0.045)
Vietnam	Reading	0.175*** (0.028)	0.338*** (0.065)	-0.015 (p=.790) (0.055)
	Math	0.177*** (0.033)	0.386*** (0.068)	-0.052 (p=.375) (0.059)
Non-CHCs	Reading	0.205*** (0.021)	0.581*** (0.047)	0.057 (p=.310) (0.056)
	Math	0.162*** (0.022)	0.618*** (0.049)	0.043 (p=.398) (0.050)

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

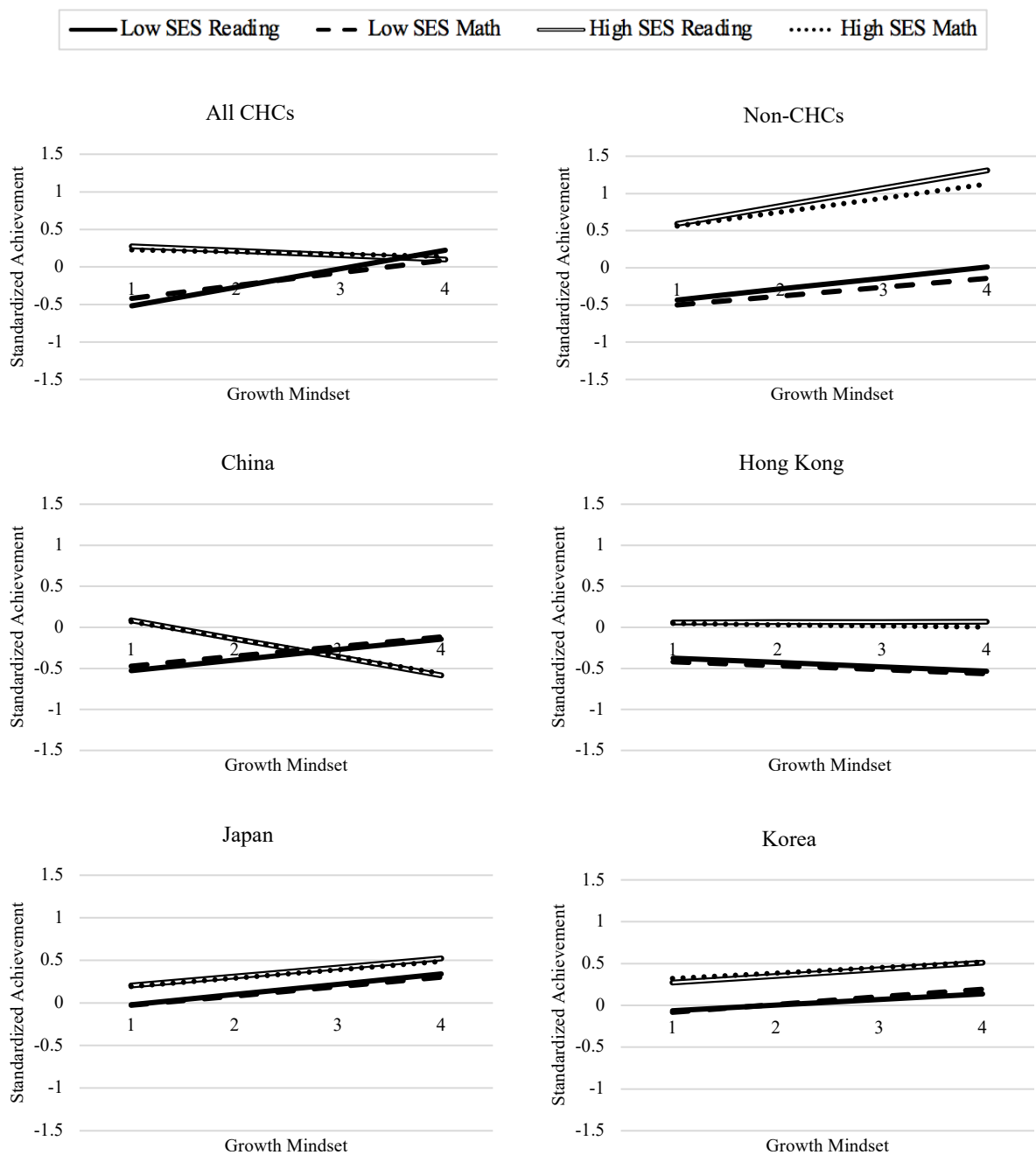


Figure 1. Growth mindset predicting reading and math achievement for low SES and high SES

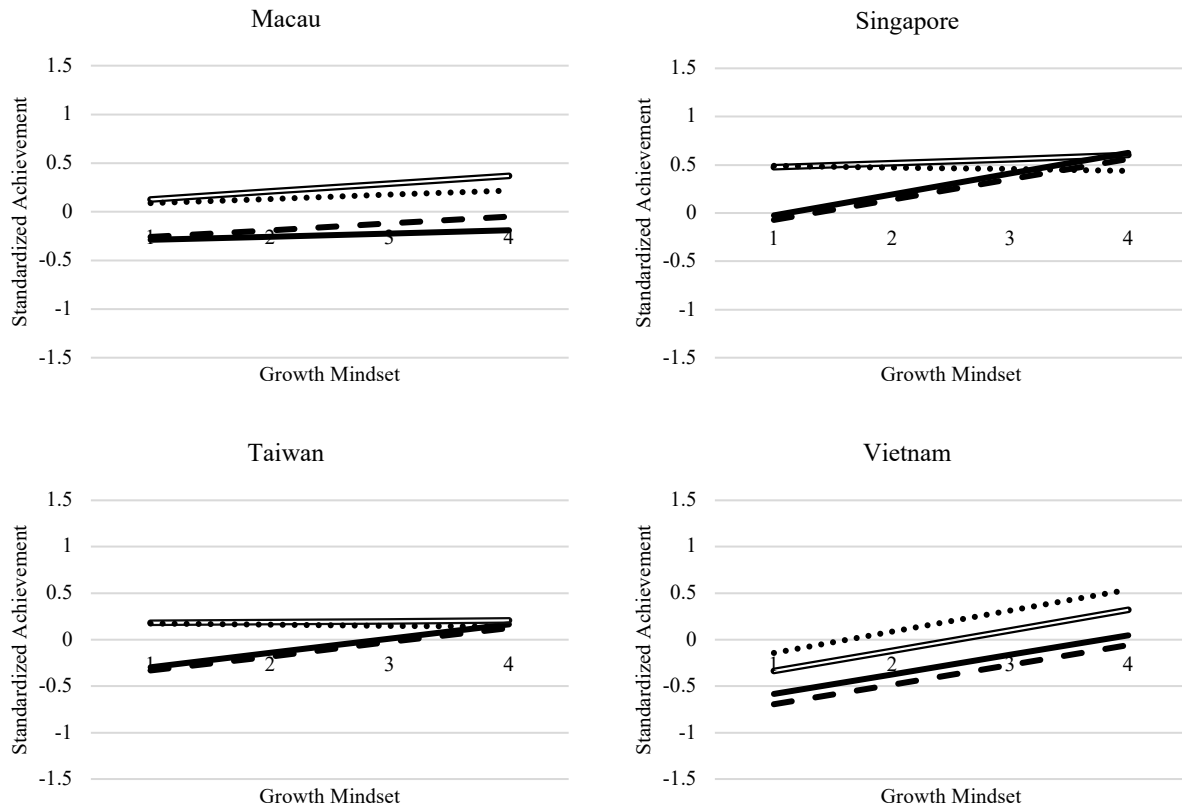


Figure 1 (continued). Growth mindset predicting reading and math achievement for low SES and high SES

Table 5 presents the list of results for gender moderating the relation between growth mindset and achievement. See Figure 2 for a graphical representation.

For most of the CHCs, gender does not moderate the relation between growth mindset and achievement. In China and Korea, males have a stronger positive association between growth mindset and reading achievement, but there is no gender difference in math. For non-CHCs, females have a slightly stronger association between growth mindset and achievement in reading, but there is no gender difference in math. In addition, males tend not to perform as well in reading across most samples but there are no gender differences in math.

Table 5. Growth Mindset, Gender, and Gender x Growth Mindset Predicting Achievement

Sample	Domain	Growth Mindset	Male	Male x Growth Mindset
All CHCs	Reading	0.034 (p=.525) (0.054)	-0.140*** (0.023)	0.057** (0.019)
	Math	0.048 (p=.389) (0.055)	0.014 (p=.447) (0.019)	0.035** (0.007)
China	Reading	-0.095*** (0.020)	-0.104*** (0.045)	0.048*** (0.048)
	Math	-0.085*** (0.019)	0.051 (p=.218) (0.041)	0.030 (p=.498) (0.044)
Hong Kong	Reading	-0.018 (p=.421) (0.023)	0.165** (0.051)	0.019 (p=.703) (0.051)
	Math	-0.034 (p=.119) (0.022)	-0.021 (p=.676) (0.050)	0.027 (p=.588) (0.050)
Japan	Reading	0.121*** (0.021)	-0.074 (p=.135) (0.050)	-0.028 (p=.565) (0.049)
	Math	0.110*** (0.021)	0.088 (p=.076) (0.050)	-0.023 (p=.624) (0.048)
Korea	Reading	0.041* (0.018)	-0.184*** (0.047)	0.095* (0.043)
	Math	0.059** (0.023)	-0.018 (p=.726) (0.050)	0.062 (p=.190) (0.047)
Macau	Reading	0.068** (0.028)	-0.109* (0.054)	0.003 (p=.960) (0.052)
	Math	0.046 (p=.102) (0.028)	0.027 (p=.601) (0.052)	0.011 (p=.823) (0.050)
Singapore	Reading	0.138*** (0.020)	-0.110* (0.047)	0.029 (p=.465) (0.040)
	Math	0.108*** (0.020)	0.014 (p=.751) (0.045)	0.036 (p=.376) (0.041)
Taiwan	Reading	0.044* (0.018)	-0.144** (0.042)	0.048 (p=.232) (0.040)
	Math	0.040 (p=.052) (0.021)	0.012 (p=.788) (0.046)	0.016 (p=.727) (0.045)
Vietnam	Reading	0.155*** (0.022)	-0.220*** (0.049)	0.087 (p=.081) (0.050)
	Math	0.178*** (0.028)	-0.082 (p=.133) (0.055)	0.068 (p=.234) (0.057)
Non-CHCs	Reading	0.205*** (0.014)	-0.079*** (0.009)	-0.029*** (0.007)
	Math	0.151*** (0.017)	0.016 (p=.430) (0.020)	0.010 (p=.441) (0.050)

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

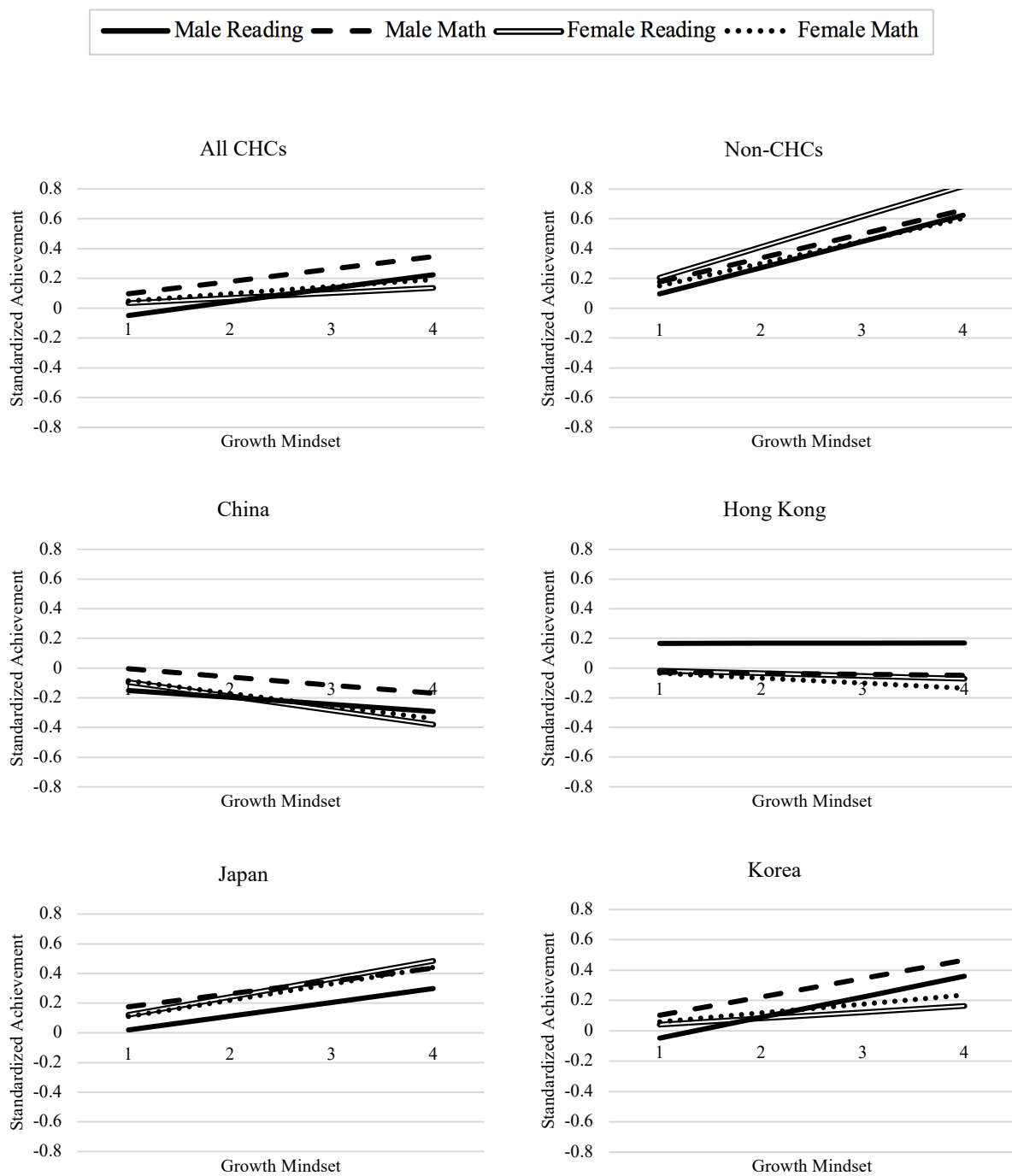


Figure 2. Growth mindset predicting reading and math achievement for males and females

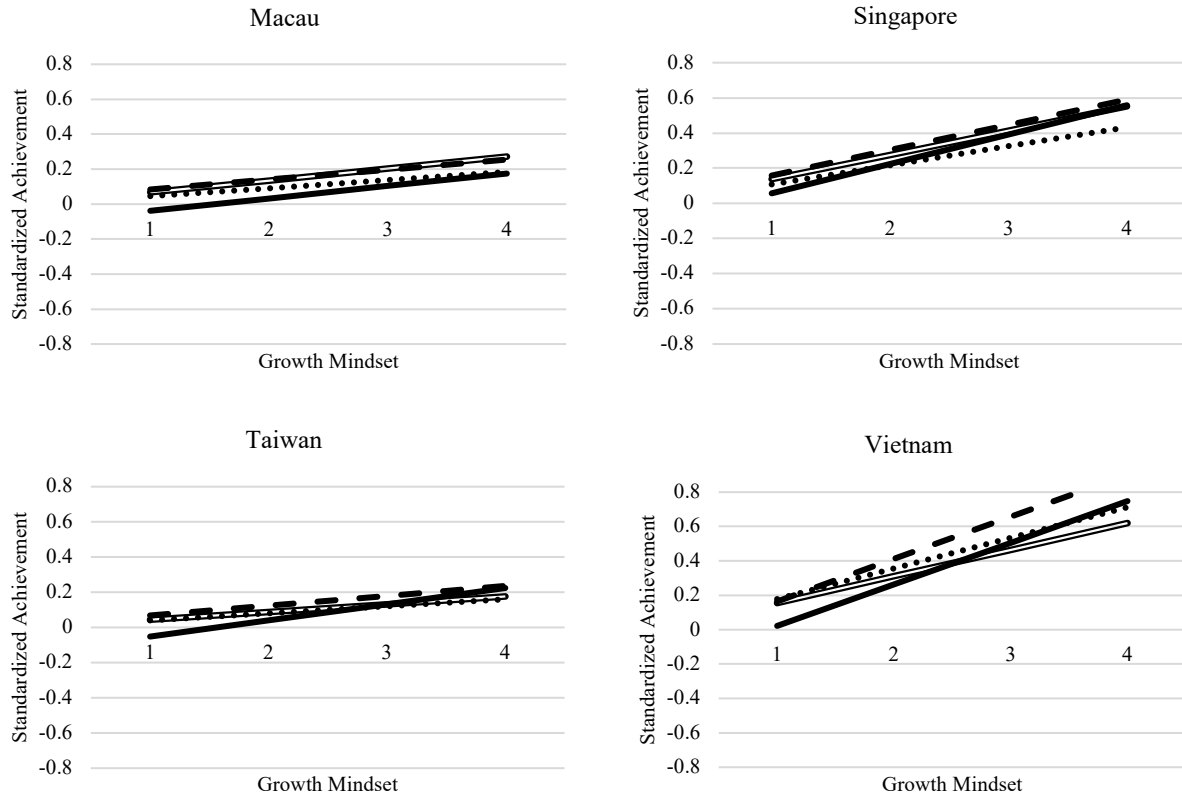


Figure 2 (continued). Growth mindset predicting reading and math achievement for males and females

4 Discussion

The findings from this study indicate that SES and gender do not consistently moderate the association between growth mindset and achievement between the CHCs and non-CHCs, as well as when comparing the CHCs to one another. First, for China, Singapore, and Taiwan, growth mindset has a stronger positive association with achievement for low SES students. For Hong Kong, Japan, Korea, Macau, and Vietnam, there is no difference in the relation between growth mindset and achievement for low versus high SES students. For non-CHCs, growth mindset does not predict achievement differently for high and low SES students. Next, for most of the CHCs, gender does not moderate the relation between growth mindset and achievement. In

China and Korea, males have a stronger positive association between growth mindset and reading achievement, but there is no gender difference in math. For non-CHCs, females have a slightly stronger association between growth mindset and achievement in reading, but there is no gender difference in math.

Compared to gender, there is more evidence from this study in support of SES moderating the relation between growth mindset and achievement for CHCs. Consistent with the findings in the OECD (2021) report, growth mindset has a stronger positive association with growth mindset for low SES students in China, Singapore, and Taiwan. For China, where the main effect of growth mindset on achievement is negative, focusing exclusively on this main effect may suggest that growth mindset has a negative association with achievement for all students. However, the results from this study indicate that growth mindset actually has a positive association with achievement for low SES students in China, which suggests that growth mindset may still be able to be regarded positively in the context of academic achievement for these students. On the contrary, the finding that growth mindset has a negative association with achievement for high SES students in China also has interesting implications. These findings alert us against the tendency to assume that growth mindset is essential or universally positive for all students. Important to note here is that this study is descriptive, not causal, therefore any mention of the association between growth mindset and achievement does not imply causal relations.

Although it is difficult to explain why growth mindset has a stronger positive association with growth mindset for low SES students in China, Singapore, and Taiwan, the existing studies in the literature may provide some potential explanations. According to these studies, growth mindset may positively predict achievement for low SES students because growth mindset

provides the resilience and persistence needed for them to overcome their obstacles (Claro et al., 2016; Destin et al., 2019). It may be that it is motivating for low SES students, who typically do not perform as well as high SES students, to believe that they can improve their intelligence and performance through effort. Compared to low SES students, high SES students are more likely to have higher achievement regardless of their mindsets, which may lead them to believe that achievement and intelligence are the result of innate abilities. Because they are more likely to believe that their abilities are special, innate, and unable to be matched by others, high SES students may benefit from having a fixed mindset because it may reinforce their confidence in their own abilities (Claro et al., 2016; Destin et al., 2019). For CHCs, this may be especially likely because students tend to have a very strong desire to work hard and to perform well academically to please their parents, teachers, and to fulfill their duties to society (Ho, 1986; Lin & Fu, 1990; Mau, 1997, Law, 2009). As a result, it is likely that low SES students who tend not to perform as well find that endorsing growth mindset allows them to overcome their challenges, while high SES students who tend to perform better endorse a fixed mindset to feel confident in their own abilities and to work towards fulfilling the belief in their superiority.

Still, the results from this study for Hong Kong, Japan, Korea, Macau, and Vietnam indicate no difference in the relation between growth mindset and achievement for low and high SES students, which is also the case for non-CHCs. These findings align with some of the findings in the literature which also indicate no differences between low and high SES students (Destin et al., 2019; Hwang et al., 2016). It is possible that in some of these CHCs the pressure to achieve is so great that all students, regardless of their SES group, put in the effort necessary to improve their performance (Miller et al., 1997; Ng et al., 2007; Bao & Lam, 2008; Hong, 2001). Thus, irrespective of their level of growth mindset, they will perform as best as they can.

Even though there is only limited evidence from this study in support of the moderation of SES on the association between growth mindset and achievement for some CHCs, the results from this study indicate that growth mindset has a weaker association with achievement across students of all SES levels for all CHCs when compared with non-CHCs. For non-CHCs, there is a moderately sized association between growth mindset and achievement for students of all SES levels. Whereas for all of the CHCs, this association is either negative, nearly zero, or weakly positive for students of all SES levels.

In addition, this study finds that growth mindset does not predict achievement differently for males and females across math and reading in most CHCs. Only in China and Korea do males have a stronger positive association between growth mindset and reading achievement but there is no gender difference in math. For non-CHCs, females have a slightly stronger association between growth mindset and reading achievement, but there is also no gender difference in math. Thus, there is a small difference when comparing China and Korea with non-CHCs on reading achievement, but overall there is little difference between CHCs and non-CHCs in the moderation of gender on growth mindset predicting achievement.

The stronger positive association between growth mindset and reading achievement for males in China and Korea in this study is not directly supported by the findings in the literature, although previously conducted studies provide some possible explanations for this finding. Because males are seen as having less of the innate ability needed for reading achievement, having a growth mindset should be even more important to their success because it would lead to stronger resilience and effort (Reilly et al., 2019; Heyder et al., 2017; Heyder et al., 2021; Lee et al., 2021). Perhaps male students in CHCs feel more pressure to perform well academically and thus believing in a growth mindset set gives them the encouragement and resilience necessary to

overcome their greater obstacles in reading. However, it is difficult to explain why this is only the case for China and Korea, and not the remaining CHCs.

In non-CHCs, however, this study finds that females have a slightly stronger association between growth mindset and reading achievement, which is consistent with the findings in the OECD (2021) report. Although this does not align with the findings in the literature either, the explanations provided in existing studies may shed light on the results for this study as well. Because females tend to perform better in reading than males do, female students may experience fewer barriers to success in reading, which may increase the likelihood that the effort they put in helps their performance (Heyder et al., 2017; Heyder et al., 2021). Males, on the other hand, may find that even having a growth mindset does not allow them to overcome the obstacles they face from differential treatment or gender stereotypes, which results in a negative association between growth mindset and achievement (Zhao et al., 2021).

Ultimately, the results from this study provide little evidence in support of gender moderating the relation between growth mindset and achievement for either CHCs or non-CHCs. The results either show no differences or very small differences between males and females in the association between growth mindset and achievement, which aligns with the findings in the majority of studies in the literature (Claro et al., 2016; Pierce, 2017; Hwang et al., 2016; Gandhi et al., 2020; Macnamara & Rupani, 2017). It is possible that these students are not particularly affected by gender stereotypes do not receive significantly differential treatment due to gender, or do not have very different academic experiences given their gender.

Because there are so few studies on this topic conducted in non-CHCs and none conducted in CHCs, it is difficult to say whether or not the findings from this study are aligned with the literature or not. Some of the findings align with the OECD (2021) report on the PISA

2018 data, but those results are not all supported by the rest of the literature. Given that the existing studies in the literature have produced various different results, it is difficult to determine which findings are the most robust. In addition, the different results between the CHC in this study suggests that this grouping may be too broad when examining the SES and gender moderators of the association between growth mindset and achievement. It is possible that for this topic each of CHCs should be regarded independently rather than as a group. Even so, the results from this study do indicate that there are some differences between CHCs and non-CHCs, which suggests that this is a topic that warrants further investigation.

5 Limitations

An additional imitation of this study involves the PISA data itself. First, the items of the motivation constructs on the PISA survey could be problematic given that PISA only included one item for the growth mindset measure, unlike the 8-item measure of the original questionnaire (Dweck 1999). Moreover, although the PISA data can show the associations between motivation and achievement, it is difficult to explain why these associations exist. It is not possible to know what was going on in the minds of the students who took the PISA assessment and survey. There would need to be additional studies conducted examining this topic, perhaps paired with qualitative methods such as interviews. In addition, due to the sampling procedures of PISA, the results from the study may not be as readily generalizable across entire countries. For example, the data from China comes from four large cities which may not be representative of other parts of the country (Luo, 2021). Lastly, the PISA data only measures 15-year-olds, who may not be representative of students of different ages.

Another limitation of this study is that the grouping of CHCs may be too broad. The results of this study show that both differences and similarities exist when comparing the CHCs,

even though the literature more frequently groups the CHCs together than identifies their differences (Liu et al., 2018; Carson, 1998; Nguyen et al., 2006; Turner, 2011; Guo, 2015).

One last limitation is that growth mindset, developed from the perspective of WEIRD researchers and primarily conducted on WEIRD (Western, Educated, Industrialized, Rich and Democratic) participants, does not completely capture the motivation of individuals in CHCs (Henrich et al., 2010). For instance, emerging studies conducted in CHCs and non-CHCs have also examined a motivation measure not from the main motivation theories called social goals, which measures the extent to which parents, teachers, peers, and society influence students' behaviors (Watkins & Hattie, 2012; Yu & McLellan, 2019). In CHCs, individuals are taught to value the expectations of parents, teachers, peers, and society overall, often times above their own interests, which may make social goals a more appropriate measure of motivation in these contexts (Cheng & Lam, 2013; Chan, 2008). However, work on this measure has been published in the past two decades and only two studies have validated a social goals measure among Chinese and Filipino students (King & Watkins, 2012; King & Watkins, 2013), which may account for lack of widespread use and lack of inclusion in studies such as PISA. Although there may be other better motivation measures for CHCs, this study was limited to the constructs in the current PISA data.

6 Conclusion

This study finds that SES and gender do not consistently moderate the association between growth mindset and achievement between the CHCs and non-CHCs, as well as when comparing the CHCs to one another. Growth mindset has a stronger positive association with growth mindset for low SES students for some CHCs, but not for others where SES does not moderate the relation between growth mindset and achievement. For non-CHCs, growth mindset

does not predict achievement differently for high and low SES students. In addition, for most of the CHCs, gender does not moderate the relation between growth mindset and achievement, except in China and Korea, where males have a stronger positive association between growth mindset and reading achievement. For non-CHCs, females have a slightly stronger association between growth mindset and reading achievement. None of the results indicate gender differences in the relation between growth mindset and math achievement.

However, this study is one in only a small handful of existing studies on this topic. More studies needed to be conducted examining these moderators on growth mindset and achievement in order to produce more robust results. If future studies similarly find differences between CHCs and non-CHCs, then they will contribute to the growing body of literature that suggests that growth mindset relates differently to achievement across various contexts.

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Conclusion

This dissertation explores the relations between growth mindset, mastery goal orientation, intrinsic motivation, and achievement in the PISA 2018 data set by comparing CHCs to non-CHCs. The results from all three papers indicate that there are at least some differences between CHCs and non-CHCs, which contributes to the growing body of evidence that the relations between these motivation constructs and achievement varies across different contexts.

Study 1, which examines the relations between these motivation constructs and achievement, finds that growth mindset does not predict achievement for the overall sample of CHCs, and mastery goal orientation does not predict achievement across most of the CHCs. On the other hand, aligned with the main studies in the literature, intrinsic motivation predicts achievement for both CHCs and non-CHC, which suggests that intrinsic motivation may be the most generalizable of the motivation constructs. Moreover, this study also finds that growth mindset, mastery goal orientation, and intrinsic motivation positively predict one another. In addition, there are more commonalities than differences among the CHCs; however, Vietnam appears to differ the most from the other CHCs.

Study 2, which examines how the value of effort in school mediates the relations between these motivation constructs and achievement, shows that although students in the CHCs do not have a positive association between achievement and growth mindset or mastery goal orientation, they do have a positive indirect association between achievement and the value of effort in school. This finding is important in establishing growth mindset, mastery goal orientation, intrinsic motivation as different constructs from the value of effort in school. This finding also dispels the hypothesis that students in CHCs do not believe in the value of effort in school or that there is no association at all between growth mindset or mastery goal orientation

and achievement. It further reveals that although growth mindset and mastery goal orientation may not function in the same ways for students in CHCs as compared to non-CHCs, both growth mindset and mastery goal orientation can still have a positive indirect association with achievement for those in CHCs. For both CHCs and non-CHCs, intrinsic motivation appears to behave the most similarly across contexts, a finding that is consistent with the results from Study 1. Lastly, although the results are fairly consistent across all CHCs, the findings for Vietnam indicate that it differs the most from the rest of the CHCs, which is also consistent with the results from Study 1.

Study 3, which focuses on growth mindset exclusively, finds some evidence in support of SES and gender moderating the association between growth mindset and achievement for CHCs and non-CHCs. First, for China, Singapore, and Taiwan, growth mindset has a stronger positive association with growth mindset for low SES students. For Hong Kong, Japan, Korea, Macau, and Vietnam, there is no difference in the relation between growth mindset and achievement for low versus high SES students. For non-CHCs, growth mindset does not predict achievement differently for high and low SES students. Next, for most of the CHCs, gender does not moderate the relation between growth mindset and achievement. In China and Korea, males have a stronger positive association between growth mindset and reading achievement, but there is no gender difference in math. For non-CHCs, females have a slightly stronger association between growth mindset and achievement in reading, but there is no gender difference in math.

Ultimately, these results contribute to the growing body of evidence that students in CHCs may experience motivation, and especially growth mindset, differently from students in other countries, which leads to a few implications. Growth mindset may not necessarily be regarded as having a positive association with achievement for all students, either within

academia or in schools. In this dissertation, of all of the three motivation constructs, growth mindset is the one that behaves the most differently when comparing CHCs and non-CHCs, given that it does not predict achievement or weakly predicts achievement. Although it is difficult to know why this is the case, it is possible that students in CHCs simply do not need to have a growth mindset in order to put in the effort necessarily to perform well academically. The theory behind growth mindset is that believing in the malleability of intelligence encourages students to put in more effort which leads to improvements in academic performance. However, if students in CHCs believe that they should put in effort anyway, regardless of their views on intelligence, then growth mindset may not be necessary for these students.

One implication of these studies is that growth mindset and value of effort in school may not be the same construct, even though the terms growth mindset and effort are often used interchangeably. These constructs can be correlated with one another, but growth mindset measures one's belief in the malleability of intelligence, which is not the same as one's belief in the value of effort in school. The results from these studies suggest that growth mindset and value of effort in school are not the same construct if they predict achievement differently.

Another implication is that an integrated study of the three motivation constructs provides a more nuanced understanding of the relation between motivation and achievement. Although these constructs have similarities and overlapping aspects, most studies in the literature do not address all of them together. Scholars tend to focus on one construct or theory of motivation and rarely take an integrated approach using multiple constructs or theories. One advantage of taking an integrated approach is that it allows us to examine whether these constructs are more similar or different from one another. As the findings from these studies show, growth mindset, mastery goal orientation, and intrinsic motivation behave differently when predicting achievement,

particularly in the CHCs, which suggests that they are distinct constructs. Another advantage of taking an integrated approach in these studies is that we can compare constructs to see which are more generalizable across contexts. In the case of these studies, intrinsic motivation is the most generalizable, whereas growth mindset is the least generalizable across contexts.

An additional implication is that SES may be an important moderator of the relation between growth mindset and achievement worthy of future studies. The results of Study 3 suggest that an area of future study could be the high SES students in CHCs, particularly in China, who appear to benefit from a fixed mindset. SES could be an important moderator of the relation between growth mindset and achievement for students in CHCs, possibly due to the extremely strong emphasis on academic achievement and the competitiveness of the academic environment.

Moreover, because these studies use individual-level data collected in several countries, they can potentially inform policy and practice in these contexts. Given the size of the PISA data set, these studies have potentially generalizable results. However, there are limits of this generalizability as well. For instance, the samples in some countries, such as China, only include participants from large cities, which are not necessarily representative of all people in China. In addition, the PISA survey is only given to 15-year-olds, who are not necessarily representative of all age groups. Moreover, the variation between individuals within a country also make it difficult to broadly generalize the results from this study. Given that there are still too few studies in the literature conducted on this topic, the results from these studies would need to be supported by additional studies in order to truly inform policy and practice.

One point to note is that there are benefits and limitations of grouping all of the CHCs together as opposed to considering them as individual countries or territories. Even the report

released by the OECD noted a similarity across Asian countries, which suggests that there are enough commonalities between the CHCs to warrant grouping them together. One of the benefits of grouping them together is that studies in the literature conducted on CHCs can all be used to support and explain the findings from these studies, which is especially helpful given the few numbers of studies conducted in the CHCs on this topic. To do an in-depth study of each of the individual CHCs would be much more difficult due to the few numbers of studies in the literature. Another benefit of grouping the CHCs together is that the results can be more generalizable across contexts. However, there is enough variation between and within the CHCs to suggest that one should not generalize these results too broadly.

Lastly, although this study is not an intervention study and does not have direct implications for classroom practice, it may lead to more intervention studies to determine the effectiveness of growth mindset in the classroom. Future intervention studies may influence the way practitioners view growth mindset, particularly if they find that growth mindset does not lead to success for all students. Currently, practitioners may believe in the importance of developing growth mindsets in students, but studies such as these indicate that growth mindset does not necessarily predict achievement. Although most studies in the literature do not indicate that growth mindset has a negative association with achievement, which suggests that promoting growth mindsets among students does not have a harmful relation with academic performance, it may also not have as much of a positive relation as currently assumed. On the other hand, the results from these studies support the evidence that intrinsic motivation, especially, and also to some extent mastery goal orientation, may still be helpful across different contexts.

Given that the studies in CHCs are still small in number, more studies need to be conducted in order to fully explore and understand how motivation, and especially growth

mindset, relates to achievement in these contexts. Even more studies need to be conducted in order to explain why there may be differences between the CHCs and other countries, as well as when comparing the CHCs to one another. One such study could examine how growth mindset and other motivation constructs, such as mastery goal orientation and intrinsic motivation, mediate the relation between parent/teacher factors and achievement in the CHCs. Due to the strong emphasis on meeting the expectations of parents and teachers in Asian culture, parent/teacher factors may relate differently to the motivations of students in the CHCs when compared to students in the US or the West. Another study could examine how different motivation constructs relate to various emotions for students in the CHCs. Motivations such as intrinsic motivation and growth mindset tend to be positively associated with emotions such as happiness and negatively associated with emotions such as anger. Is that the case for students in the CHCs as compared to those in the US or the West? Does SES moderate this relation? As more studies are conducted on these topics, the findings on the similarities and differences between CHCs and other countries will become more robust. If differences indeed exist, then growth mindset and perhaps even other motivation constructs may be less generalizable than once thought.