Passion matters but not equally everywhere: Predicting achievement from interest, enjoyment, and efficacy in 59 societies

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How to identify the students and employees most likely to achieve is a challenge in every field. American academic and lay theories alike highlight the importance of passion for strong achievement. Based on a Western independent model of motivation, passionate individuals—those who have a strong interest, demonstrate deep enjoyment, and express confidence in what they are doing—are considered future achievers. Those with less passion are thought to have less potential and are often passed over for admission or employment. As academic institutions and corporations in the increasingly multicultural world seek to acquire talent from across the globe, can they assume that passion is an equally strong predictor of achievement across cultural contexts? We address this question with three representative samples totaling 1.2 million students in 59 societies and provide empirical evidence of a systematic, cross-cultural variation in the importance of passion in predicting achievement. In individualistic societies where independent models of motivation are prevalent, relative to collectivistic societies where interdependent models of motivation are more common, passion predicts a larger gain (0.32 vs. 0.21 SD) and explains more variance in achievement (37% vs. 16%). In contrast, in collectivistic societies, parental support predicts achievement over and above passion. These findings suggest that in addition to passion, achievement may be fueled by striving to realize connectedness and meet family expectations. Findings highlight the risk of overweighting passion in admission and employment decisions and the need to understand and develop measures for the multiple sources and forms of motivation that support achievement.

culture | passion | achievement

In our increasingly diverse world, universities and companies in the United States face the challenge of identifying the students and employees most likely to achieve and perform well (1). Currently, as these institutions gauge the achievement potential of applicants in highly diverse applicant pools, many of their criteria highlight the importance of "passion," a term that is typically not defined but indexed by measures of "interest" in and "enjoyment" of one's educational and career goals and projects (2, 3). For example, each of the top 20 universities in the United States mentions one of these attributes at least twice on their admissions webpage and suggests that they are indicators of "students' potential to succeed" (*SI Appendix*). Moreover, researchers have long emphasized how positive attitudinal characteristics predict higher achievement (4–6). Here we ask: Given the widely acknowledged importance of passion for achievement in the West, how well does it generalize across cultures?

To address this question, we focus on a key dimension of cultural difference: A society's emphasis on individualism (7–9). Societies grounded in individualism, such as many in North America and Western Europe, are animated by a cultural model of agency that encourages a construal of one's self as separate and independent and that identifies personal and internal attributes as the source of normatively good behavior (10–14). This cultural model is reflected in a dense web of mutually constituting values, ideas, institutional practices, interactional norms, and personal beliefs. According to this independent model of motivation, if I pursue a path consistent with my passion—that is, if I pursue something that I enjoy, that interests me, and for which I have a sense of self-efficacy—I will be motivated and do it well. The reverse is also true: If I do something very well, it is because I like it, I enjoy doing it, and I am efficacious at it (15). Consistent with this view, Falk, Dunn, and Norenzayan (16) found that expected enjoyment was a stronger predictor for decisions about which courses to take among people with more independent selves.

Research from multiple disciplines in Western societies across decades converges on the finding that students who self-report strong "interest," "enjoyment," and "confidence" toward learning—often labeled "passionate" students—tend to achieve higher levels than their peers who report fewer of those traits (12, 17–20). As a result, in many schools in North America, especially those in middle- or upper-class communities, teachers, parents, and school policies emphasize not only effort and hard work but also the importance of helping students find their passion: Developing interests, experiencing enjoyment, and gaining

Significance

In three large-scale datasets representing adolescents from 59 societies across the globe, we find evidence of a systematic cultural variation in the relationship between passion and achievement. In individualistic societies, passion better predicts achievement and explains more variance in achievement outcomes. In collectivistic societies, passion still positively predicts achievement, but it is a much less powerful predictor. There, parents' support predicts achievement as much as passion. One implication of these findings is that if admission officers, recruiters, and managers rely on only one model of motivation, a Western independent model, they may risk passing over and mismanaging talented students and employees who increasingly come from sociocultural contexts where a more interdependent model of motivation is common and effective.

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efficacy. These individual efforts and individualized programs are fueled by the belief that passion enables students to do better in school (21, 22). Yalcinkaya and Adams (23) recently labeled this the "self-expressive construction of academic choice" and theorized that it is more prevalent in individualistic societies.

Societies grounded in collectivism, including the majority of societies outside North America and Western Europe, are often animated by cultural models of agency that encourage the construal of one's self as interdependent with close others and as a part of an encompassing social whole. What moves people to action includes one's internal thoughts and feelings, but also the thoughts, feelings, and actions of close others. This model identifies being responsive to these close others, realizing their expectations, and fulfilling obligations as the source of good, moral, or normatively appropriate behavior. As is the case with an independent model of motivation, this interdependent model of motivation is reflected in and supported by national educational systems, policies, and curricula, teaching and parenting practices, achievement and education-relevant products such as films, television, advertisements, and other media, and by daily interactions among teachers, students, and their peers (9, 10, 23–26).

According to an interdependent model of motivation, doing well in school stems in some large parts from the close others with whom the student is connected, and includes striving to realize this connectedness, through doing what duty and obligation require, what one is expected to do, and what makes one's family and friends proud (23, 27–31). For example, one study compared Asian American and European American children in three conditions: When they chose a word puzzle task for themselves, when their mothers chose it for them, and when the experimenter chose it for them. The Asian American students solved more puzzles in the mom-choice condition, while the European Americans performed best in the self-choice condition. Neither group performed well when the experimenter chose (32).

A confluence of achievement-relevant socialization practices reinforces an interdependent view of motivation in which the focus is less on what is personally interesting and exciting and more on what is required and expected in a given situation to meet high standards or excel. When their children succeed, parents with East Asian heritage and background often direct them toward ways to further improve in a competitive system, rather than highlighting their children's personal interests and accomplishments (33, 34). Students are encouraged to adjust to the situation and do well in whatever task or assignment is given them (35, 36). Whether the assignment is of interest or enjoyable is a secondary concern. This apparent pressure from parental expectations does not seem to strain adolescents' relationships with their parents (25). In fact, a brain imaging study found that when asked to make judgments about themselves and about their mothers, North American respondents showed activation in two distinct brain regions, while Chinese respondents showed activation of the same area for both self and mother, suggesting an embodied or close connection with self and mother (33). Notably, trying to meet standards or expectations for achievement needs not be experienced as extrinsic, aversive, or have the feel of grudging compliance (37, 38). Some of the differences between independent and interdependent models of motivation for achievement outcomes are summarized in Table 1.

Given that an independent model of motivation is pervasive in individualistic but not in collectivistic societies, we hypothesized that passion, understood here as a form of internal, independent motivation, should be more tightly related to achievement in individualistic societies, but more loosely linked to achievement in collectivistic societies. In other words, cultural individualism is expected to moderate the strength of the relationship between passion and achievement. Additionally, in more collectivistic societies, interdependent forms of motivation, such as parents' emotional support, are expected to predict achievement over and above passion. Previous studies provide some initial support for this hypothesis. A metaanalysis (39), based on samples of students with European backgrounds and from predominantly individualistic societies, found a correlation between one specific form of independent motivation (self-efficacy) and achievement at $r = 0.33$. In contrast, a study of students in more collectivist contexts—including Japan, Thailand, and Indonesia (40)—found a weaker link between self-efficacy and achievement ($r = -0.05$ to $r = 0.17$).

The present study further examines cultural variability in the link between passion and achievement and makes three unique contributions. First, it compares a wider range of culturally diverse societies ($n = 59$). In the samples used here, Western, educated, industrialized, rich, and democratic (WEIRD) societies account for only half of all observations (24). Second, it compares the moderating role of individualism with that of other cultural dimensions of societies, such as tight versus loose norms, uncertainty avoidance, and long-term orientation (41–43). Third, while previous studies used mainly convenience samples consisting of college students or online survey respondents, with varying metrics of performance, the present research uses nationally representative samples and a uniform high-stake standardized achievement test administered in school settings.

Predicting Achievement from Passion

We draw data from the Program for International Student Assessment (PISA), a triennial international survey that evaluates education systems worldwide (44). PISA findings have been widely influential for educational policy-making (45). We chose these datasets because they contained our variables of interest and provided diverse samples across a wide range of cultures. The three datasets used in this research have sample sizes of $n_1 = 434{,}948$, $n_2 = 416{,}513$, and $n_3 = 402{,}776$, drawn as representative samples from 56, 52, and 54 societies based on the past three PISAs in the years of 2015, 2012, and 2009, respectively. Students were about 15 years of age at the time of the test (mean = 15.79, SD = 0.29), with 50.18% of the sample self-identifying as girls. All data and materials are publicly available on the PISA website. We report all analyses below and in *SI Appendix*. Academic achievement in science (from PISA 2015), mathematics (from PISA 2012), and reading (from PISA 2009), respectively, were measured in 90-min, 120-min, and 120-min standardized closed-book examinations. PISA's design process aimed to create "culturally unbiased measures," and the psychometrics of the measures were culturally invariant (44). Globally, students' science scores ranged from 25.10 to 888.36 (mean = 469.49, SD =102.37), mathematics scores from 19.79 to 962.23 (mean = 469.41, SD = 103.33), and reading scores from 12 to 871.12 (mean = 460.53, SD = 104.19).

Measuring passion and testing passion-linked theories across cultural contexts pose multiple challenges for researchers. Chief among them is defining what passion means. In English, passion has multiple meanings and is often readily associated with romance. Although now in the popular culture, the word "passion" is commonly used (e.g., "We believe people with passion will change the world for better" – Steve Jobs), researchers rarely used the exact word "passion" in passion scales (21, 22, 46, 47).

Besides, the word doesn't translate well. The word "passion" originates from Latin and gains its contemporary meaning in late Latin and old French. It translates relatively well across Western societies, yet it lacks a direct counterpart in languages, such as Thai and Mandarin. In Thai, the word translates as "ความหลงใหล," which means fascination or charisma. In Mandarin, most-cited studies on Google Scholar translated "passion" as *jiqing* (激情), its closest linguistic match (46, 48, 49). The term

Table 1. Culture's influence on academic motivation and achievement in individualist and collectivist contexts

Cultural context		Achievement-relevant ideas, socialization, educational policies, practices, norms and products emphasize:		Cultural construal of what moves people to action (model of agency)		Student outcome
Individualist	→	Pursuing what is exciting and interesting regardless of social and family expectations; Expressing personal preferences in making academic choices; Belief that students will do well when interested, enjoying, feeling efficacious in what they are doing.	↔	Independent motivation	→	Passion predicts achievement more strongly.
Collectivist	→	Fulfilling expectations and contributing to success and well-being of family and/or important relationships; Comparing oneself to relevant others and excelling in a competitive educational system; Expectation that students will adjust and do well in most situations; academic choice often not available/relevant.	↔	Interdependent motivation	→	Passion predicts achievement but to a lesser extent. Parental support predicts achievement over and above passion.

jiqing, however, refers predominantly to sexual and romantic passion, rather than passion toward professional or educational goals. Although there's not complete agreement on elements of passion (47, 50), terms such as "interest," "enjoy," and "competence" have been widely used in the literature to index passion (5, 21, 22). Importantly, unlike the word "passion," translation and back-translation show that these terms have relatively similar meanings across a wide range of cultural contexts (51).

PISA included measures of enjoyment, interest, and efficacy. These self-reports were collected after the administered standardized achievement tests. These forms of independent motivation have often been the way passion has been defined in previous studies (21, 52, 53). The translations and back translations of these terms have been compared and validated widely in previous studies, and the meanings are comparable (44). Relying on a composite (Cronbach's $\alpha = 0.80$) derived from these measures, we define "passionate students" as students who express strong independent motivation, indexed here as strong interest, enjoyment, and efficacy. When one or two of these measures were unavailable (6.43% of valid observations), we averaged the available measures. PISA coded all indices such that higher scores indicate greater levels of passion. We averaged all items to create a passion composite, then standardized this composite for each society. Separating enjoyment, interest, and efficacy in the analyses would not change the pattern (*SI Appendix*, Tables S7–S12).

We also conducted an internal validity analysis and found that the individual items load on the same constructs across all societies (with all Cronbach's $\alpha > 0.75$, all eigenvalues > 0.83). Our analyses also confirmed the cross-cultural measurement invariance of these scales (*SI Appendix*).

Results

We first calculated the Pearson correlation between passion and achievement for each society, then examined whether society-level individualism predicted these correlation coefficients. We chose the achievement test for the years when passion was measured. In 2015, passion for science and achievement in science were measured. In 2012, passion for math and achievement in math were measured. In 2009, passion for reading and achievement in reading were measured.

The individualism score for each society was measured by averaging the two most widely used indices of individualism–collectivism (42, 54), derived from large-scale international surveys administered over the past decades (Cronbach's $\alpha = 0.90$). In this process, we first reverse-coded the collectivism index and standardized each index across its available societies, then averaged the available indices for each society and standardized the composite. The standardized individualism score was used for all subsequent analyses. If we use each individualism index separately, the same pattern would emerge [*SI Appendix, Hierarchical Linear Models (HLM) Specification*].
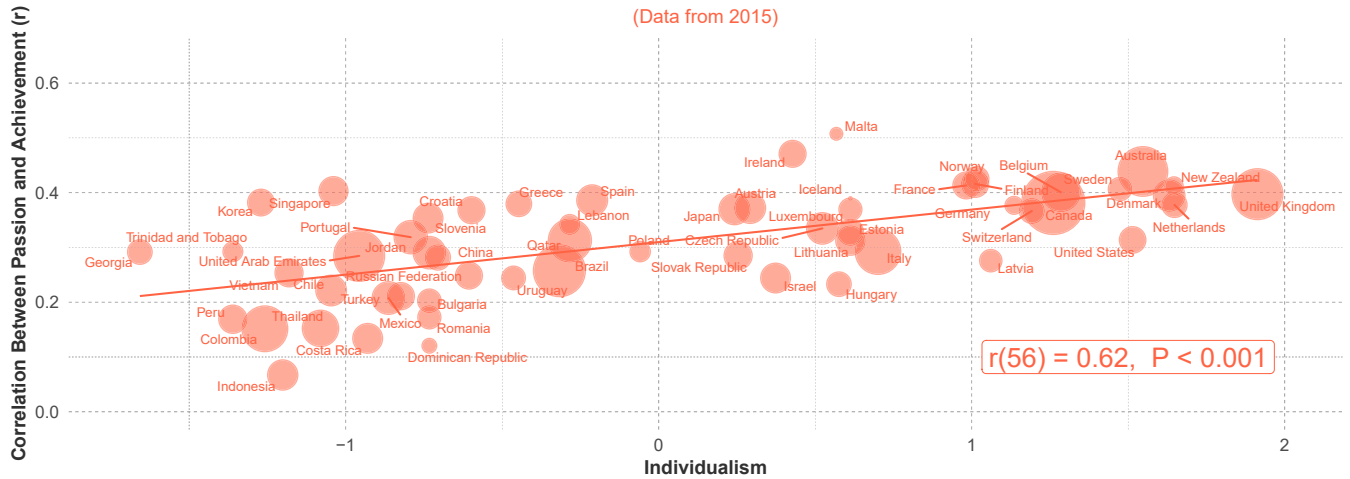
Results show that first, in the domain of science learning, passion was positively correlated with academic achievement in science. Students with stronger enjoyment, interest, and efficacy tended to have higher test scores. However, societies differed substantially on the strength of this passion–achievement correlation (Fig. 1). Individualism predicted significantly stronger correlation between passion and achievement in science: $r(56) = 0.59$, $P < 0.001$. Notably, individualism explained 37.97% of the variance in the strength of the passion–achievement correlation worldwide. The passion–achievement correlation was robust in individualistic societies, such as the United States [$r(5,390) = 0.28$, $P < 0.001$], Australia [$r(12,396) = 0.38$, $P < 0.001$], and the United Kingdom [$r(12,724) = 0.35$, $P < 0.001$]. In contrast, the passion–achievement correlation was weaker in collectivistic societies, such as Indonesia [$r(6,264) = 0.08$, $P < 0.001$], Thailand [$r(8,269) = 0.15$, $P < 0.001$], and Colombia [$r(10,706) = 0.11$, $P < 0.001$].

These results were replicated when we examined mathematics achievement. Individualism predicted a stronger passion–achievement correlation, $r(52) = 0.57$, $P < 0.001$, and explained 32.52% of the variance in the strength of the passion–achievement correlation worldwide. Finally, these findings extended to reading achievement. Individualism predicted a stronger correlation between passion and achievement, $r(54) = 0.6$, $P < 0.001$ and explained 44.34% of the variance in that link across the globe.

Preliminary results from the simple Pearson correlation supported the hypothesis that passion was a stronger predictor of academic achievement in individualistic societies and a relatively weaker predictor of academic achievement in collectivistic societies. However, this method did not take into account the nested

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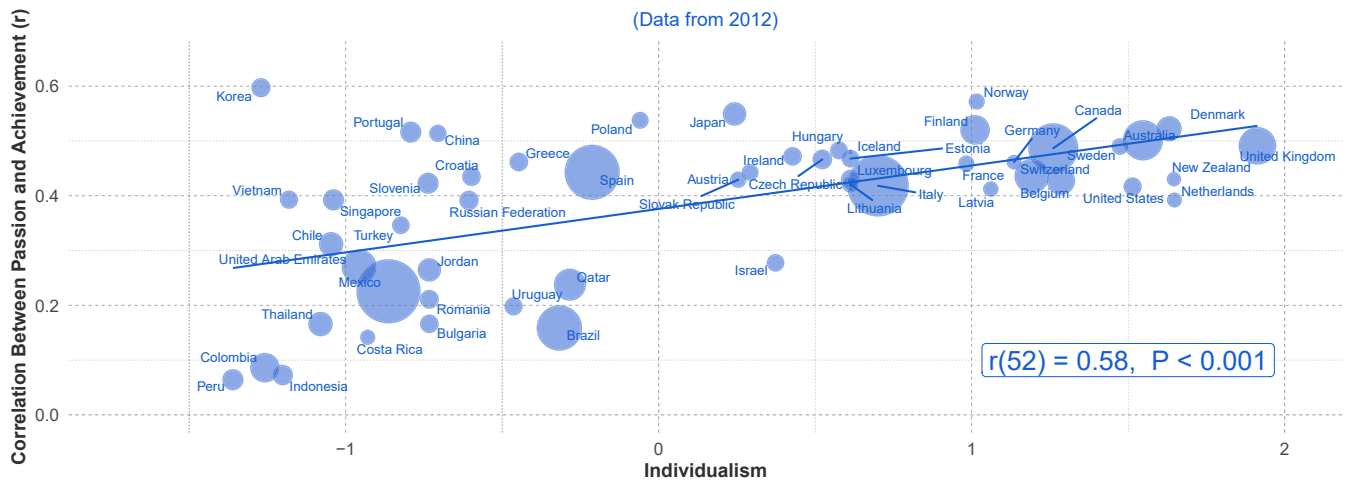
Fig. 1. Individualism predicted stronger correlation between passion and academic achievement (in science, math, and reading).

structure of the data (i.e., students in schools and schools in societies) and did not control for covariates, such as gender, socioeconomic status, student-level le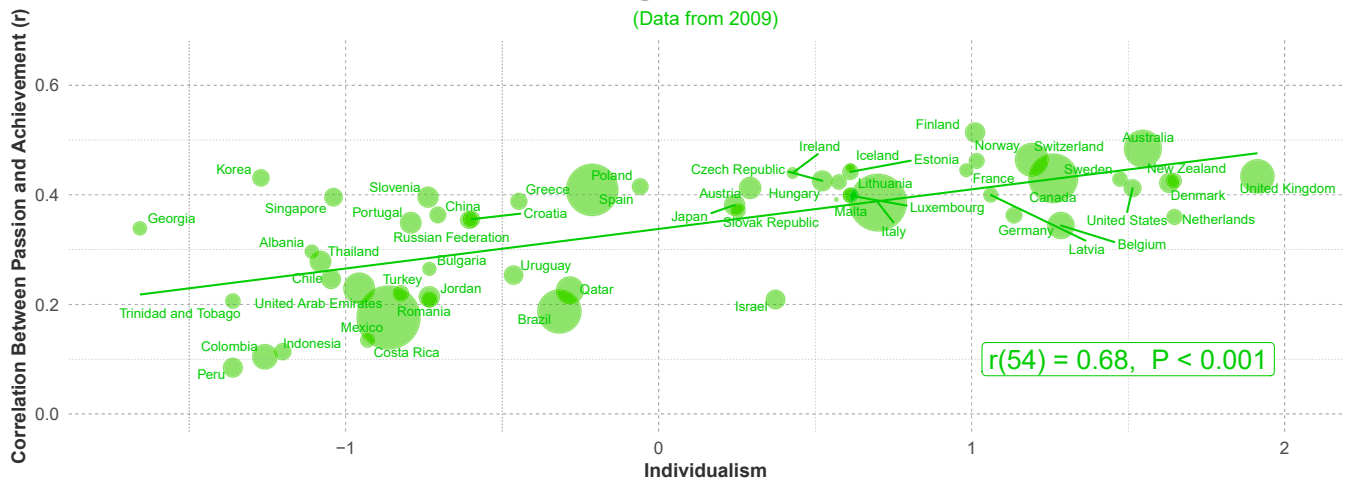arning time (minutes per week in each learning domain), total learning time (minutes per week totaling all learning domains), immigration status, grade level, and grade repetition history.

To address these issues, consistent with previous studies using international student datasets (55, 56), we built hierarchical linear models (HLMs) in R. We used passion, individualism, and their interaction to predict academic achievement. We evaluated model fit by adopting the likelihood-ratio test and the Bayesian information criterion (57). Results suggested that models with student-level covariates robustly yielded the best fit across all passion indices and academic achievement measures. Therefore, we report these models in the main text and report simple models without covariates in *SI Appendix*.

Results from HLMs were consistent with results from simple correlation analyses (*SI Appendix*, Tables S1–S3). First, passion positively predicted achievement in science, $B = 18.92$, SE = 3.61, 95% CI = [11.82, 26.02], $t = 5.24$, $P < 0.001$. Second and more important, passion interacted with individualism, $B = 4.41$, SE = 0.81, 95% CI = [2.84, 6.01], $t = 5.48$, $P < 0.001$, suggesting that the degree to which passion predicted achievement depended on a society's level of individualism. In individualistic societies (+1 SD), one unit increase in passion predicted a larger gain in achievement test scores, $B = 23.33$, SE = 3.70, 95% CI = [16.08, 30.58], $t = 6.31$, $P < 0.001$. In collectivistic societies, one unit increase in passion predicted a smaller gain, $B = 14.51$, SE = 3.70, 95% CI = [7.26, 21.76], $t = 3.92$, $P < 0.001$. Next, we examined passion and achievement in mathematics and found the same pattern. There was a significant interaction between passion and individualism in predicting achievement, $B = 3.79$, SE = 0.86, 95% CI = [2.11, 5.47], $t = 4.42$, $P < 0.001$. Finally, the passion × individualism interaction was replicated in predicting reading achievement, $B = 5.35$, SE = 0.91, 95% CI = [3.57, 7.14], $t = 5.88$, $P < 0.001$. To illustrate the predictive power of passion in different types of societies, we plotted the points gained from 1 SD increase in passion against individualism in Fig. 2.

As documented in multiple studies (43, 58), individualism was strongly related to economic development, indexed by gross domestic product (GDP) per capita ($r = 0.61$, $P < 0.001$). Yet even when controlling for GDP per capita, individualism was still significant in predicting: The relationship between passion and achievement, $B = 4.25$, SE = 1.23, 95% CI = [1.84, 6.66], $t = 3.47$, $P = 0.001$; the relationship between passion and math achievement, $B = 2.99$, SE = 0.93, 95% CI = [1.17, 4.81], $t = 3.22$, $P = 0.002$; and the relationship between passion and reading achievement, $B = 4.81$, SE = 1.02, 95% CI = [2.81, 6.81], $t = 4.72$, $P < 0.001$.

It is possible that cultural differences other than individualism–collectivism could be driving the cultural variation in the link between passion and academic achievement. We tested eight previously documented cultural indices that could moderate the passion–achievement link (41, 59, 60): Survival versus expression value, secular versus rational value, power distance, masculinity, uncertainty avoidance, indulgence, long-term orientation, and tightness–looseness. We found no evidence that any of the eight cultural indices could robustly predict the correlation between passion and achievement. Moreover, even after controlling for these cultural indices, individualism remained the strongest predictor of the strength of the link between passion and achievement (*SI Appendix*, Tables S4–S6).

The third alternative explanation for this finding was that collectivistic societies might have more of a certain type of outliers. In particular, they might have more low-passion, high-achieving outliers that unduly bias the correlation. A closer examination of outliers ruled out this explanation (*SI Appendix*, Table S14). In *SI Appendix*, we report analyses addressing other alternative explanations, such as different ways of operationalization, standardization, and differential distribution of passion and achievement across cultures.

Arguably, the SDs for interest, enjoyment, and efficacy were larger in more individualistic societies, as assessed by the correlation between the SD and cultural individualism at the societal level, [$r(56) = 0.50$, $P = 0.001$, $r(52) = 0.34$, $P = 0.016$, and $r(54) = 0.31$, $P = 0.016$, respectively]. This is consistent with previous observations that survey respondents from Western, individualistic societies tend to use more extreme ends of the scale, while respondents from Eastern, collectivistic societies tend to use the middle of the scale (61). This presented a potential confound, insofar as more varied measures (in individualistic societies) have a better opportunity to yield a correlation there. We addressed this potential confounder in our results in three ways. First, we computed the Pearson correlation between passion and achievement for each culture, and the computation of this correlation took into account the SD of each measure in its formula. Second, in regression analyses, we first standardized respondents' passion index separately for each society, thus rendering its mean and variance equal across societies (*SI Appendix*). Third, in the societal-level analyses, we controlled for the SDs for each passion index and results were consistent (*SI Appendix*). The SD of math and reading achievement did not correlate with cultural individualism ($r = 0.24$, $P = 0.091$ and $r = 0.27$, $P = 0.053$), but the SD of science achievement did correlate with cultural individualism ($r = 0.52$, $P < 0.001$). We show that controlling for this achievement variance did not affect our results in *SI Appendix*.
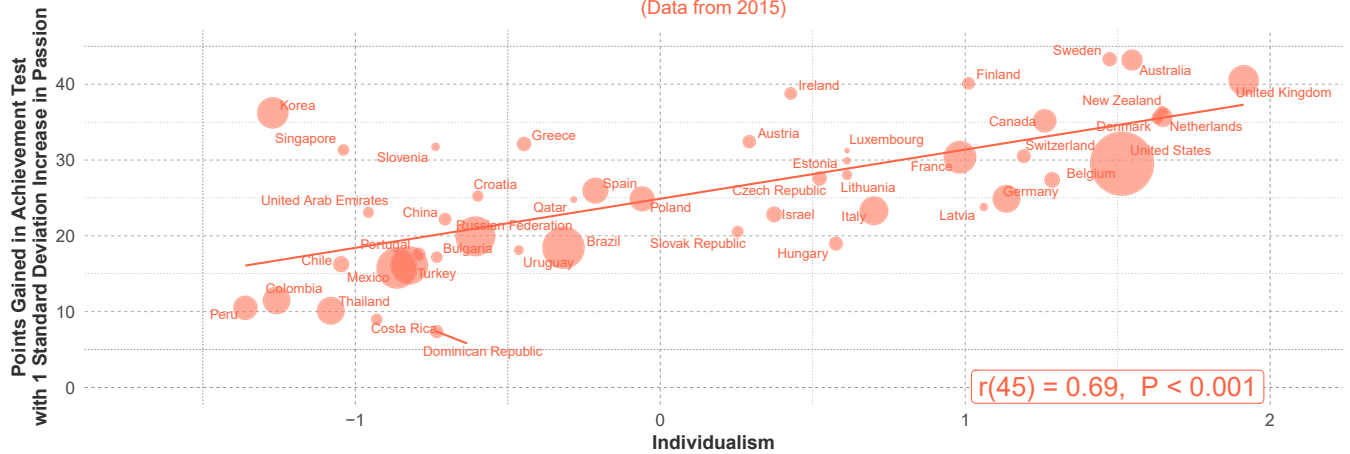
Metaanalysis. In three distinct datasets, individualism predicted tighter links between passion and academic achievement in science, mathematics, and reading for 15-y-old adolescents around the globe. In a final metaanalysis, we investigated the consistency of our findings across six indices of passion (science enjoyment, science interest, science efficacy, math interest/enjoyment, math efficacy, and reading enjoyment) at three time points (2009, 2012, and 2015). We used the *metafor* package in R. We specified a random-effect model to offer an unconditional inference of the strength of the link between passion and achievement in societies that are 1 SD above and below the global mean in individualism (see *SI Appendix* for the rationale and details for this metaanalysis model).

We used the sample size of each dataset as the weight for each index's effect. Our focus in the metaanalysis was the interaction term between individualism and passion in predicting academic achievement, not the main effect of individualism or the main effect of passion. This interaction term indicated the degree to which individualistic culture explained the strength of the passion–achievement relationship.

The metaanalysis revealed that individualism significantly moderated the link between passion and academic achievement, $B = 4.99$, SE = 0.40, 95% CI = [4.21, 5.77], $t = 12.54$, $P < 0.001$ (Fig. 3). For individualistic societies (+1 SD), passion predicted higher achievement: One unit increase in passion contributed to 22.67 more points in standardized achievement tests, $B = 22.67$, SE = 0.55, 95% CI = [21.60, 23.75], $t = 41.22$, $P < 0.001$. In contrast, in collectivistic societies (−1 SD), the effect of passion on achievement was moderate at best: One unit increase in passion corresponded to a 12.69 point gain in test scores, $B = 12.69$, SE = 0.54, 95% CI = [11.64, 13.74], $t = 23.50$, $P < 0.001$. The benefit of passion was 44% smaller in collectivistic cultures. Notably, enjoyment was more predictive for reading and science achievement, especially in the individualistic societies, and efficacy (rather than enjoyment and interest) was most predictive for math achievement. Future research might explore whether and why different components of passion predict achievement more strongly in different cultural contexts.

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Science Achievement
(Data from 2015)

r(45) = 0.69, P < 0.001

Math Achievement
(Data from 2012)

r(47) = 0.57, P < 0.001
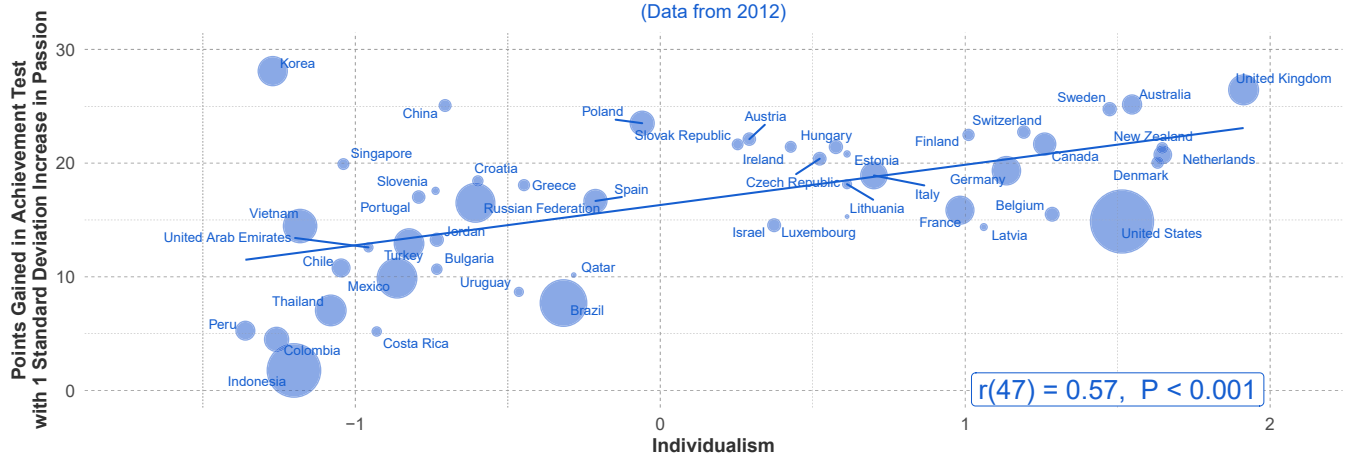
Reading Achievement
(Data from 2009)

r(52) = 0.69, P < 0.001

Fig. 2. Individualism predicted larger gain on achievement test scores (in science, reading, math) from increase in passion.

Points Gained in Achievement Test
(with 1 unit increase in Passion)

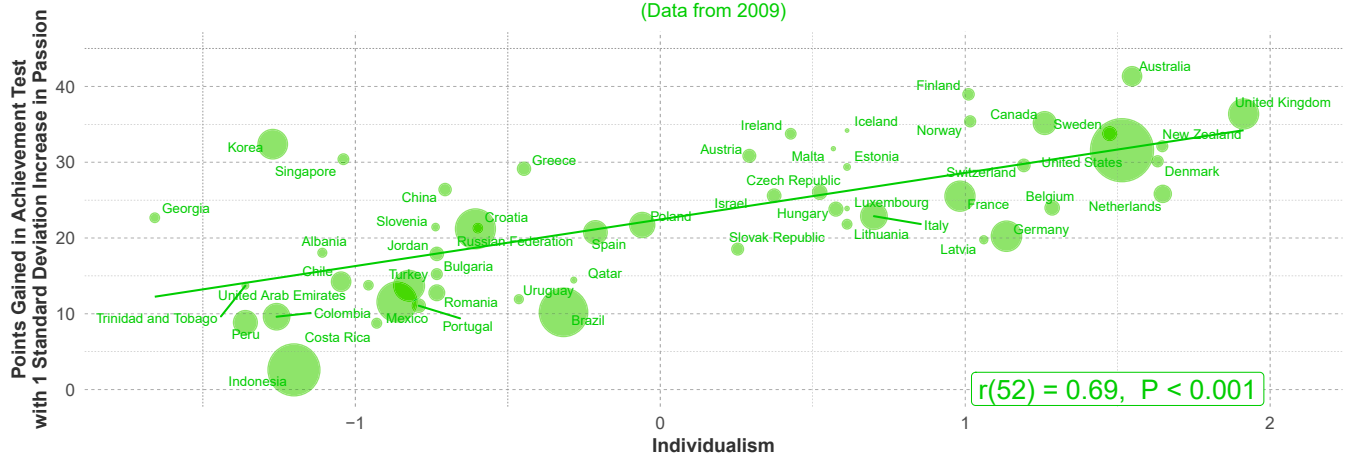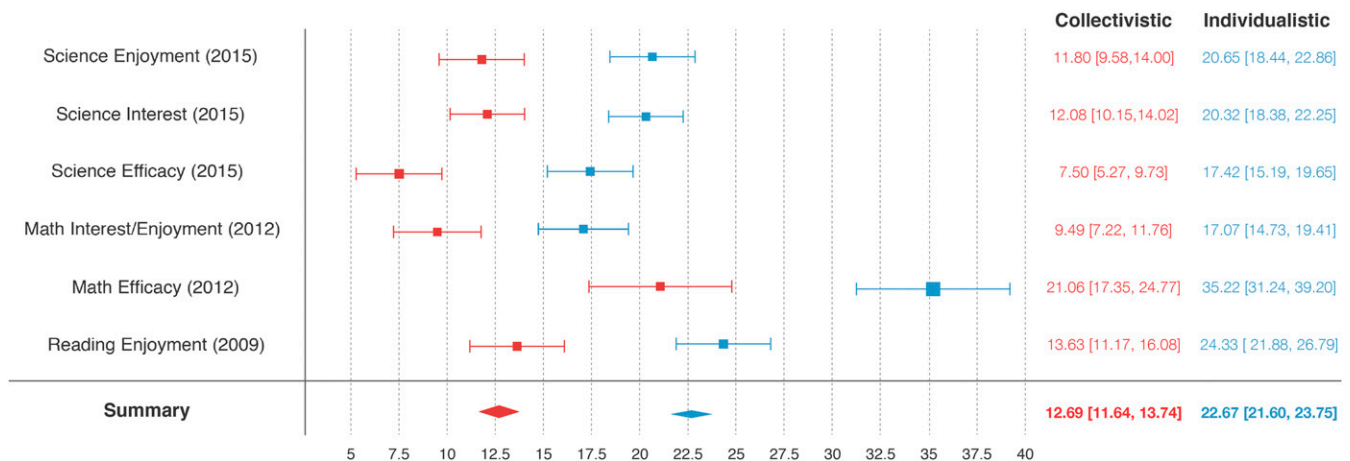|	Collectivistic	Individualistic
Science Enjoyment (2015)	11.80 [9.58,14.00]	20.65 [18.44, 22.86]
Science Interest (2015)	12.08 [10.15,14.02]	20.32 [18.38, 22.25]
Science Efficacy (2015)	7.50 [5.27, 9.73]	17.42 [15.19, 19.65]
Math Interest/Enjoyment (2012)	9.49 [7.22, 11.76]	17.07 [14.73, 19.41]
Math Efficacy (2012)	21.06 [17.35, 24.77]	35.22 [31.24, 39.20]
Reading Enjoyment (2009)	13.63 [11.17, 16.08]	24.33 [21.88, 26.79]
Summary	12.69 [11.64, 13.74]	22.67 [21.60, 23.75]

Fig. 3. Points gain in achievement tests from increase in passion in individualistic (+1 SD) and collectivistic societies (−1 SD) across three datasets. The boxes are β-coefficients for passion in both types of societies with 95% CIs (in brackets).

Predicting Achievement from Interdependent Motivation. So far, we have presented evidence that passion predicts academic achievement more strongly in individualistic societies than in collectivistic ones. We now move to identify what else, other than passion, could be an important predictor of academic achievement in collectivistic societies. Based on previous studies in the literature, we examined the role of interdependent motivation. PISA did not ask students the type of questions we hypothesized would most clearly index interdependent motivation (e.g., "My parents care about my success" and "I want to make my parents proud"). The questions in PISA most relevant to interdependent motivation were four items answered by parents that indexed parental emotional support contained in the PISA 2015 parents' dataset. This index included items such as, "I support my child when he/she is facing difficulties at school" (Cronbach's α = 0.84). Results from this measure should be interpreted as exploratory. Fewer societies participated in this parent survey than the student survey; thus, including this measure from the parent survey reduced our observations to 17 societies.

Results showed that individualism predicted significantly weaker correlation between parental support and achievement in science: $r(15) = -0.78$, $P < 0.001$ (Fig. 4). Results from HLMs were consistent with results from simple correlation analyses. There was a significant main effect of parental emotional support on students' academic achievement worldwide, $B = 1.19$, SE = 0.29, 95% CI = [0.62, 1.76], $t = 4.10$, $P < 0.001$. More important, even after controlling for passion, there was a significant interaction between individualism and parental emotional support in predicting achievement, $B = -1.05$, SE = 0.32, 95% CI = [−1.68, −0.42], $t = -3.28$, $P = 0.001$. In collectivistic societies (−1 SD), parental support predicted stronger achievement, $B = 2.24$, SE = 0.43, 95% CI = [1.40, 3.08], $t = 5.21$, $P < 0.001$, and it remained significant even after controlling for students' passion, $B = 1.27$, SE = 0.40, 95% CI = [0.49, 2.05], $t = 3.18$, $P = 0.001$. In contrast, in individualistic societies (+1 SD), parental emotional support did not predict achievement either by itself, $B = -0.31$, SE = 0.40, 95% CI = [−1.09, 0.48], $t = -0.78$, $P = 0.435$, or above and beyond the effect of passion, $B = -0.40$, SE = 0.43, 95% CI = [−1.24, 0.44], $t = -0.93$, $P = 0.522$.

Science Achievement
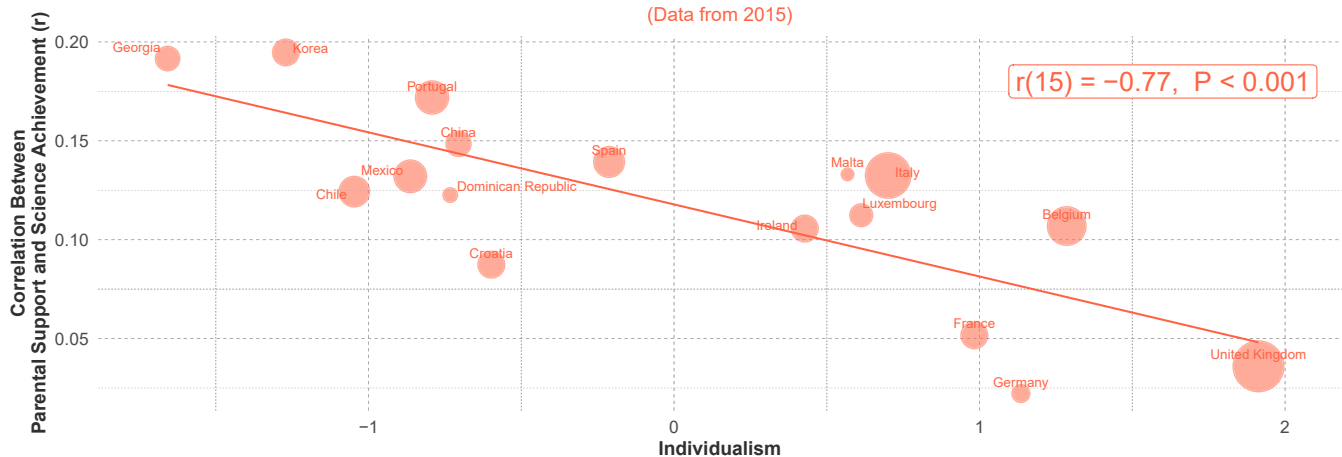### (Data from 2015)

r(15) = −0.77, P < 0.001

Fig. 4. In collectivistic but not individualistic societies, parental emotional support (completed by parents and used here as a proxy for interdependent motivation) predicted stronger achievement in science.

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Discussion

Across three datasets and a metaanalysis, we found that passion positively predicts academic achievement in science (2015), math (2012), and reading (2009). But its predictive power depends on culture. In individualistic societies, passion correlates more strongly with achievement ($r = 0.37$), predicts a larger gain in achievement (31.25 points), and explains more between-student variances in achievement (36.63%), after controlling for personal covariates, such as gender, socioeconomic status, student-level learning time (minutes per week in each learning domain), total learning time (minutes per week totaling all learning domains), immigration status, grade level, and grade repetition history. In collectivistic societies, however, passion correlates less strongly with achievement ($r = 0.26$), predicts a smaller gain in achievement (20.23 points), and explains less between-student variances in achievement (15.76%). These results extend to achievement in mathematics (data from 2012) and reading (data from 2009). Meanwhile, parental support matters more in predicting performance in collectivistic cultures than in individualistic ones. No cultural index other than individualism could robustly explain the passion–achievement relationship across the globe.

The present study strengthens the theory that motivation—what moves people to action—assumes different forms in different sociocultural contexts (10, 18, 62, 63). Individualistic contexts reflect and reinforce a view of independent motivation. In this model, action derives primarily from what's inside the person: interests, preferences, and attributes. Yet collectivist contexts—the majority of the world's contexts—reflect and reinforce a more interdependent model of motivation. In this model, motivation is primarily rooted more externally and takes the form of being receptive to specific others, realizing expectations and following culturally prescribed norms of why and how to achieve. Many conceptualizations in social psychology distinguish intrinsic motivation, more prevalent in individualistic contexts, from extrinsic motivation (64). The present study and many others elucidate two important insights related to this topic.

First, from the perspectives of Western researchers, interdependent motivation might be seen as more "extrinsic." Yet from the perspectives of people in more collectivist cultural contexts, interdependent motivation need not feel like coercive pressure from the outside. First, doing what the important others with whom one is interdependent expect could thus feel like choosing to do it for oneself (9). Second, from the perspective of Western researchers, interdependent "extrinsic" motivation might be seen as secondary, inauthentic, or less efficient than intrinsic motivation. Yet in addition to the present study, many others also suggest that motivation from what is construed from a Western lens as the "outside" can be just as energizing and can predict achievement in some cultural contexts just as strongly as motivation from the "inside" does in individualistic contexts (3, 11, 28–32, 65).

Our findings challenge the view that passion is a universally powerful cornerstone of achievement. Cross-cultural comparisons of the sources and correlates of behavior in other domains beyond academic achievement—including health, consumer choice, and sustainable behavior—also suggest that internal attributes (including attitudes, preferences, intrinsic motivation, and beliefs) may not be the main engine of behavior, as they are often assumed to be in the West (66, 67). For example, positive affect predicts better health and negative affect predicts worse health in individualistic societies, whereas these links between affect and health are decidedly weaker in collectivistic societies (68, 69). Similarly, personal preferences drive product choice, spouse choice, and job choice more in the United States than in collectivist cultures (70). In still another example, personal attitudes drive proenvironmental behavior in individualistic societies

more than in collectivistic ones, such as Japan, where social norms—others' views of what is expected and right—are more strongly linked to behavior (71).

The role of social influence from close others in motivation increases as one's perspective moves away from the WEIRD cultural context. In contrast, intrinsic, independent forms of motivation, such as passion, show decreasing interpretive power outside the WEIRD context (72). Two implications emerge from these findings. First, academic institutions and workplaces in the West—if overemphasizing the role of passion, as indexed by enjoyment, interest or efficacy—may risk missing and mismanaging talent. Passion as construed by Western theorists represents only one form among many other diverse forms of motivation. Perceiving and explaining students' or employees' behavior with a mismatched cultural model of motivation can be a major barrier to effective intercultural communication and collaboration (65, 73). In schools, it can lead to discriminatory curricula and programs that fail to motivate diverse classrooms of students (3).

Second, researchers need to design and validate measures of interdependent motivation in order to gauge the achievement potential for individuals in more collectivistic cultural contexts. It is telling that there were no such measures of interdependent motivation in the PISA dataset. Such interdependent motivation could be tapped by assessing perceived norms in a classroom, sense of belongingness at school, and feelings of responsibility to make one's family proud and financially secure, or raise their societal status (26, 36, 74, 75). It is critical to underscore that these interdependent forms of motivation need not feel overbearing and corrosive to personal autonomy. Instead, they can be a source of empowerment, persistence, and resilience (10, 28, 29, 32).

Identifying interdependent sources of motivation could be critical in aiding the design of educational interventions. For example, in one large-scale field tstud, a self-regulation intervention improved online course completion rates for learners in individualistic societies, because the idea of self-regulation matched with their predominant model of motivation: the independent model. However, the self-regulation intervention was ineffective in collectivistic societies. In these cultural contexts, trying to leverage the power of passion—the interests, enjoyment, and efficacy—of the independent self without addressing its social reality in the relevant cultural context is not sufficient for improving achievement (76).

Four limitations constrain the interpretation of our results. First, despite using data from large-scale, nationally representative samples, the present investigation could not shed light on the many distal and proximal causal mechanisms linking individualism to the increased role of passion in achievement that are sketched in Table 1. The ideology of individualism is made into a practical belief system and crafted into what is called "passion" in the West through common socialization practices, everyday norms of achievement, and a wide network of informal and formal social institutions, such as the free market, on-request educational services, extracurricular opportunities, and school elective courses (77). These individualistic ideas, practices, and social institutions help convert students' passion into achievement. For example, in the United States, a student who is interested in physics can take fewer biology and more physics classes, attend the school's physics club, or even enroll in a summer camp for young physicists. But in China, it will be logistically challenging for that student to choose more physics courses because courses are more standardized and students tend to have few electives.

Second, our analyses combined different indices of independent motivation without examining the potential interactions between them. Previous studies suggest a synergistic effect

between interest and self-efficacy in predicting academic achievement (78), which we examine in detail in *SI Appendix*.

Third, in the present study, we define cultural context by students' nation of origin. It is always imperative to highlight that there is substantially cultural variability within all societies. For example, within the United States, researchers have found that students from high socioeconomic status European American, and continuing-generation backgrounds tend to have a more independent model of motivation. Meanwhile, students from lower socioeconomic status, ethnic minority, and first-generation backgrounds tend to be more interdependent (3). Future research that taps into such within-society cultural variability has the potential to reveal new insights about what motivates people to action.

Fourth, although we ruled out various confounds, we did not experimentally manipulate some features of individualism and attempt to assess their impact on the passion–performance relationship, an important objective for future research.

Finally, these findings do not imply that for students with more interdependent selves—those who come from more collectivist, lower socioeconomic status, ethnic minority, and first-generation backgrounds—passion is not "important" or passion "doesn't matter." In contrast, these data suggest that passion still significantly predicts achievement in these contexts. Future research might productively investigate how to better leverage independent and interdependent motivation in unleashing students' potential in diverse cultural contexts, as well as how to identify barriers and constraints in collectivist cultural contexts that may prevent students' from transforming their passion into stronger achievement.

By investigating cultural variability in the link between passion and achievement, the data reveal the role of individualism in strengthening this link across three academic domains: science, mathematics, and reading. Passion is positively correlated with achievement but less so in collectivist cultures. There, other factors can be important. This new evidence challenges the implicit belief communicated by higher institutions in WEIRD cultures that passion underlies students' future success, regardless of the diversity of student background (3). To establish a fair and meritocratic educational system, it is important to acknowledge that motivation can take many forms, including those taken in the interdependent cultures that account for over 75% of the world's population (24).

Materials and Methods

Following statistical guidelines developed by PISA, we applied trimmed nonresponse student-adjusted weights in all analyses to correct for nonresponse students and ensure the representativeness of the samples. Consistent with PISA's data manual, the final test score reported in our analyses was derived from all available plausible values using a multiple-imputation method (44).

For the PISA 2015 science dataset, we analyzed enjoyment (four items assessing positive affect toward learning science; e.g., "I generally have fun when I am learning science topics," Cronbach's $\alpha = 0.93$), interest (five items assessing interest in scientific topics; e.g., "I'm interested in the biosphere," Cronbach's $\alpha = 0.88$), and efficacy (eight items evaluating students' confidence in performing science-related tasks; e.g. , "How easy do you think it would be for you to perform the following tasks on your own: Recognize the science question that underlies a newspaper report on a health issue," Cronbach's $\alpha = 0.88$). For the PISA 2012 mathematics dataset, we analyzed enjoyment/interest (four items assessing mathematics interest/enjoyment; e.g., "I enjoy reading about mathematics" and "I am interested in the things I learn in mathematics," Cronbach's $\alpha = 0.81$), and efficacy (eight items assessed students' confidence in performing math-related tasks on their own; e.g., "How easy do you think it would be for you to perform the following tasks on your own: Calculating how much cheaper a TV would be after a 30% discount," Cronbach's $\alpha = 0.86$). For the PISA 2009 reading dataset, we analyzed enjoyment (11 items were used to assess students' reading enjoyment; e.g., "I feel happy if I receive a book as a present" and "Reading is one of my favorite hobbies," Cronbach's $\alpha = 0.86$).

Data Availability. The data are available in PISA (https://www.oecd.org/pisa/data/2015database/). All analyses are included in the main text and *SI Appendix*.

1. M. Zaveri, E. S. Rueb, U.S. wants to allow more foreign workers while also restricting immigration. NY Times, 8 April 2019. https://www.nytimes.com/2019/04/08/us/politics/trump-administration-h2b-visa.html. Accessed 16 July 2019.
2. L. Z. Bencharit et al., Should job applicants be excited or calm? The role of culture and ideal affect in employment settings. *Emotion* **19**, 377–401 (2018).
3. N. M. Stephens, S. A. Fryberg, H. R. Markus, C. S. Johnson, R. Covarrubias, Unseen disadvantage: How American universities' focus on independence undermines the academic performance of first-generation college students. *J. Pers. Soc. Psychol.* **102**, 1178–1197 (2012).
4. S. A. Jackson, H. W. Marsh, Development and validation of a scale to measure optimal experience: The Flow State Scale. *J. Sport Exerc. Psychol.* **18**, 17–35 (1996).
5. H. W. Marsh et al., Passion: Does one scale fit all? Construct validity of two-factor passion scale and psychometric invariance over different activities and languages. *Psychol. Assess.* **25**, 796–809 (2013).
6. C. Sansone, D. B. Thoman, Interest as the missing motivator in self-regulation. *Eur. Psychol.* **10**, 175–186 (2005).
7. G. Hofstede, Motivation, leadership, and organization: Do American theories apply abroad? *Organ. Dyn.* **9**, 42–63 (1980).
8. H. C. Triandis, Individualism-collectivism and personality. *J. Pers.* **69**, 907–924 (2001).
9. H. R. Markus, S. Kitayama, Culture and the self: Implications for cognition, emotion, and motivation. *Psychol. Rev.* **98**, 224 (1991).
10. H. R. Markus, What moves people to action? Culture and motivation. *Curr. Opin. Psychol.* **8**, 161–166 (2016).
11. V. C. Plaut, H. R. Markus, "The 'inside' story: A cultural-historical analysis of being smart and motivated, American style" in *Handbook of Competence and Motivation*, J. Elliot, C. S. Dweck, Eds. (Guilford Publications, 2005), pp. 457–488.
12. E. L. Deci, R. M. Ryan, The empirical exploration of intrinsic motivational processes. *Adv. Exp. Soc. Psychol.* **98**, 39–80 (1980).
13. A. P. Fiske, S. Kitayama, H. R. Markus, R. E. Nisbett, "The cultural matrix of social psychology" in *The Handbook of Social Psychology*, D. T. Gilbert, S. T. Fiske, G. Lindzey, Eds. (McGraw-Hill, 1998), pp. 915–981.
14. H. Markus, Y. Uchida, H. Omoregie, S. Townsend, S. Kitayama, Going for the gold: Modles of Olympic performance in American and Japanese contexts. *Psychol. Sci.* **17**, 99–110 (2006).
15. E. H. Erikson, *Identity and the Life Cycle: Selected Papers* (International Universities Press, 1959).
16. C. F. Falk, E. W. Dunn, A. Norenzayan, Cultural variation in the importance of expected enjoyment for decision making. *Soc. Cogn.* **28**, 609–629 (2010).
17. A. Bandura, Self-efficacy: Toward a unifying theory of behavioral change. *Psychol. Rev.* **84**, 191–215 (1977).
18. S. J. Heine, "Culture and motivation: What motivates people to act in the ways that they do?" in *Handbook of Cultural Psychology*, S. Kitayama, D. Cohen, Eds. (The Guilford Press, 2007), pp. 714–733.
19. A. L. Duckworth, C. Peterson, M. D. Matthews, D. R. Kelly, Grit: Perseverance and passion for long-term goals. *J. Pers. Soc. Psychol.* **92**, 1087–1101 (2007).
20. H. W. Marsh, A. J. Martin, Academic self-concept and academic achievement: Relations and causal ordering. *Br. J. Educ. Psychol.* **81**, 59–77 (2011).
21. P. A. O'Keefe, C. S. Dweck, G. M. Walton, Implicit theories of interest: Finding your passion or developing it? *Psychol. Sci.* **29**, 1653–1664 (2018).
22. P. Chen, P. C. Ellsworth, N. Schwarz, Finding a fit or developing it: Implicit theories about achieving passion for work. *Pers. Soc. Psychol. Bull.* **41**, 1411–1424 (2015).
23. N. Soylu Yalcinkaya, G. Adams, A cultural psychological model of cross-national variation in gender gaps in STEM participation. *Pers. Soc. Psychol. Rev.* **24**, 345–370 (2020).
24. J. Henrich, S. J. Heine, A. Norenzayan, Most people are not WEIRD. *Nature* **466**, 29 (2010).
25. I. Choi, R. E. Nisbett, A. Norenzayan, Causal attribution across cultures: Variation and universality. *Psychol. Bull.* **125**, 47 (1999).
26. A. J. Fuligni, Family obligation and the academic motivation of adolescents from Asian, Latin American, and European backgrounds. *New Dir. Child Adolesc. Dev.* **2001**, 61–75 (2001).
27. Y. Guan et al., Differences in career decision-making profiles between American and Chinese university students: The relative strength of mediating mechanisms across cultures. *J. Cross Cult. Psychol.* **46**, 856–872 (2015).
28. A. S. Fu, H. R. Markus, My mother and me: Why tiger mothers motivate Asian Americans but not European Americans. *Pers. Soc. Psychol. Bull.* **40**, 739–749 (2014).
29. M. G. Hamedani, H. R. Markus, A. S. Fu, In the land of the free, interdependent action undermines motivation. *Psychol. Sci.* **24**, 189–196 (2013).

30. E. E. Buchtel *et al.*, A sense of obligation: Cultural differences in the experience of obligation. *Pers. Soc. Psychol. Bull.* **44**, 1545–1566 (2018).

31. H. Kim, S. Lawrie, "Culture and motivation" in *Handbook of Cultural Psychology*, D. Cohen, S. Kitayama, Eds. (Guilford Press, ed. 2, 2019), pp. 268–291.

32. S. S. Iyengar, M. R. Lepper, Rethinking the value of choice: A cultural perspective on intrinsic motivation. *J. Pers. Soc. Psychol.* **76**, 349–366 (1999).

33. F. F.-Y. Ng, E. M. Pomerantz, S. F. Lam, European American and Chinese parents' responses to children's success and failure: Implications for children's responses. *Dev. Psychol.* **43**, 1239–1255 (2007).

34. S. J. Heine *et al.*, Divergent consequences of success and failure in Japan and north America: An investigation of self-improving motivations and malleable selves. *J. Pers. Soc. Psychol.* **81**, 599–615 (2001).

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

36. J. Lee, M. Zhou, *The Asian American Achievement Paradox* (Russell Sage Foundation, 2015).

37. R. Tripathi, D. Cervone, Cultural variations in achievement motivation despite equivalent motivational strength: Motivational concerns among Indian and American corporate professionals. *J. Res. Pers.* **42**, 456–464 (2008).

38. J. G. Miller, D. M. Bersoff, R. L. Harwood, Perceptions of social responsibilities in India and in the United States: Moral imperatives or personal decisions? *J. Pers. Soc. Psychol.* **58**, 33–47 (1990).

39. B. C. Hansford, J. A. Hattie, The relationship between self and achievement/performance measures. *Rev. Educ. Res.* **52**, 123–142 (1982).

40. J. Lee, Universals and specifics of math self-concept, math self-efficacy, and math anxiety across 41 PISA 2003 participating countries. *Learn. Individ. Differ.* **19**, 355–365 (2009).

41. M. J. Gelfand *et al.*, Differences between tight and loose cultures: A 33-nation study. *Science* **332**, 1100–1104 (2011).

42. G. Hofstede, *Culture's Consequences: Comparing Values, Behaviors, Institutions and Organizations across Nations* (Sage Publications, 2001).

43. R. Inglehart, *Modernization and Postmodernization: Cultural, Economic, and Political Change in 43 Societies* (Princeton University Press, 1997).

44. Organisation for Economic Co-operation and Development, *PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic, Financial Literacy and Collaborative Problem Solving* (OECD Publishing, 2017).

45. S. Breakspear, The Policy Impact of PISA: An Exploration of the Normative Effects of International Benchmarking in School System Performance. OECD Education Working Papers, No. 71. (OECD Publishing, 2012).

46. G. R. Slemp, Y. Zhao, H. Hou, R. J. Vallerand, Job crafting, leader autonomy support, and passion for work: Testing a model in Australia and China. *Motiv. Emot.*, 10.1007/s11031-020-09850-6 (2020).

47. M. S. Cardon, J. Wincent, J. Singh, M. Drnovsek, The nature and experience of entrepreneurial passion. *Acad. Manage. Rev.* **34**, 511–532 (2009).

48. R. J. Burke, M. N. Astakhova, H. Hang, Work passion through the lens of culture: Harmonious work passion, obsessive work passion, and work outcomes in Russia and China. *J. Bus. Psychol.* **30**, 457–471 (2015).

49. Y. Zhao, A. St-Louis, R. J. Vallerand, On the validation of the passion scale in Chinese. *Psychol. Well Being* **5**, 3 (2015).

50. J. Pollack, V. Ho, E. O'Boyle, B. Kirkman, Passion at work: A meta-analysis of individual work outcomes. *J. Organ. Behav.*, **41**, 311–331 (2020).

51. B. Nagengast, H. W. Marsh, "Motivation and engagement in science around the globe: Testing measurement invariance with multigroup structural equation models across 57 countries using PISA 2006" in *Handbook of International Large-Scale Assessment. Background, Technical Issues, and Methods of Data Analysis* L. Rutkowski, M. von Davier, D. Rutkowski, Eds. (Chapman and Hall/CRC, 2014), pp. 317–344.

52. J. M. Jachimowicz, A. Wihler, E. R. Bailey, A. D. Galinsky, Why grit requires perseverance and passion to positively predict performance. *Proc. Natl. Acad. Sci. U.S.A.* **115**, 9980–9985 (2018).

53. R. J. Vallerand *et al.*, Les passions de l'ame: On obsessive and harmonious passion. *J. Pers. Soc. Psychol.* **85**, 756–767 (2003).

54. M. J. Gelfand, D. P. Bhawuk, L. H. Nishii, D. J. Bechtold, "Individualism and collectivism" in *Culture, Leadership, and Organizations: The GLOBE Study of 62 Societies*, R. J. House, P. J. Hanges, M. Javidan, P. W. Dorfman, V. Gupta, Eds. (Sage Publications, 2004), pp. 437–512.

55. M. M. Chiu, R. M. Klassen, Relations of mathematics self-concept and its calibration with mathematics achievement: Cultural differences among fifteen-year-olds in 34 countries. *Learn. Instr.* **20**, 2–17 (2010).

56. M. Seaton, H. W. Marsh, R. G. Craven, Earning its place as a pan-human theory: Universality of the big-fish-little-pond effect across 41 culturally and economically diverse countries. *J. Educ. Psychol.* **101**, 403–419 (2009).

57. A. Gelman, J. Hill, *Data Analysis Using Regression and Multilevel/Hierarchical Models* (Cambridge University Press, 2006).

58. G. Hofsteds, *Culture's Consequences* (Sage Publications, Beverly Hills, CA, 1980).

59. G. Hofstede, G. J. Hofstede, M. Minkov, *Cultures and Organizations: Software of the Mind* (Citeseer, 2005).

60. R. Inglehart, Mapping global values. *Comp. Sociol.* **5**, 115–136 (2006).

61. S. J. Heine, D. R. Lehman, K. Peng, J. Greenholtz, What's wrong with cross-cultural comparisons of subjective Likert scales? The reference-group effect. *J. Pers. Soc. Psychol.* **82**, 903–918 (2002).

62. D. Oyserman, G. C. Smith, K. Elmore, Identity-based motivation: Implications for health and health disparities. *J. Soc. Issues* **70**, 206–225 (2014).

63. V. Benet-Martínez, Y. Hong, *The Oxford Handbook of Multicultural Identity* (Oxford Library of Psychology, 2014).

64. E. L. Deci, R. M. Ryan, "Intrinsic motivation" in *The Corsini Encyclopedia of Psychology*, I. R. Weiner, W. E. Craighead, Eds. (Wiley, 2010), pp. 1–2.

65. R. Tripathi, D. Cervone, K. Savani, Are the motivational effects of autonomy-supportive conditions universal? Contrasting results among Indians and Americans. *Pers. Soc. Psychol. Bull.* **44**, 1287–1301 (2018).

66. H. Riemer, S. Shavitt, M. Koo, H. R. Markus, Preferences don't have to be personal: Expanding attitude theorizing with a cross-cultural perspective. *Psychol. Rev.* **121**, 619–648 (2014).

67. E. M. Tucker-Drob, A. K. Cheung, D. A. Briley, Gross domestic product, science interest, and science achievement: A person × nation interaction. *Psychol. Sci.* **25**, 2047–2057 (2014).

68. K. B. Curhan *et al.*, Just how bad negative affect is for your health depends on culture. *Psychol. Sci.* **25**, 2277–2280 (2014).

69. S. Kitayama, J. Park, Emotion and biological health: The socio-cultural moderation. *Curr. Opin. Psychol.* **17**, 99–105 (2017).

70. K. Savani, H. R. Markus, A. L. Conner, Let your preference be your guide? Preferences and choices are more tightly linked for North Americans than for Indians. *J. Pers. Soc. Psychol.* **95**, 861–876 (2008).

71. K. Eom, H. S. Kim, D. K. Sherman, K. Ishii, Cultural variability in the link between environmental concern and support for environmental action. *Psychol. Sci.* **27**, 1331–1339 (2016).

72. L. M. Brady, S. A. Fryberg, Y. Shoda, Expanding the interpretive power of psychological science by attending to culture. *Proc. Natl. Acad. Sci. U.S.A.* **115**, 11406–11413 (2018).

73. A. G. Dittmann, N. M. Stephens, S. S. M. Townsend, Achievement is not class-neutral: Working together benefits people from working-class contexts. *J. Pers. Soc. Psychol.* **119**, 517–539 (2020).

74. H. Hitokoto, Y. Uchida, Interdependent happiness: Theoretical importance and measurement validity. *J. Happiness Stud.* **16**, 211–239 (2015).

75. K. Hui, R. W. Lent, The roles of family, culture, and social cognitive variables in the career interests and goals of Asian American college students. *J. Couns. Psychol.* **65**, 98–109 (2018).

76. R. F. Kizilcec, G. L. Cohen, Eight-minute self-regulation intervention raises educational attainment at scale in individualist but not collectivist cultures. *Proc. Natl. Acad. Sci. U.S.A.* **114**, 4348–4353 (2017).

77. M. Charles, K. Bradley, Indulging our gendered selves? Sex segregation by field of study in 44 countries. *AJS* **114**, 924–976 (2009).

78. A. Wigfield, J. S. Eccles, Expectancy–value theory of achievement motivation. *Contemp. Educ. Psychol.* **25**, 68–81 (2000).

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